

Department of Pathology and Laboratory Medicine

Supervised Machine Learning & the Automated-ML platform MILO (Machine Intelligence Learning Optimizer)

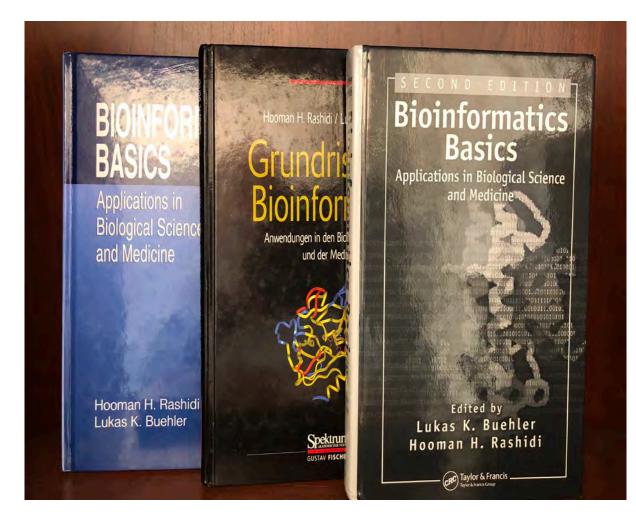
Hooman H. Rashidi, MD, MS

Professor & Vice Chair of GME Vice Chair of Informatics & Computational Pathology University of California, Davis School of Medicine



My background

- Practicing Physician
 - Clinical Hematopathologist
- My graduate studies (UCSD) was in Bioinformatics (Masters Degree)
 - Extensive background in Bioinformatics
 - Hence the strong interest in Artificial Intelligence (AI) and Machine Learning (ML)
- PI of multiple ML research studies
 - 30+ members within the research group



 Systems And Methods For Machine Learning-based Identification Of Acute Kidney Injury In Trauma Surgery And Burned Patients (Early Prediction Of Aki With Machine Learning): Co-inventors (Hooman H. Rashidi MD MS & Nam Tran PhD)

• University Of California Intellectual Property

 Systems And Methods For Machine Learning-based Identification Of Sepsis (Early Prediction Of Sepsis With Machine Learning): Co-inventors (Hooman H. Rashidi MD MS & Nam Tran PhD)

• University Of California Intellectual Property

• Systems And Methods For Automated Machine Learning (MILO: Machine Intelligence Learning Optimizer)

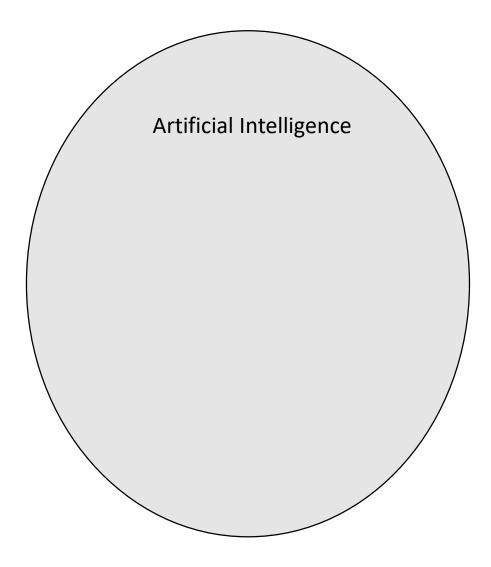
- University Of California Intellectual Property (Patent Pending)
 - Co-inventors Of MILO
 - Hooman H. Rashidi MD MS
 - Samer Albahra MD
 - Nam Tran PhD

Disclosures

Talk Outline

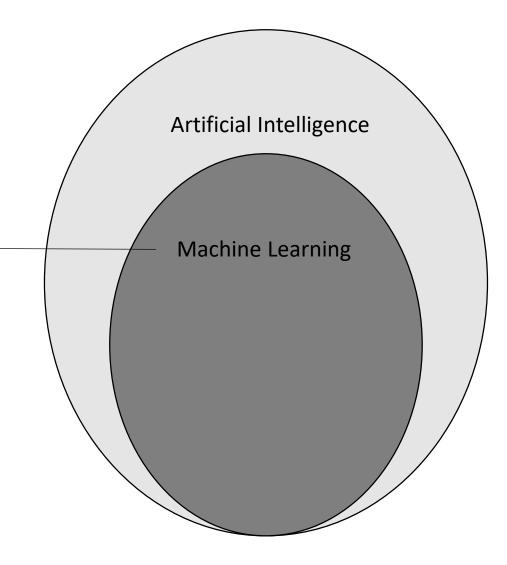
- Machine Learning (ML) overview
 - ML classification
- Supervised Machine Learning (ML)
- Non-Image ML models:
 - Our AKI ML studies
- Automated Machine Learning
 - MILO: Machine Intelligence Learning Optimizer

What is Artificial Intelligence / Machine Learning?



What is Artificial Intelligence / Machine Learning?

"Al is the capability for machines to imitate intelligent human behavior, while ML is an application of Al that allows computer systems to automatically learn from experience without explicit programming. Paraphrasing Arthur Samuel and others, ML models are constructed by a set of data points and trained through mathematical and statistical approaches that ultimately enable prediction of new previously unseen data without being explicitly programmed to do so"

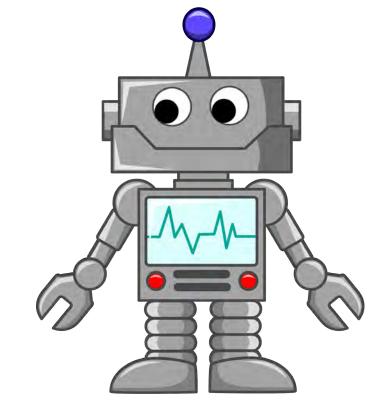


Human Learning versus Machine Learning

Human learns through "experiences" and forms neuronal connections to help recall



Machine learns by experiences AKA "DATA" to build neuronal connections to be able to recall



Examples of AI and ML in our daily life

- Siri and Alexa
- spam filtering
- photo organizers
- Facebook or LinkedIn people connectors
- Amazon recommendations, etc.





Is there a difference in machine learning for medical applications?

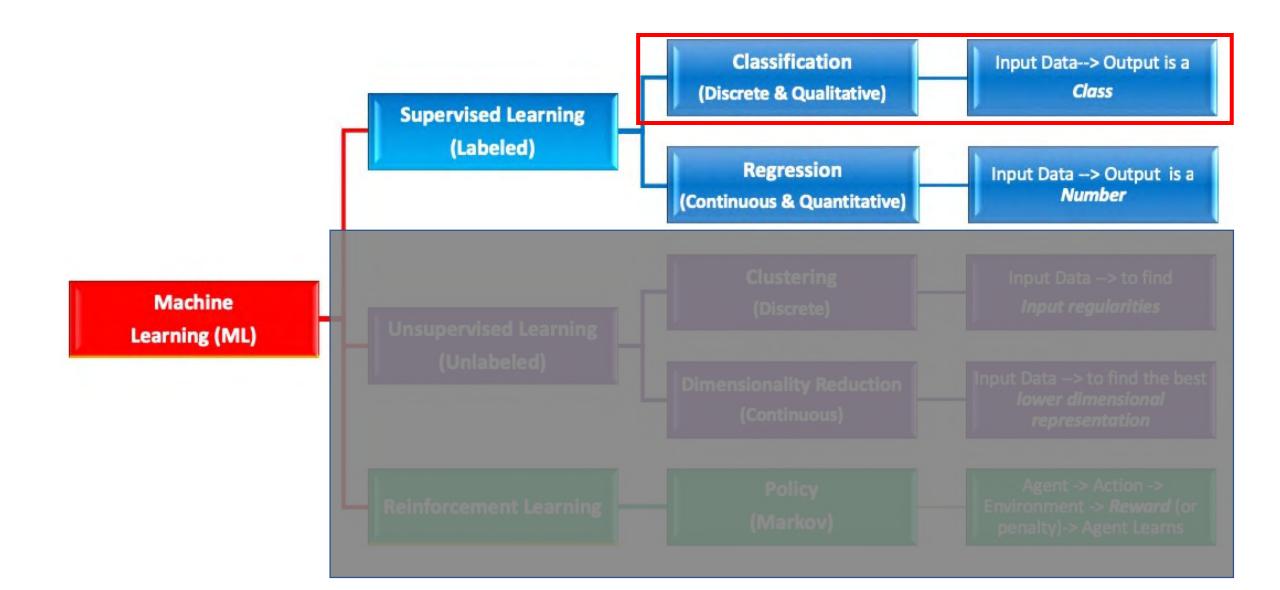
YES, Absolutely !

What is so different about our field (medicine)?

- Practice of medicine is still a balance between art and science
 - most fields are experience driven
- Since the gold standard for how we practice is based on expertise that is experience driven, the data collected will have more variations
 - Ultimately increases the chance of interobserver variability
- Hence the data sets used in our fields are not as easily reproducible as in other fields that employ machine learning

What ML approaches are used the most in medicine / pathology?

• Supervised Machine Learning





10 > MD Anderson Taps IBM Watson to Power "Moon Shots" Mission

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MD Anderson Taps IBM Watson to Power "Moon Shots" Mission

MD Anderson News Release October 18, 2013



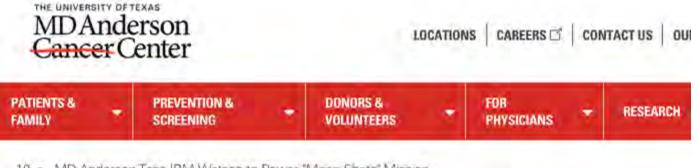
MD Anderson partners with IBM Watson to use "Oncology Expert Advisor" for targeting cancer therapy.

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- MD Anderson partners with IBM Watson to use "Oncology Expert Advisor" for targeting cancer therapy.
- "A new era of computing has emerged, in which cognitive systems "understand" the context within users' questions, uncover answers from Big Data, and improve in performance by continuously learning from experiences"

EDITOR'S PICK | 212,548 views | Feb 19, 2017, 03:48pm

MD Anderson Benches IBM Watson In Setback For Artificial Intelligence In Medicine



Matthew Herper Forbes Staff

Pharma & Healthcare I covered science and medicine, and believe this is biology's century.

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\$62 million wasted without achieving goals

"Treating cancer is more complex than winning a trivia game, and the "vast universe of medical knowledge" may not be as significant as purveyors of artificial intelligence make it out to be..."

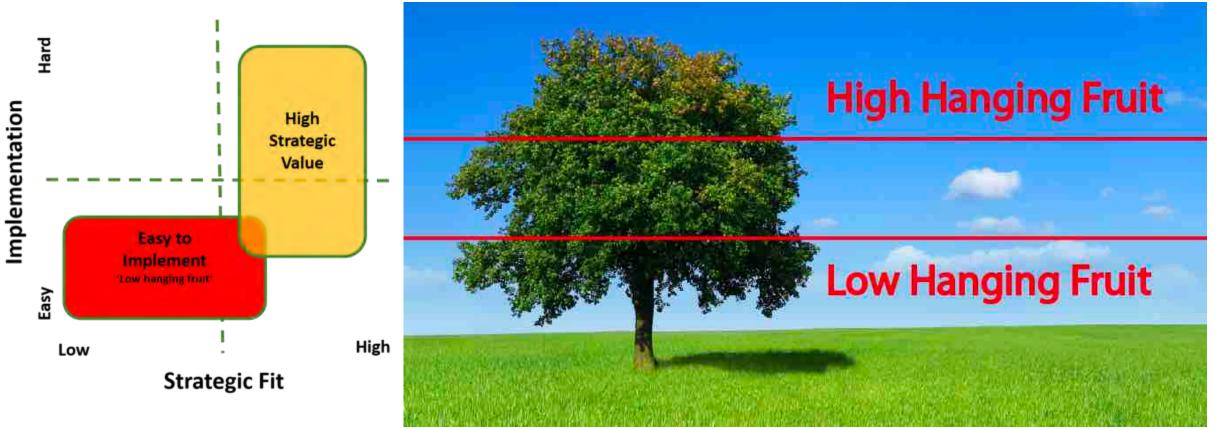
https://www.healthnewsreview.org/2017/02/md-anderson-cancer-centers-ibm-watson-project-fails-journalism-related/

WHERE DO WE GO NOW?

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What are some potential "safe" applications of AI/ML in health care?

Realistic Opportunities for Healthcare AI/ML?



AI/ML Enhanced Detection of Burn Related AKI: A Proof of Concept

Tran NK, Sen S, Palmieri TL, Lima K, Falwell S, Wajda J, Rashidi H. Burns 2019

• Goal: To build Models that predict Acute kidney Injury (AKI)

Current Standard for AKI diagnosis

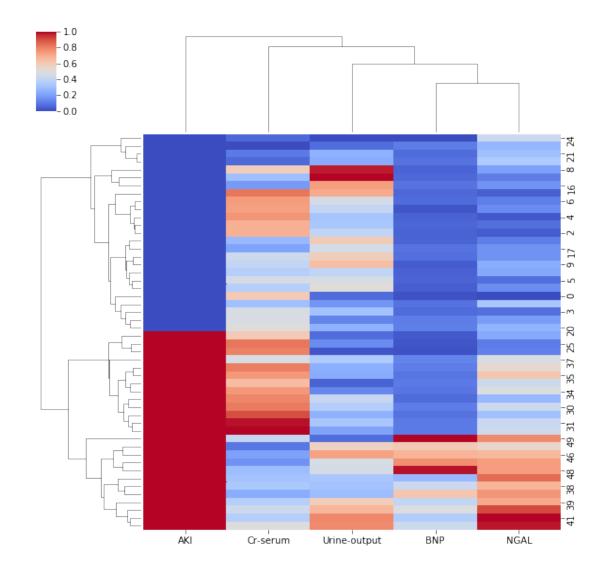
- Kidney Disease and Improving Global Outcome (KDIGO)
- Based on Serial Creatinine (Cr) and Urine Outputs (UOP)
- Takes days (since it's on serial Cr and UOP measurements)
- Sensitivity in 50s

Here comes NGAL to the rescue

- NGAL (Neutrophil Gelatinase Associated Lipocalin)
- Used in Europe
- Reportedly in the process of being FDA cleared in US

AI/ML Enhanced Detection of Burn Related AKI: A Proof of Concept

Tran NK, Sen S, Palmieri TL, Lima K, Falwell S, Wajda J, Rashidi H. Burns 2019



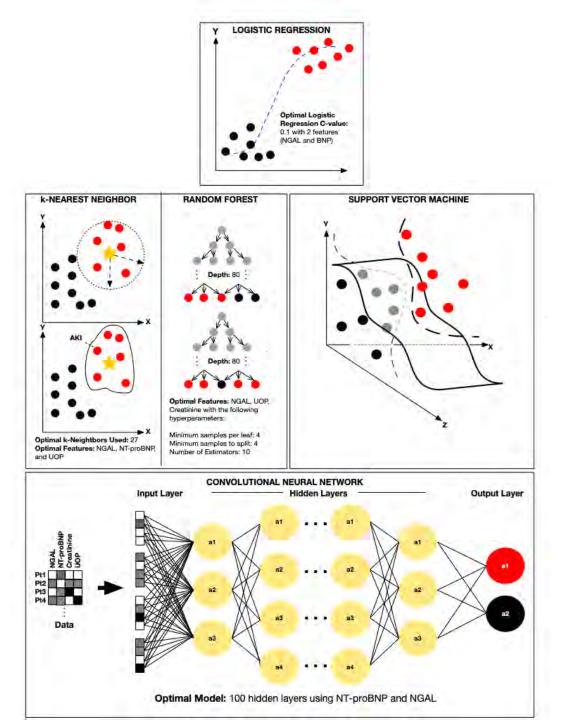
The "Burns" population proof of concept

- Showed that ML (specifically a K-NN model) can enhance NGAL's performance for
 - By combining it with other markers
 - BNP
 - Cr
 - UOP
- Sensitivity and accuracy in low 90s

Our Follow up AKI ML study

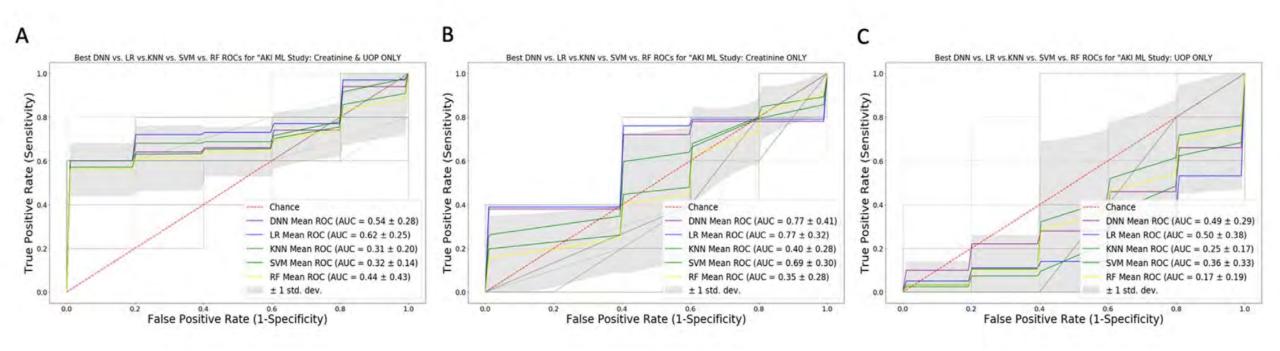
• Can the Burns-derived AKI ML model predict AKI in Non-Burn Trauma patient population

Early Recognition of Burn- and trauma-Related Acute Kidney injury: A pilot comparison of Machine Learning techniques. Hooman H. Rashidi*, Soman Sen, Tina L. Palmieri, Thomas Blackmon, Jeffery Wajda & Nam K. Tran*. Nature Scientific Reports Jan 2020



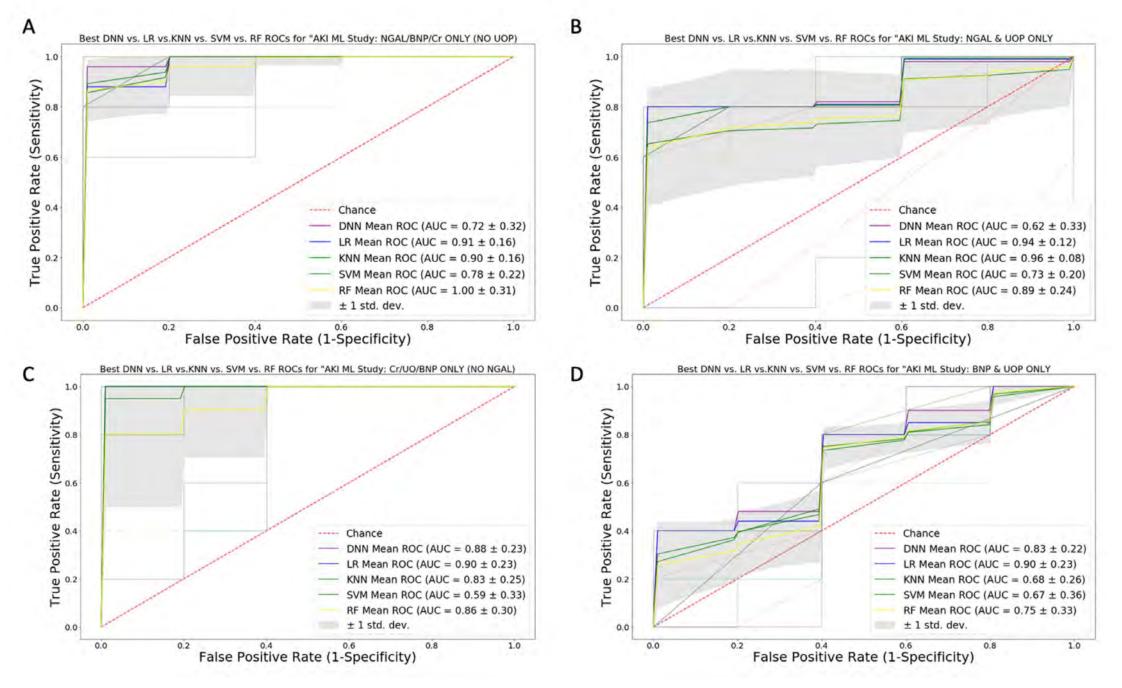
Rashidi H. et. al. Nature's Scientific Reports, 2020

Creatinine + UOP vs Creatinine Only vs UOP Only

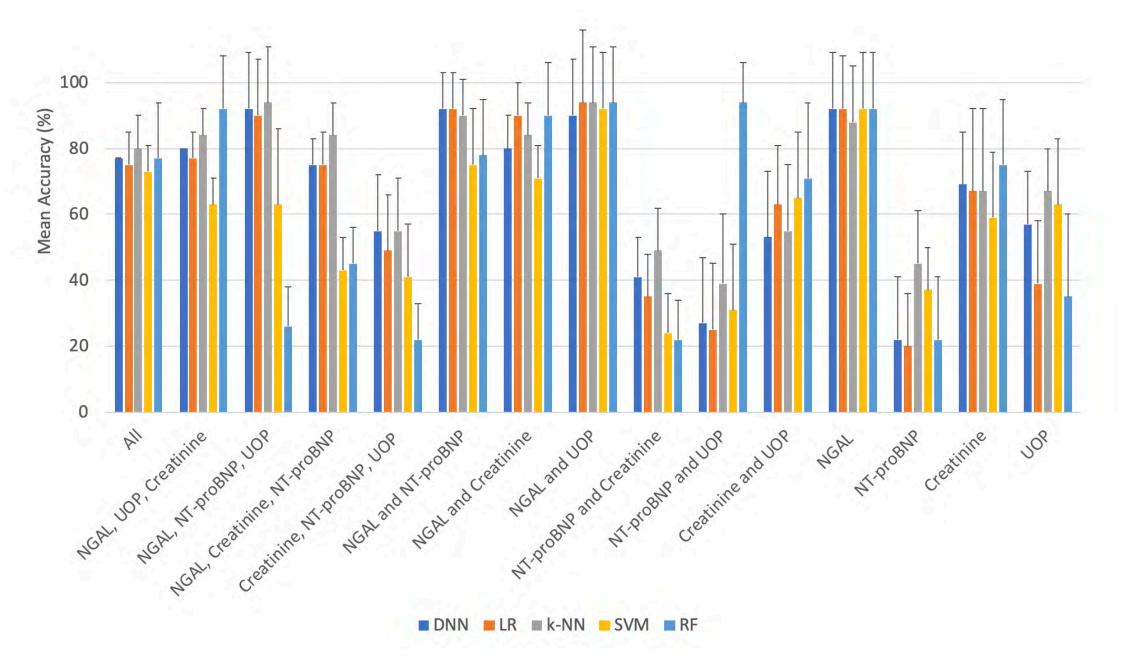


Rashidi H. et. al. Nature's Scientific Reports, 2020

What Happens when you Introduce NGAL



Rashidi H. et. al. Nature's Scientific Reports, 2020

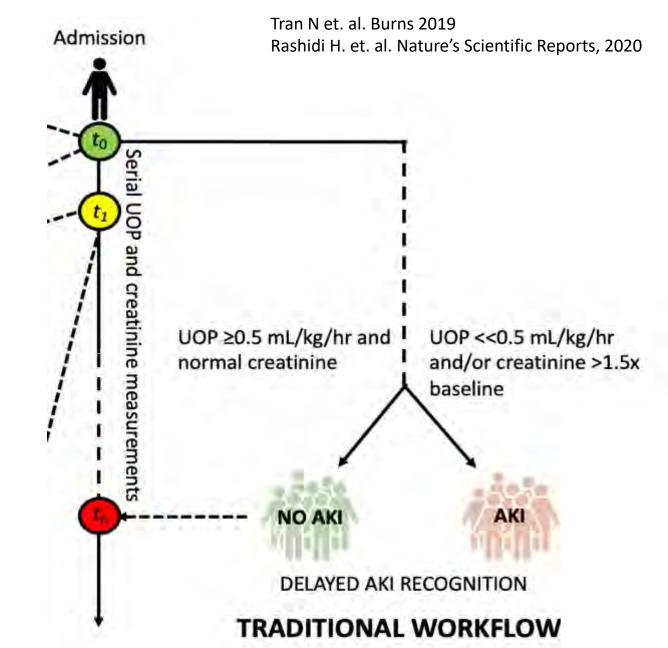


Rashidi H. et. al. Nature's Scientific Reports, 2020

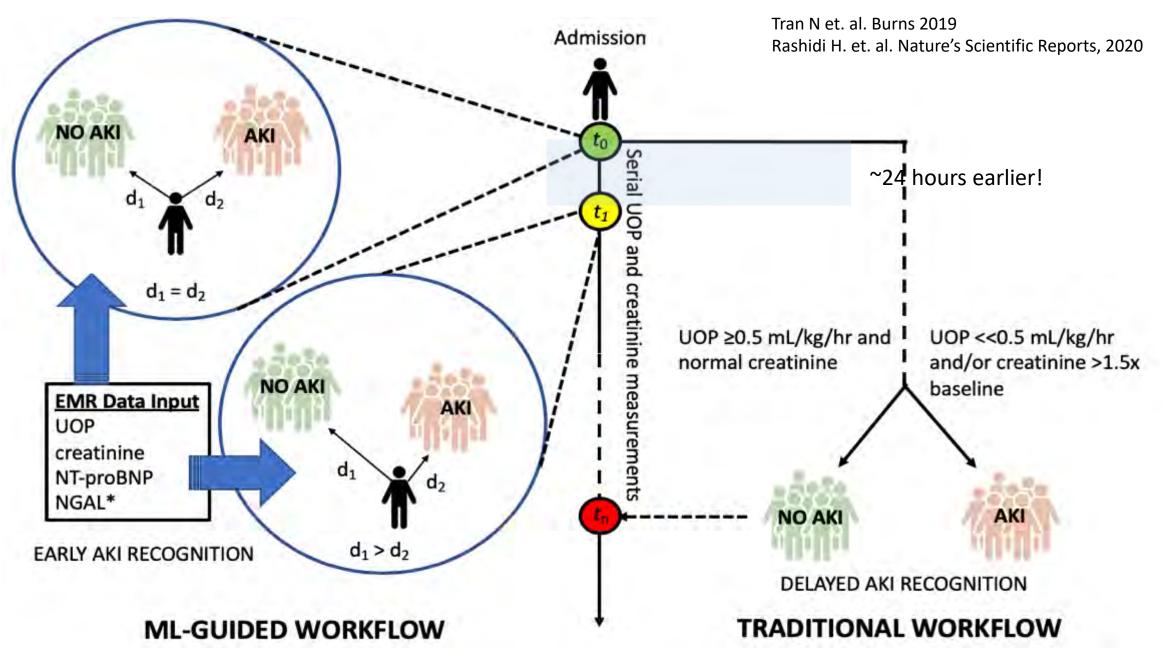
In summary

- The AKI ML models trained on the Burn Population were able to predict AKI in Non-Burn trauma and Burn patient populations
- ML enhances the predictive capability of NGAL and NGAL combined with other markers (esp. Cr and BNP)
- Most importantly:
 - The AI/ML algorithm helped predict AKI 61.8 (32.5) hours faster than the KDIGO criteria for burn and non-burned trauma patients

AI/ML Real World Application for Burn AKI?



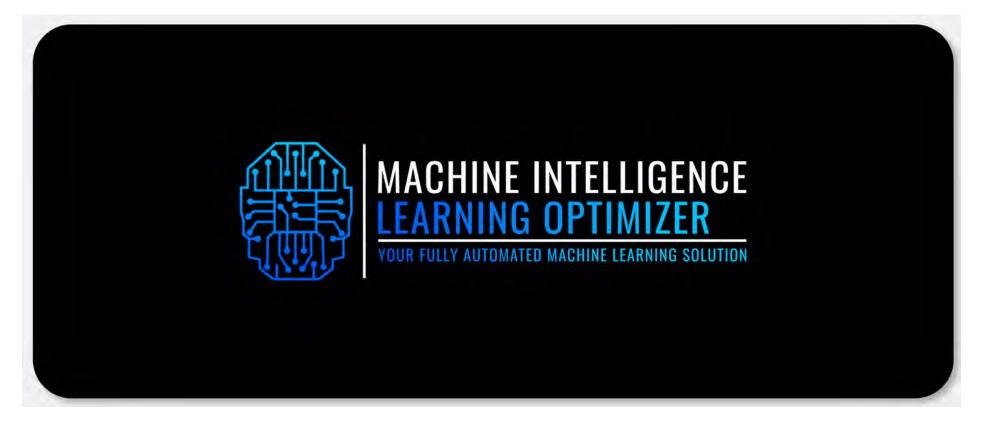
AI/ML Real World Application for Burn AKI?



Can this Machine Learning process that was used in this study be automated?

- So that ALL investigators can have EASY access to these Machine Learning methods
- How to automate this process so that
 - No ML expertise is required
 - No programming or Software Engineering background is needed

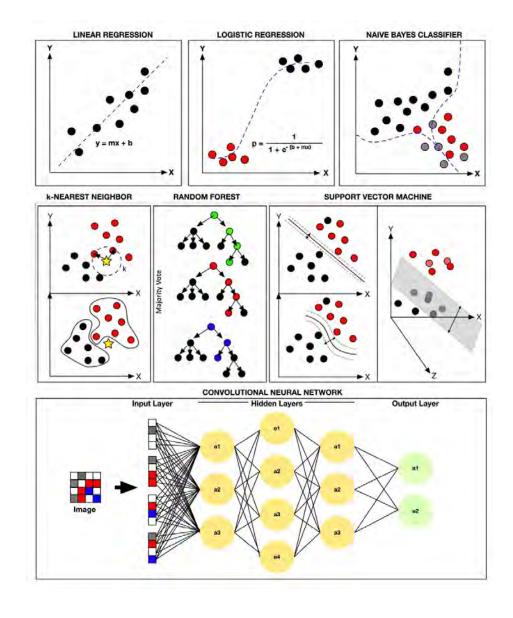
MILO



Some Basic Facts:

 Artificial intelligence / Machine learning (ML) is a very powerful tool

 ML is starting to get incorporated into various aspects of health care and health science disciplines



Rashidi, HH et al. Academic Pathology, 2019



Current Challenges with ML:

- Can be intimidating
 - requires a team with ML, statistics and programming expertise
- Can be very time consuming and not easily accessible
- Final ML model can be very challenging to deploy
 - requires software engineering expertise to make an App or Website

0

NO ML or Statistics expertise needed

Imagine a world where Artificial Intelligence (AI) / Machine Learning (ML) studies are as EASY as using a website on your laptop or even your smart phone



NO Software engineering expertise needed



NO Programming required



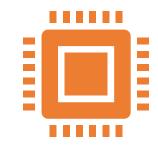
It's just plain easy to do !!!

OUR SOLUTION: MILO



MILO : Machine Intelligence Learning Optimizer

Your Fully Automated Machine Learning (Auto-ML) Solution



MILO makes AI/ML accessible for ALL

No Coding, No Programming No Machine Learning expertise required All the heavy lifting is done by MILO!

MILO's key highlights?



~~~

Expedites the machine learning process

Drastically reduces the time required to complete an ML project

• Much faster than the current traditional ML approach

Improves the performance outcome of the machine learning models

Builds a much **larger number** of ML models compared to the current ML approach

**Finds the best ML model** for a given study compared to the current ML approach

A very simple User Interface (UI)

MILO's Web-App makes the AI/ML study **super easy** to operate

All the heavy lifting is done through MILO's UI

## MILO Expedites the Machine Learning Process

- Traditional ML study approach
  - Acute Kidney Injury (AKI) project required ~400 man hours (4 months) to complete
  - Sepsis project required ~300 man hours (3 months) to complete

- MILO's Auto-ML Approach
  - Acute Kidney Injury (AKI) project through MILO was completed in <20 hours</li>
  - Sepsis project through MILO was completed in <18 hours</li>

Tran et. al. Burns 2019.

Rashidi et. al. Nature's Scientific Reports 2020.

## MILO: A Validated Platform

AI/ML Enhanced Detection of Burn Related AKI: A Proof of Concept **Tran et. al.** *Burns* **2019** 

Early Recognition Of Burn- And Trauma-related Acute Kidney Injury: A Pilot Comparison Of Machine Learning Techniques Rashidi et. al. Nature's Scientific Reports 2020

# Validated on 10 different IRB approved studies

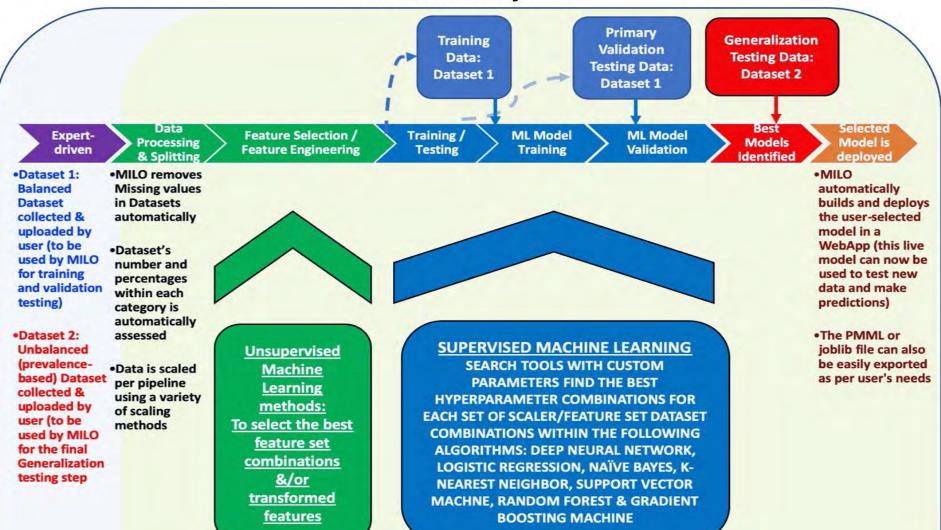
- Acute kidney injury (AKI) predictor (study 1):
- AKI predictor (study 2): Burns Surgery
- Sepsis predictor: Burns
- Delayed Graft Function predictor: Kidney transplant
- Cath Result PET predictor: Cardiology
- TB (11 Ag): Global Health Infectious disease
- TB(31 Ag): Global Health Infectious disease
- Massive Transfusion Protocol (MTP): Trauma
- Step 1 Test Early intervention Predictor: Med school
- Step 1 Test Late intervention Predictor: Med School

## How does MILO work?

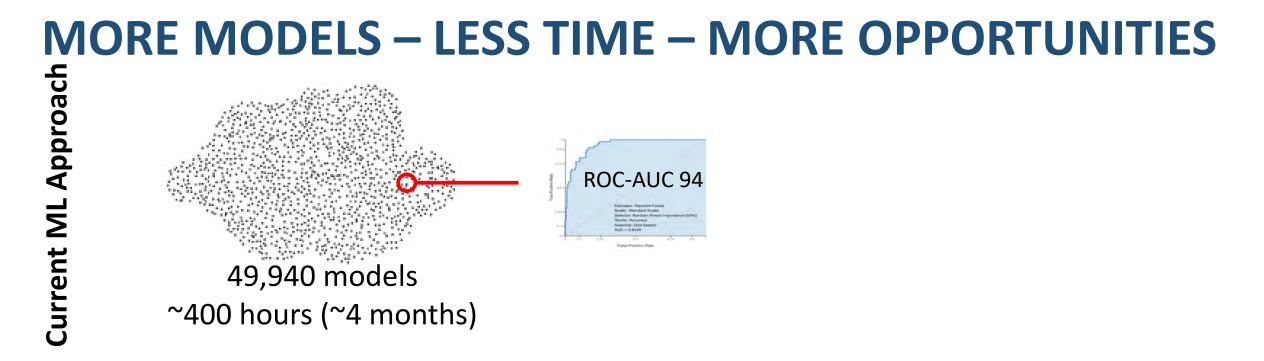
- MILO makes NO Assumptions
  - About your dataset
- MILO enables each Unique Dataset to find its most suitable ML Algorithm/Model
  - rather than having a data scientist and their team choosing an ML algorithm that they feel is most suitable for finding the best model for the dataset
  - Follows Industry's CRISP-DM Approach

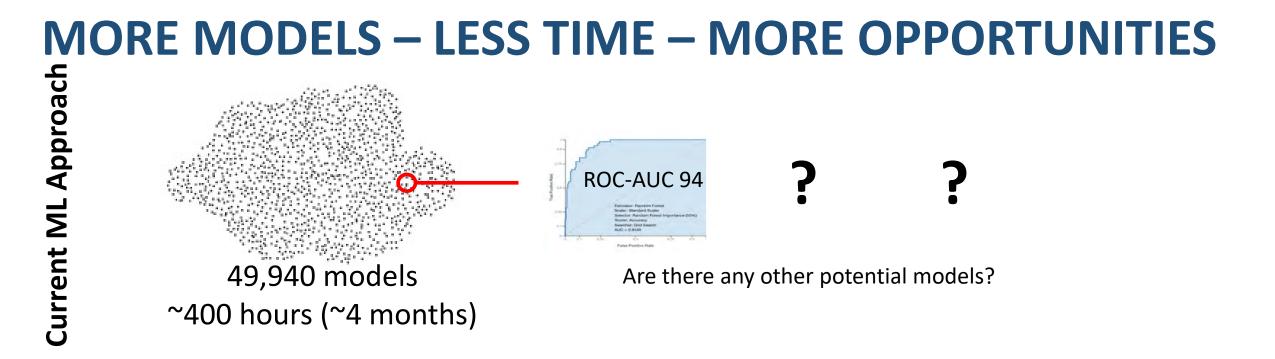


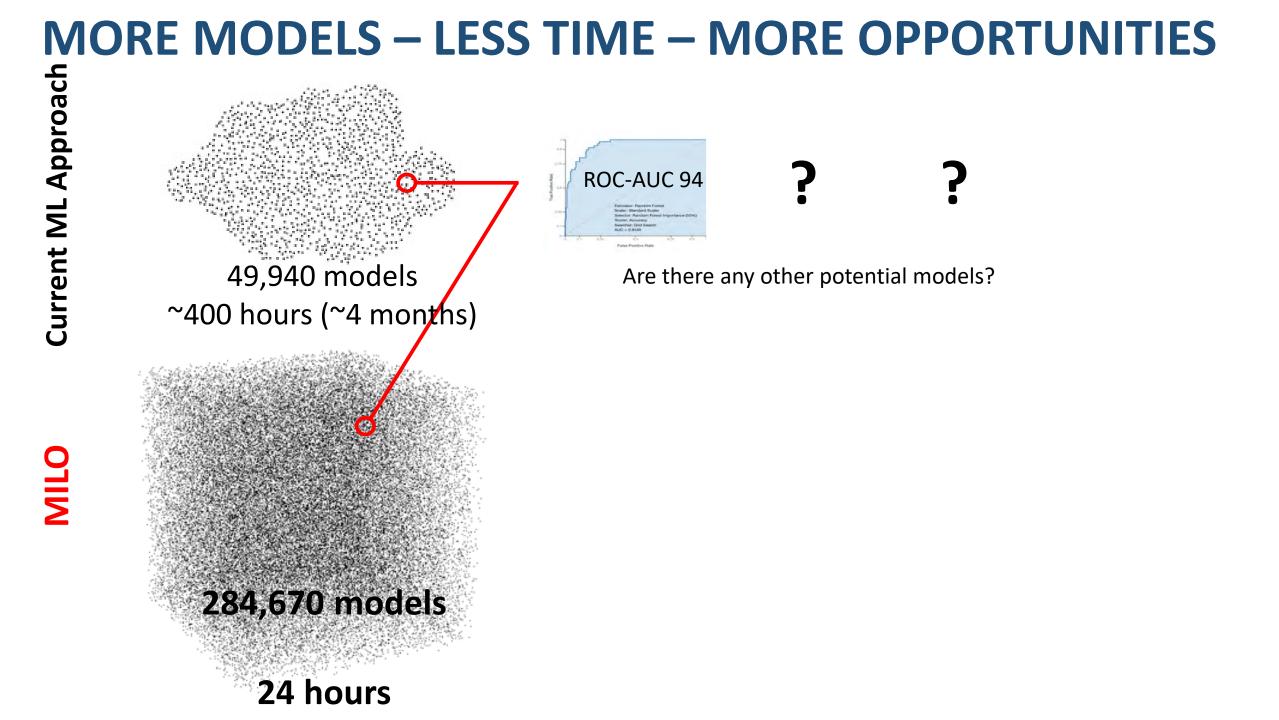
# MILO: Machine Intelligence Learning Optimizer

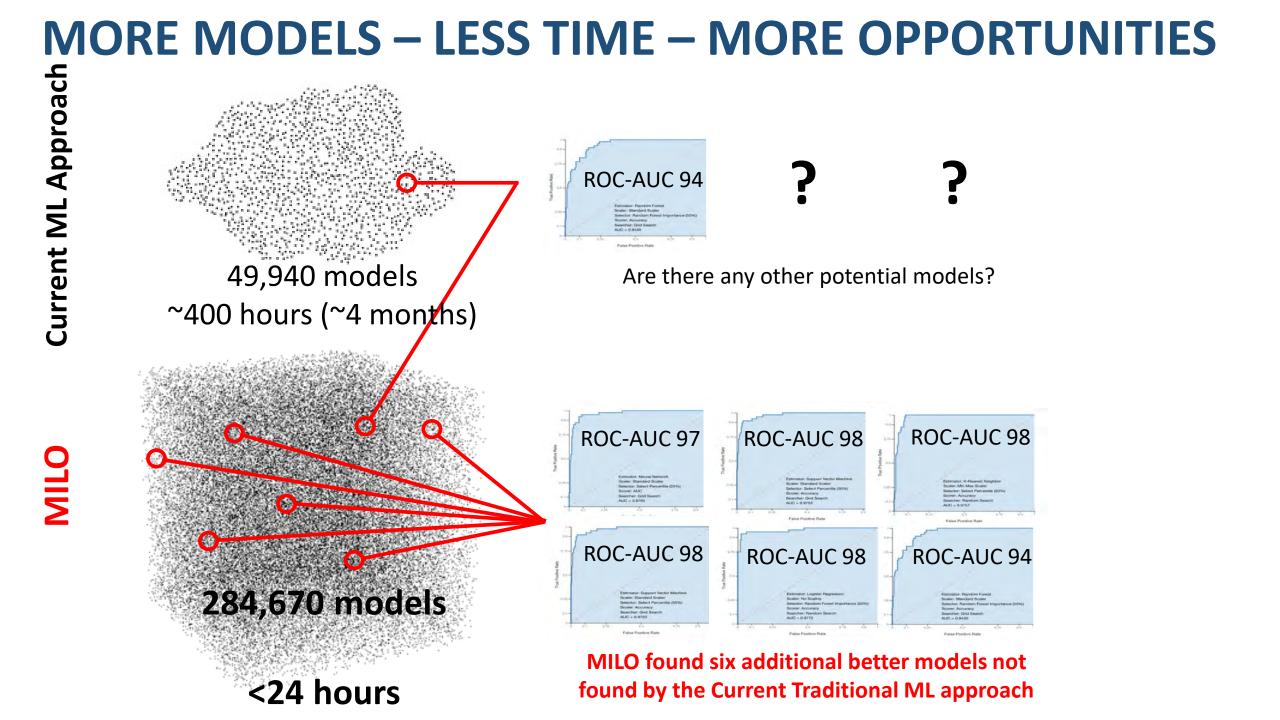


WRAPPED IN MILO'S WEB-BASED USER INTERFACE









## How does MILO achieve this?

#### Builds 300,000+ ML models



Optimized to find the best hyperparameters and feature sets with our proprietary embedded approach & FOLLOWS ML STUDY BEST PRACTICES

(SIMILAR TO THE FOLLOWING RECENT MANUSCRIPTS)

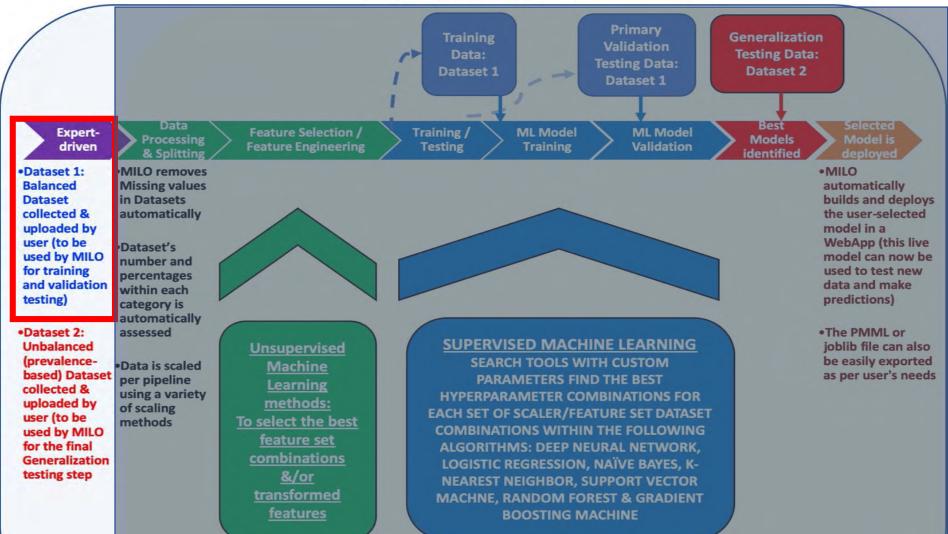
Rashidi et. al. Nature's Scientific Reports Jan 2020

Rashidi, HH et al. Academic Pathology, 2019

## QUICK DEMO OF MILO

## BUILD A MODEL TO PREDICT SEPSIS WITH MILO

# MILO: Machine Intelligence Learning Optimizer

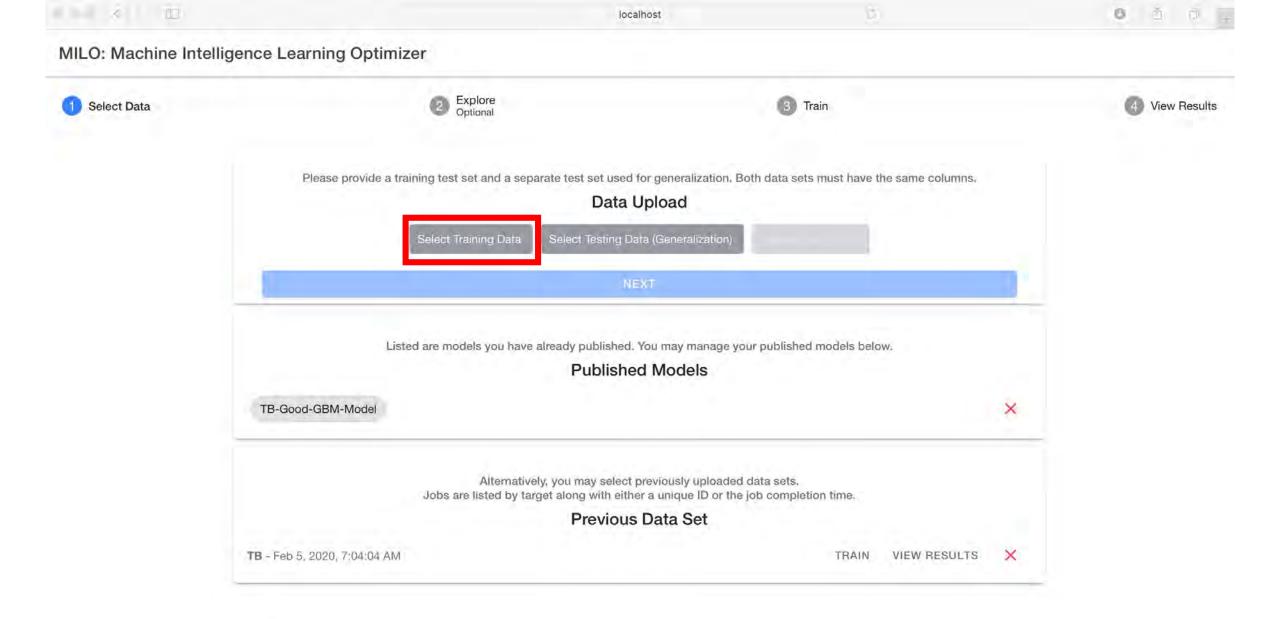


#### WRAPPED IN MILO'S WEB-BASED USER INTERFACE

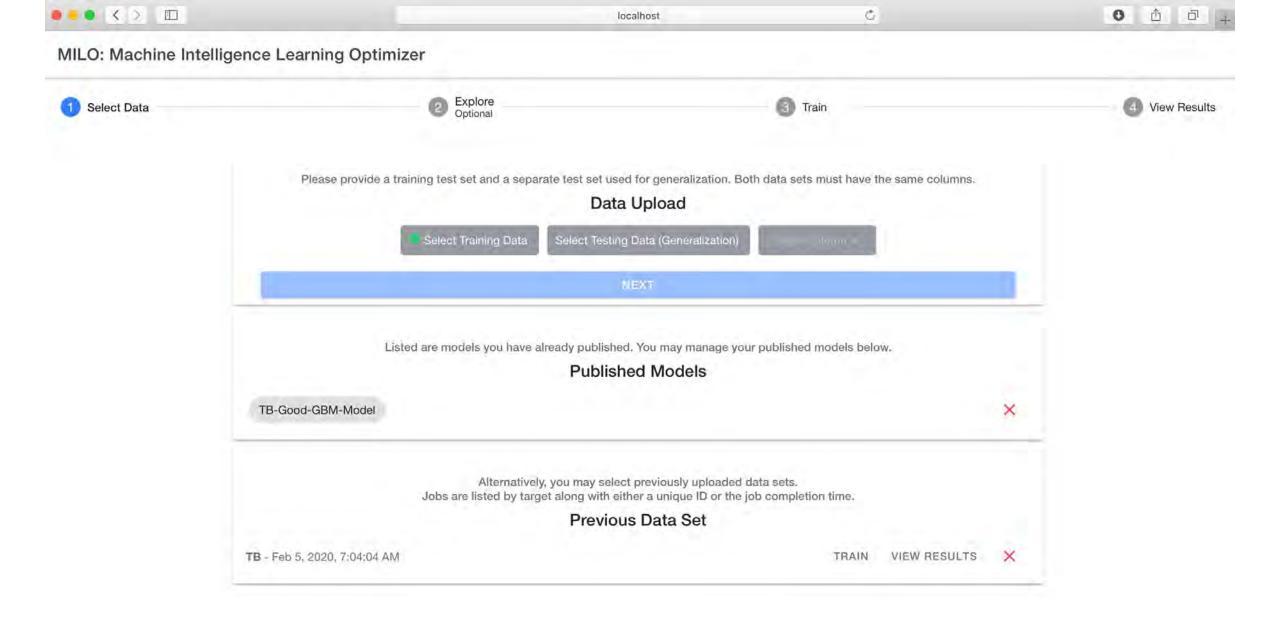
## Import in the Balanced Training Dataset (Dataset 1)

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| 66<br>99<br>110<br>76<br>70                   | 13<br>10<br>11<br>11<br>11                         | 5 21<br>92 13<br>2 14<br>8 19<br>99 12<br>6 24                                                                                                                                                             | 38.6<br>36.3<br>38.6<br>38.9<br>38<br>39.6                                 | 11<br>15<br>8<br>14<br>13                 | 99<br>99<br>99<br>100<br>100                                    | 7<br>5<br>9<br>0<br>0<br>0                | 1 18<br>0 17.3<br>1 19.3<br>0 17.8<br>0 7.9                                                                                                                                                | 1<br>1<br>1            | 7.3<br>3.8<br>4.5<br>8.1<br>0.7                      | 21.5<br>38.6<br>42.5<br>23.4<br>30.3                         | 179<br>98<br>246<br>438<br>323                      | 133<br>134<br>137<br>135<br>133                      | 4.2<br>3.8<br>3.9<br>4.3<br>4.1                    | 11<br>11<br>18<br>9<br>11                   | 0.4<br>1.15<br>1.76<br>0.7<br>0.56<br>0.85                         | 27.5<br>9.56521739<br>10.2272727<br>12.8571429<br>19.6428571                                           | 108<br>133<br>143<br>115<br>164                      | 105<br>98<br>105<br>105<br>104                      | 9.2<br>8.8<br>17.9<br>12.3<br>11.1                       | 23<br>31<br>18<br>22<br>22                         | 0<br>0<br>0<br>0      |
| 66<br>99<br>110<br>76<br>70<br>75             | 13<br>10<br>11<br>11<br>10<br>11                   | 5 21<br>12 13<br>2 14<br>8 19<br>19 12<br>6 24<br>6 16                                                                                                                                                     | 38.6<br>36.3<br>38.6<br>38.9<br>38<br>39.6<br>37.3                         | 11<br>15<br>8<br>14<br>13                 | 9<br>99<br>99<br>100<br>100<br>100<br>100                       | 7<br>5<br>9<br>0<br>0<br>0<br>7           | 1 18<br>0 17.3<br>1 19.3<br>0 17.8<br>0 7.9<br>1 16.5                                                                                                                                      | 1<br>1<br>1<br>1       | 7.3<br>3.8<br>4.5<br>8.1<br>0.7<br>7.3               | 21.5<br>38.6<br>42.5<br>23.4<br>30.3<br>22.5                 | 179<br>98<br>246<br>438<br>323<br>476               | 133<br>134<br>137<br>135<br>133<br>134               | 4.2<br>3.8<br>3.9<br>4.3<br>4.1<br>4.4             | 11<br>11<br>18<br>9<br>11<br>20             | 0.4<br>1.15<br>1.76<br>0.7<br>0.56<br>0.85<br>0.46                 | 27.5<br>9.56521739<br>10.2272727<br>12.8571429<br>19.6428571<br>23.5294118                             | 108<br>133<br>143<br>115<br>164<br>108               | 105<br>98<br>105<br>105<br>104<br>103               | 9.2<br>8.8<br>17.9<br>12.3<br>11.1<br>11.4               | 23<br>31<br>18<br>22<br>22<br>22<br>24             | 0<br>0<br>0<br>0<br>0 |
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| 66<br>99<br>110<br>76<br>70<br>75<br>70<br>86 | 13<br>10<br>11<br>11<br>10<br>11<br>11             | S         21           12         13           12         14           18         19           19         12           6         24           6         16           15         30           18         20 | 38.6<br>36.3<br>38.6<br>38.9<br>38<br>39.6<br>37.3<br>37.8<br>37.8<br>38.5 | 11<br>15<br>8<br>14<br>13<br>15<br>7<br>6 | 999<br>999<br>1000<br>1000<br>1000<br>1000<br>1000<br>1000<br>1 | 7<br>5<br>9<br>0<br>0<br>0<br>7<br>0<br>8 | 1         18           0         17.3           1         19.3           0         17.8           0         7.9           1         16.5           1         17.4           1         14.6 | 1.<br>1<br>1<br>1<br>1 | 7.3<br>3.8<br>4.5<br>8.1<br>0.7<br>7.3<br>0.2<br>7.5 | 21.5<br>38.6<br>42.5<br>23.4<br>30.3<br>22.5<br>30.4         | 179<br>98<br>246<br>438<br>323<br>476<br>215<br>105 | 133<br>134<br>137<br>135<br>133<br>134<br>145<br>141 | 4.2<br>3.8<br>3.9<br>4.3<br>4.1<br>4.4<br>4.2<br>3 | 11<br>11<br>18<br>9<br>11<br>20<br>10<br>20 | 0.4<br>1.15<br>1.76<br>0.7<br>0.56<br>0.85<br>0.46<br>0.83<br>1.57 | 27.5<br>9.56521739<br>10.2272727<br>12.8571429<br>19.6428571<br>23.5294118<br>21.7391304<br>24.0963855 | 108<br>133<br>143<br>115<br>164<br>108<br>117        | 105<br>98<br>105<br>105<br>104<br>103<br>113<br>108 | 9.2<br>8.8<br>17.9<br>12.3<br>11.1<br>11.4<br>12.2<br>16 | 23<br>31<br>18<br>22<br>22<br>24<br>24<br>24<br>20 |                       |

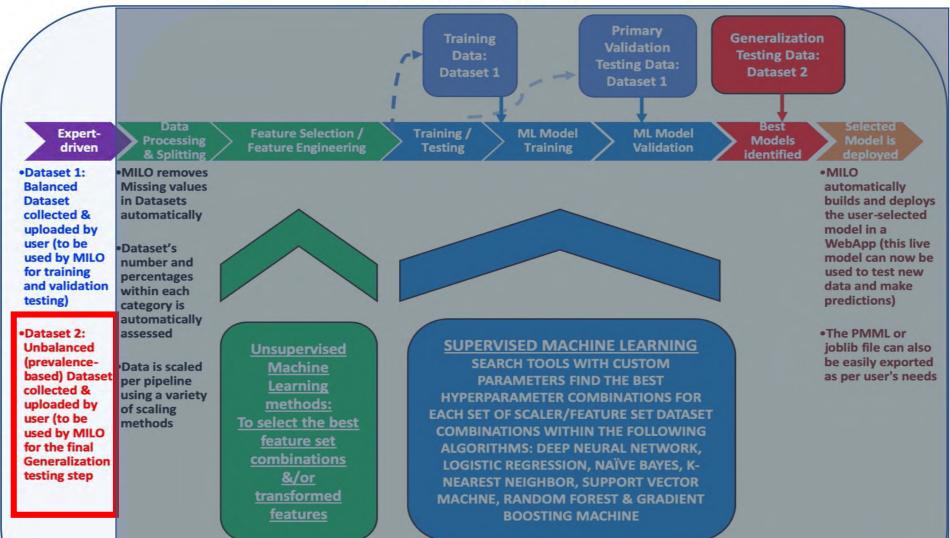
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| 85  | 97  | 20 | 38.3 | 11 | 99  | 1 | 8.18 | 7   | 22   | 388 | 142  | 3.8 | 25  | 0.45 55.5555556 | 140 | 106 | 5.8  | 34 | 4 |   |
| 68  | 115 | 24 | 39.5 | 10 | 100 | 1 | 12.3 | 8.7 | 28   | 287 | 142  | 3.3 | 17  | 1.01 16.8316832 | 104 | 109 | 7.3  | 29 | 3 | 3 |
| 62  | 102 | 17 | 39.1 | 9  | 98  | 1 | 3.84 | 8.2 | 25   | 264 | 142  | 4.5 | 12  | 0.93 12.9032258 | 129 | 102 | 9.5  | 35 | 4 |   |
| 68  | 162 | 26 | 39.7 | 11 | 100 | 1 | 12   | 7.1 | 21.6 | 401 | 142  | 3.6 | 7   | 0.37 18.9189189 | 120 | 105 | 13.6 | 27 | 2 |   |
| 71  | 122 | 16 | 38.1 | 14 | 98  | 0 | 17.6 | 9.7 | 32   | 645 | 142  | 3.3 | 26  | 0.57 45.6140351 | 331 | 112 | 9.3  | 24 | 1 |   |
| 68  | 113 | 16 | 38.3 | 15 | 97  | 0 | 23.9 | 6.9 | 23   | 732 | 142  | 3.6 | 25  | 0.48 52.0833333 | 122 | 112 | 9.6  | 24 | 0 |   |
| 109 | 123 | 17 | 38.2 | 11 | 99  | 1 | 13.5 | 6.8 | 21   | 174 | 142  | 3.4 | 22  | 0.75 29.3333333 | 102 | 108 | 7.4  | 30 | 2 |   |
| 62  | 74  | 19 | 38.1 | 11 | 97  | 1 | 7.56 | 7.5 | 25   | 288 | 142  | 3.6 | 44  | 1.38 31.884058  | 189 | 111 | 7.6  | 27 | 3 |   |
| 56  | 78  | 26 | 37.9 | 14 | 95  | 0 | 14.7 | 8.7 | 26.7 | 497 | 142  | 4.3 | 20  | 0.41 48.7804878 | 129 | 115 | 3.3  | 28 | 1 |   |
| 80  | 104 | 24 | 38.7 | 11 | 99  | 1 | 8.26 | 7.2 | 24   | 496 | 143  | 4.4 | 29  | 0.47 61.7021277 | 103 | 110 | 5.4  | 32 | 5 |   |



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|                                          | Google Drive               | Sepsis-ABA-features-Generalization.c      | sv                   | Dec 31, 2019 at 9:48 PM | 5 KB        | Commet (.csv) |                |
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|                                          | Co iCloud Drive            | Sepsis-All-features-Batch1.csv            |                      | Dec 16, 2019 at 9:35 AM | 19 KB       | Commet (.csv) |                |
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# MILO: Machine Intelligence Learning Optimizer

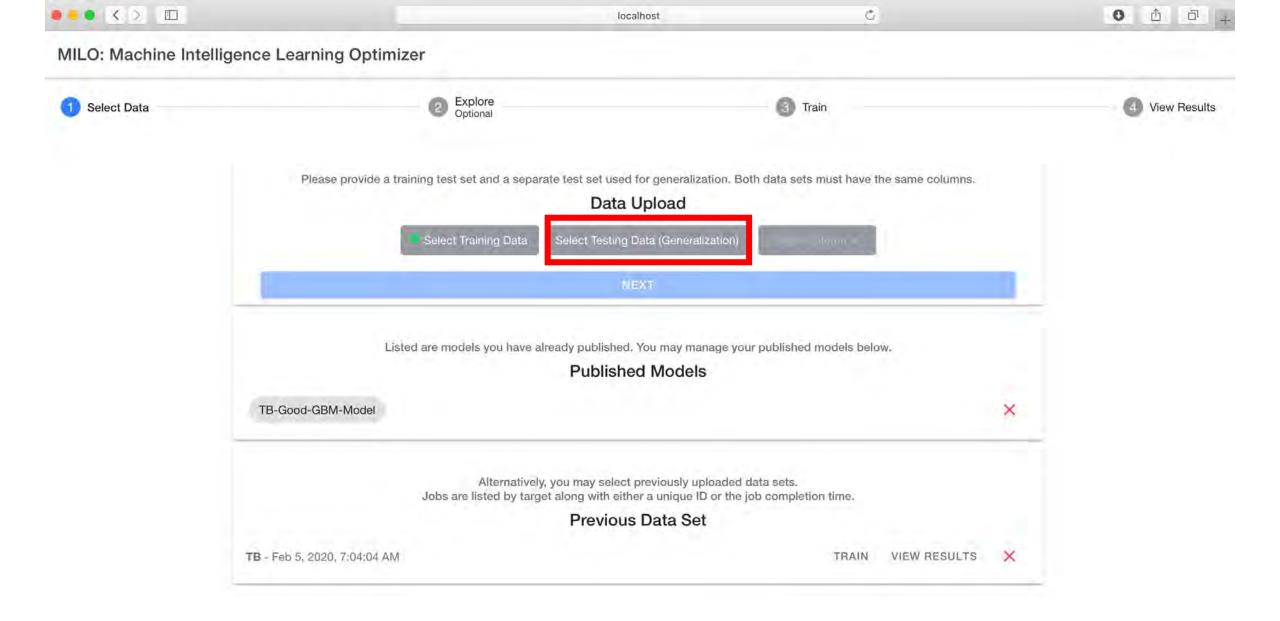


#### WRAPPED IN MILO'S WEB-BASED USER INTERFACE

## Import Generalization Dataset (Dataset 2): Representing the true prevalence

|            | AutoSave | OFF 🏫 🗔                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 5 × 0   | -                     |           |        |      |                  | 2       | Sepsis-All- | features | -Generalization-dat | a      |            |      |              |            |          |            |              | Q (2)      |
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| ]° Å<br>∏n | Cut      | Calibri (Body)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | v 1     | 2 × A A               | = =       | = * •  | ab w | /rap Text 🖌      | General |             | ÷.       | •                   | Normal | Bad        |      |              | s- 💼 -     | ∑ AutoSi | · .        | Q. 4         |            |
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| " 🖈        | Format   | B I ∐ ∾                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | - *     | <u>A</u> ~ <u>A</u> ~ | 동풍        | 표 편 편  | EM   | lerge & Center 🛩 | \$ * %  | 5 2 %       | 8 -48    | Formatting as Table | 0000   | (Victoria) |      | insert Den   | ete ronnat | Clear 1  |            | Select       | Senanoità  |
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| С          | 1        | ) E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         | F G                   | н         | i i    |      | J K              | in the  |             | м        | N C                 | P      | Q          |      | R            | S          | T        | U 1        | v w          | x          |
| AP         | HR       | RR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | TEMP    | GCS                   | O2SAT     | VENT   | WBC  | HGB              | HCT     | PLT         |          | NA K                | BUN    | CREAT      | В    | UN/CREAT GLU | CL         | Anio     | n Gap TCO2 | MODS         | Sepsis     |
|            | 81       | 139                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 24      | 38.8                  | 11        | 98     | 0    | 4.6              | 7.5     | 22.7        | 508      | 131                 | 4      | 6          | 0.58 | 10.3448276   | 135        | 102      | 10         | 23           | 0          |
|            | 69       | 130                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 21      | 37.8                  | 10        | 98     | 1    | 7.8              | 5.8     | 18.1        | 495      | 131                 | 3.7    | 18         | 0.6  | 30           | 140        | 104      | 10.7       | 20           | 0          |
|            | 72       | 110                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 19      | 38.3                  | 15        | 99     | 0    | 9.4              | 9.1     | 27          | 561      | 131                 | 3.8    | 6          | 0.8  | 7.5          | 131        | 97       | 11.8       | 26           | 0          |
|            | 75       | 116                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 19      | 37                    | 15        | 100    | 0    | 2.9              | 16      | 46.6        | 124      | 131                 | 4.4    | 12         | 1.22 | 9.83606557   | 105        | 100      | 9.4        | 26           | 0          |
|            | 81       | 111                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 18      | 38.5                  | 15        | 99     | 0    | 25.9             | 11.6    | 34.3        | 480      | 131                 | 3.8    | 9          |      | 10.5882353   | 176        | 97       | 11.8       | 26           | 0          |
|            | 52       | 115                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 17      | 39.3                  | 15        | 99     | 0    | 7.4              | 7.9     | 24.1        | 598      | 131                 | 4.6    | 5          | 0.78 | 6.41025641   | 85         | 101      | 8.6        | 26           | 0          |
|            | 74       | 101                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 12      | 38.1                  | 15        | 93     | 0    | 4.3              | 15.3    | 46.2        | 202      | 131                 | 4.9    | 10         | 0.94 | 10.6382979   | 201        | 98       | 11.9       | 26           | 0          |
|            | 75       | 120                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 16      | 38.1                  | 11        | .95    | 1    | 5.6              | 10.6    | 31          | 285      | 132                 | 4.2    | 7          | 0.59 | 11.8644068   | 181        | 99       | 9.2        | 28           | 0          |
|            | 59       | 129                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 19      | 38.8                  | 10        | 100    | 1    | 11.1             | 7.1     | 21.9        | 363      | 132                 | 4.6    | 18         | 1.03 | 17.4757282   | 127        | 105      | 9.6        | 22           | 0          |
|            | 63       | 116                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 32      | 38.3                  | 8         | 99     | 1    | 20.5             | 7.5     | 23.4        | 275      | 132                 | 5.3    | 17         | 0.7  | 24.2857143   | 109        | 102      | 13.3       | 22           | 0          |
|            | 56       | 129                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 19      | 39.4                  | 11        | 100    | 1    | 8.1              | 7.2     | 21.6        | 198      | 132                 | 4      | 23         | 1.17 | 19.6581197   | 124        | 100      | 13         | 23           | 0          |
|            | 87       | 134                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 14      | 38.7                  | 11        | 100    | 1    | 10,2             | 9.6     | 25.6        | 265      | 132                 | 4      | 8          | 0.6  | 13.3333333   | 131        | 97       | 11         | 28           | 2 0        |
|            | 81       | 113                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 20      | 38.7                  | 14        | 100    | 0    | 26.5             | 6.8     | 22          | 1029     | 148                 | 3.9    | 43         | 1.55 | 27.7419355   | 163        | 108      | 16.9       | 27           |            |
|            |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |                       |           |        |      |                  |         |             |          |                     |        |            |      |              |            |          |            |              | 1 1        |
|            | 92       | 120                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 30      | 38.5                  | 11        | 96     | 1    | 12.1             | 5.3     | 18          | 337      | 148                 | 4.7    | 24         | 0.64 | 37.5         | 101        | 111      | 6.7        | 35           | 1          |
|            | 71       | 91                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 19      | 38.6                  | 10        | 99     | 1    | 5.61             | 5.8     | 19          | 370      | 149                 | 4.3    | 27         |      | 52.9411765   | 157        | 114      | 5.3        | 34           | 1          |
|            | 93       | 117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 14      | 39.9                  | 13        | 96     | 0    | 10.4             | 7.2     | 23          | 673      | 149                 | 3.3    | 22         |      | 30.1369863   | 138        | 114      | 8.3        | 30           | 1          |
|            | 83       | 117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 23      | 38.4                  | 10        | 97     | 1    | 16.1             | 6.1     | 20          | 332      | 149                 | 4.4    | 24         | 0.5  | 48           | 108        | 110      | 8.4        | 35           | 1          |
|            | 62       | 126                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 20      | 40.3                  | 10        | 100    | 1    | 13.3             | 9.3     | 29          | 286      | 150                 | 4.3    | 19         |      | 20.8791209   | 113        | 116      | 9.3        | 29           | 1          |
|            | 89       | 131                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 19      | 40                    | 8         | 97     | 1    | 6.86             | 11.2    | 35          | 162      | 150                 | 3.6    | 18         |      | 14.6341463   | 127        | 111      | 9,6        | 33           | 1          |
|            | 81       | 120                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 20      | 40.4                  | 10        | 96     | 1    | 4.76             | 10.1    | 32          | 178      |                     | 3.3    | 19         |      | 13.7681159   | 158        | 111      | 9,3        | 34           | 1          |
|            | 79       | 112                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 18      | 39                    | 10        | 100    | 1    | 4.22             | 9.8     | 31          | 212      |                     | 3.6    | 20         |      | 12.987013    | 132        | 115      | 7.6        | 34           | 1          |
|            | 92       | 125                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 20      | 38.2                  | 14        | 100    | 0    | 20.4             | 7.9     | 26          | 950      | 153                 | 3.5    | 32         |      | 60.3773585   | 126        | 114      | 9.5        | 33           | 1          |
|            | 79       | 127                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 16      | 38.4                  | 12        | 99     | 0    | 19.9             | 8.3     | 28          | 937      | 157                 | 3.4    | 36         | 0.48 | 75           | 114        | 115      | 10.4       | 35           |            |

Ready



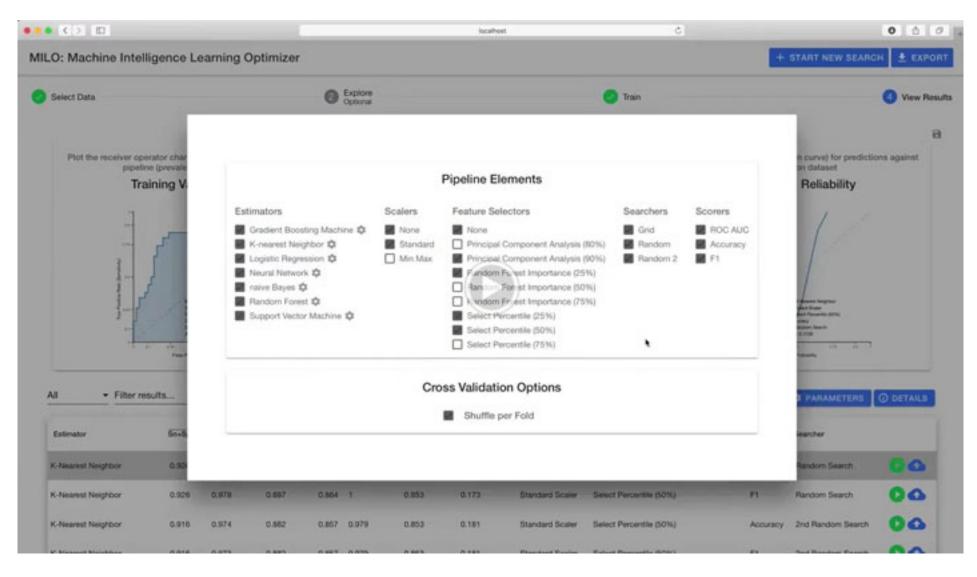
| MILO: Machine Int | elliç <> =- E              | 3 Sepsis-MILO-Full-run                                                                           | Q Search                |               |               |              |
|-------------------|----------------------------|--------------------------------------------------------------------------------------------------|-------------------------|---------------|---------------|--------------|
|                   | Favorites                  | Name                                                                                             | Date Modified           | Size          | Kind ^        |              |
|                   | Recents                    | 🔻 📃 ABA-feeatures-MILO-run                                                                       | Jan 10, 2020 at 4:26 PM | 44            | Folder        |              |
| 1 Select Data     | Applications               | ABA-features-Sepsis-MILO-run-results                                                             | Jan 10, 2020 at 4:29 PM |               | Folder        | View Results |
|                   |                            | OLD-ABA-Sepsis-features-RF1350-results                                                           | Jan 2, 2020 at 8:32 AM  |               | Folder        |              |
|                   | Google Drive               | Sepsis-ABA-features-Generalization.csv                                                           | Dec 31, 2019 at 9:48 PM | 5 KB          | Commet (.csv) |              |
|                   | O Downloads                | Sepsis-ABA-features-Training.csv                                                                 | Dec 31, 2019 at 9:47 PM | 11 KB         | Commet (.csv) |              |
|                   |                            | Jupyter-test-of-top5-features                                                                    | Jan 9, 2020 at 9:43 AM  |               | Folder        |              |
|                   | Desktop                    | OLDER-Sepsis-FULL-RUN-RESULTS                                                                    | Jan 10, 2020 at 6:42 AM |               | Folder        |              |
|                   | 😭 hoomanrashidi            | Sepsis-FULL-RUN-Results-1-10-2020                                                                | Jan 10, 2020 at 6:47 AM |               | Folder        |              |
|                   | the second                 | SOFA-Sepsis-features-MILO-run-results                                                            | Jan 10, 2020 at 4:18 PM |               | Folder        |              |
|                   | iCloud                     | Traditional-run-results                                                                          | Jan 6, 2020 at 10:57 AM |               | Folder        |              |
|                   | C iCloud Drive             | Sepsis-All-features-Batch1.csv                                                                   | Dec 16, 2019 at 9:35 AM | 19 KB         | Commet (.csv) |              |
|                   | Desktop                    | Sepsis-All-features-Batch2.csv                                                                   | Dec 16, 2019 at 9:44 AM | 19 KB         | Commet (.csv) |              |
|                   | Documents                  | Sepsis-All-features-Generalization-data.csv                                                      | Jul 16, 2019 at 5:05 PM | 19 KB         | Commet (.csv) |              |
|                   | Documents                  | Sepsis-All-features-Training.csv                                                                 | 47 KB                   | Commet (.csv) |               |              |
|                   | Tags                       | SEPSIS TRADITIONAL vs MILO Best Models-Results                                                   | 17 KB                   | Micros(.docx) |               |              |
|                   | Orange                     |                                                                                                  |                         |               |               |              |
|                   |                            |                                                                                                  |                         |               |               |              |
|                   | O Work                     |                                                                                                  |                         |               |               |              |
|                   | 🨑 Yellow                   |                                                                                                  |                         |               |               |              |
|                   | Important                  |                                                                                                  |                         |               |               |              |
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|                   |                            |                                                                                                  |                         | Cancel        | Choose        |              |
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|                   |                            | Alternatively, you may select previously<br>Jobs are listed by target along with either a unique |                         |               |               |              |
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|                   | <b>TB</b> - Feb 5, 2020, 7 | 04:04 AM                                                                                         | JLTS X                  |               |               |              |

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| MILO: Machine In | telligence Learning Optimizer                                                                                       |                              |               |   |              |
| Select Data      | Optional                                                                                                            | Train                        |               |   | View Results |
|                  | Please provide a training test set and a separate test set used for generalization. E                               | Both data sets must have the | same columns. |   |              |
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|                  | TB-Good-GBM-Model                                                                                                   | Anion Gap                    | 0             | × |              |
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| MILO: Machine Intel | ligence Learning Optimizer                                                       |                                |                |              |
| 1 Select Data       | Explore<br>Optional                                                              | Train                          |                | View Results |
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MILO IN ACTION Quick Demo

## INSERT MILO MP4 VIDEO 1



## MILO is also very transparent

## INSERT MILO MP4 VIDEO 2

| 0.00.(4)                      |                                                |                                              |         |            |       |               | teatran                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
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| LO: Ma                        | schine Intellig                                | ence Learning                                | Optim   | izor       |       |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | D to an                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |
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| • •                           |                                                | 10.0-0+                                      |         |            |       |               | A next -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
| e bar                         | t Draw Pagel                                   | ayout Formulas                               | Data    | Review 1   | **    |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | d they O for                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -      |
|                               | -                                              | Conventione                                  | -       | dist.      | 1     |               | 10 40 B C2 P. KD 20 20 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
|                               | 13. IS.                                        | [] Imparian                                  | ÎÌ      | ap         | In R  |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | our Securit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |
| Test Int                      | Gary Al                                        | 1 1.001.0000                                 | and the | (any other | 11.4  | an row G Adam | North Fach Rations Sera Constitions Shard State States Section 1 States                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | e (tera)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |
|                               | i i fa bay                                     |                                              |         |            |       |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
| -                             | 4 8 1                                          | 4 8                                          |         |            |       |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
| 100.0                         | 0.000 (0.000, 0.00)                            | 6.000 (0.198, 0.0                            | 0.4817  | 1 1 1      | 104   | 10 IL         | 21 (NY, TEMP, WHC, WHY, WCT, NA, Y, BUW, URLAF, BUW/ORLAF, TODY)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | (* Seed, party * Jeed, Spr. * Jeed, Spr. * preventer, * preventer, * preventer, * 2016, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |
| 0.004,12                      | 0.000 (0.754), 0.00                            | 8,050 (8,036,031                             | 0.4817  | 1          | 104   |               | 21 (WY, TEMP, WHC, WHF, WF, WF, WF, W, BOY, UMAF, BOW/DEAF, TOP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Complex: 1,000,000,000,000,0,000,0,00,00,00,00,00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 11000  |
| 0.404,12                      | 1.8526 (0.767, 0.964                           | 8,255 (8,218,4,21                            | 0.4761  | 1          | 104   | 4 4           | D FW, TEMP, WEC, WEF, WET, WE, Y, YOK, UNAT, BUNCHDAT, TODY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Twenghor: 1(0.0, 0.0, 0.0) (0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |
| (0.406.10<br>(0.406.10        | 0.4095 (0.7521, 0.07<br>0.4095 (0.7521, 0.07   | 8.2550 (8.2588, 6.25<br>8.2550 (8.2588, 6.25 | 0.4504  |            | 108   | 2 1           | [38] THY, YEMY, WHY, WHY, WHY, WHY, WHY, WHAY, WHAY, WHAY, WHY, WHY, WHY, WHY, WHY, WHY, WHY, WH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Twengin' 1 (0.0, 0.0, 0.0, 0.0), 0.00, 0.0, 0.0, 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |
| 10.404.12                     | 0.4005 (0.751), 0.01                           | 0.000 (0.1700.0.2)                           | 0.4804  | 1          | 108   |               | 18 [187, 187, 107, 107, 188, 167, 167, 187, 18, Y. BUK, URAT, SUB/DEAT, DUT, T. Hose-Day,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | "007. W081 [C.4 M/95 364, 64, 64 (64, 64) & 364, 64, 64 (64, 64)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |
| (11.804,10                    | 84005 (0.751), 846                             | 8,2353 (8.2768, 4.81                         | 04804   | 1          | 108   |               | 10 (160*, 160, 1010*, 1017, 1607, 1607, 160*, 167, 164, 17, 80.07, 10147, 1014/08147, 1017, 17, 18mm-dagt,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | "1007", "MOON"] [1"-0.94000 [0.4, 0.4, 0.0 [0.4, 0.4], 0.0, 0.4, 0.0 [0.4, 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1000   |
| 0.406.12                      | 0.4005 (0.7513, 0.40)<br>1.4005 (0.7513, 0.40) | 9,250 (h.1%6,6.2)<br>9,250 (h.1%6,6.2)       | 0.4214  |            | 108   | 2 2           | 38 [189] W. TEMP, MN, WAR, MAR, W.P. WE, Y. TUN, URAF, SUN, HARF, Kar, T., Noro-Lap,<br>28 [189] W. TEMP, MN, WAR, WAR, W.P. WE, Y. TUN, URAF, WAR, MAR, W.F. W. Noro-Lap,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
| 0.457, 1.0                    | 0.809 (0.794), 0.00                            | 0.200 (0.2100.0.0)                           | 0.4795  | a maile    | 100   | 2 2           | at the ter ter ter ter ter ter ter ter ter te                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
| D-8813, 0.01                  | 0.0003 (0.7654, 0.66                           | 0.250 (0.198, 6.2)                           | 0.6458  | 8.0004     | 100   | A 1.          | as jush, bar, war, we we me, now, usy, usue, vent, war, we wer, why we way, we were                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 47, WANDRAF, W.Y.C. L. WAN, M.S. && A.S. M.S. & Son. A MARKED A. S.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 44,63  |
|                               | 1.8015 (C.7654, 0.00)<br>1.8010 (C.7654, 0.00) | 0.2553 (0.2100, 0.21                         | 0.0408  | 0.0004     | 100   | 2 1           | 35 (18P, 18P, 16P, 18F, 18F, 10P, 107, 12547, 16N', 16B, 167, 16F, 16F, 16F, 16F, 16F, 16F, 16F, 16F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | P. WARDAR, W.P. L. Mas, 204, 63, 64 (10), 640; K. DA & BRADING, 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 88,88  |
| 1. ANU                        | 0.0000 (0.765A, 0.00                           | 0.2820 (0.2768, 0.20                         | 1000    | 0.0004     | 100   | 2 1           | as they ber been not be the toom with their bear well not not be too be too                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | F. M.M. DEAF, M.Y. LANSS DA. N.S. S.S. S.S. S.S. S. DA. SHERRICH, S.<br>M. M.M. DEAF, M.Y. J. MCT. MA. S.S. S.S. S.S. S.S. S. M.S. SHERRICH, J.<br>M. M. M. DEAF, M. Y. M. MARKAN, N.S. S.S. S.S. S.S. S. M.S. SHERRICH, J.<br>M. M. M. M. M. M. S.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |
| 11.6675, 2.17                 | 1.0021 (1.7614, 0.00                           | 8,000 (9-1709, 4-21                          | 1.1410  | 10015      | 1.00  | M 8           | IN THEY, THEY, THEY, THE, THEY, THEY | OF, MANYORAF, W.Y.C. LANSIN DIA, AN, AN (INA, MAR, N. (INA, AMBARIJIA, I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 44,84  |
| 0.8855, 0.91                  | 0.0022 317634, 0.00                            | 0.2850 (0.1788, 0.20                         | 0.8418  | 0.0004     | 100   | 47. 1         | 36 (18P, 18P, 16P, 16P, 19P, 19P, 102), 12547, 10N7, 16B, 167, 167, 167, 167, 167, 167, 167, 167                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | IT, BARTHAT, SITE ANTH SALAR AN INCOME AN ADDRESS OF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 44,93  |
| DARKS, D.P.                   | 1.8013 (1.7654, 8.86                           | 8.200 (8.298, 6.2)<br>8.200 (8.298, 6.2)     | 0.0410  | 0.0004     | 100   | 2 1           | 36 (167, 167, 167, 167, 17, 188, 106, 107, 107, 107, 107, 107, 107, 107, 107                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
| D. MARL. C. M.                | 14012 10 7614 1.00                             | 0.250 (0.250 0.21                            | 11414   | 1.0014     | 100   | 8 1           | as year, bar, war, at 31                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | IT, BUNCHERT, SITE ANDRESS AND AN AN AND AND A REAL AND AN AND AND A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1.008  |
| (1.4893, 0.94                 | 0.8022 (0.7634, 0.06                           | 8380 (81198, 631                             | 0.4434  | 8.980a     | 1.000 | # L           | 28 [16P, 16P, 16P, 16P, 18] TI, TOWE SCI, 10047, 16N7, 16N7, 16D, 16T, 16T, 16T, 16T, 16T, 16T, 16T, 16T                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | er, 'nonconser, 'n pri a energia, ba ba pa da da a ja da danesija, b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 140,84 |
| (1.465), 5.00                 | CAUSE IS NO. A.M.                              | 8,000 (81,788, 6.91                          | 0.4408  | 0.0004     | 100   | 10 L          | 14 [18P, 08P, 94P, 94] 18B, 10PF, 927, 9347, 9487, 968, 967, 917, 947, 947, 968                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | IT, 'BUNCTERT', 'S J'C' SAMAT' (S.C. S.S. S.S. (S.G. S.S.), S. (S.G. SAMAT (S.G. S.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 44,88  |
| 11.8891, 1.94                 | LADED (C. NOA, C.M.                            | 9.363 (0.256, 6.3)<br>9.363 (0.256, 6.3)     | 11440   | 1.0004     | 100   | 2 1           | 26 [167 [167 167 167 167 167 167 167 167 167 1697 169                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
| 10.8893.0.91                  | 0.0002 10 7614, 0.00                           | 0.2899 (0.1999, 0.31                         | 0.0438  | 0.0004     | 180   | W 1           | IN THEF, DRF, SHIF, WE, WE, TOWF, SQY, SDIAF, VENT, WEC, YEE, WCT, TUT, WE, Y, WAY, DRIV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
| 1.8651.0.91                   | 0.0000 (0.7604, 0.00                           | 0.280 (0.298, 0.31                           | 0.8438  | 0.0004     | 180   | 47 1.         | 34 (18P, W, 19MF, VOY, WEC, HOF, HOT, WE, Y, YUK, OHAT, YUM/OHAT, YUF, YU, Hear-Lag.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
| 214575, 5145<br>21428, 5146   | 101010-0120-020                                | 8,000 (8,2168, 6,0)                          | 0.4403  | 0.0012     | 104   | e 1           | 33 (W, 15M, WAC, WAF, W.F, W.F, BUR, UMAF, BUR/OBAF, 7027, MIDE)<br>30 (W, 15M, WAC, WAF, W.F, W.F, WAR, W.RAF, BUR/OBAF, 7027)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 77. 1 1427 MA 64 44 20, 142 1 24 4 44 54 54 54 54                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |
| 11818.0.100                   | 0.8718 (0.855, 0.10)                           | 6,210 (0.2788, 0.21                          | 0.4803  | 0.0784     | 100   |               | 31 (W. 15M, WSC. WF, 107, 16, Y. 10, ULAF, BAUDLET, 1027)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0 NA 94 66 03 835 9 04 84 89 04 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |
| 11414, 1.166                  | 0.0710 (0.000, 0.002                           | 0.200 (0.199, 0.2)                           | 04803   | 0.0184     | 106   | 4. 1          | 20 (14Y, TEMP, WEC, WAY, WCT, THE, Y, TONY, UMAY, TONYOTAY, TOOP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0 104,04,44,04,44,0,04,44,04,04,04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |
| 11.428, 1.76F                 | 14715 (1495, 170)                              | 8,050 (8,1%8,4,2)                            | 0.4503  | 0.0784     | 100   |               | 20 (TW, TEMP, WER, WER, WER, W. T. SH, Y. TUW, UNLAF, TUMUNEAR, TUDY)<br>20 (TW, TEMP, WER, WER, WER, W. T. SH, Y. TUW, UNLAF, TUMUNEAR, TUDY)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0 00,04,05,00,00,00,00,00,00,00,00,00,00,00,00,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
| 17.808, 1.16F                 | 0.0718 (0.000, 0.002                           | 8,2550 (6.2 %8, 6.2                          | 0.4853  | 10784      | 100   | 2 1           | 20 (107, 10497, WEC, WEF, WEF, WEF, WEF, W.F, WEW, CHLAY, WUM/ORDER, TODE)<br>20 (107, TEMP, WEF, WEF, WEF, WEF, W.F, WEW, WEAT, WUM/ORDER, TODE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0 104, 94, 95, 96, 96, 8 104, 94, 95, 95, 94, 94, 94, 94, 94, 94, 94, 94, 94, 94                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |
| 01408.0.984                   | 0.8718 (0.805, 0.002                           | 8.2950 (8.2768, 8.21                         | 0.4823  | 0.0794     | 104   |               | ST (107, TEMP, WER, WER, WET, 167, 167, W. WORK, UNLAF, WARONAF, TODE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2 394, 94, 94 395, 842, 9 394, 84, 99 394, 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1.000  |
| 11414.11161                   | 1.8718 (1.875, 1.111)                          | 0.2553 (0.1768, 0.21                         | 0.4825  | 0.0764     | 196   | 5 5           | AL YAR, YEAR, WAY, YAR, WY, MA, Y, YAR, URAF, WAROLAF, 10021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | BARARA MARARA MARARA MARARA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |
| 01404, 0.160<br>(11404, 0.160 | 14714 (1408, 1.91)                             | 9,2050 (0.1788, 6.25<br>9,2050 (0.1788, 6.25 | 0.4825  | 0.0754     | 100   |               | ALCENT, TELMT, WART, WART, WAT, WAT, W. WURT, TELMT, WARTHAMT, TODOT<br>(2017), TELMT, WART, WART, WAT, WALL, WARTHAMT, WARTHAMT, TODOT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0 34,44,44,34,34,34,44,44,44,44,44,44,44,4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |
| 11.616.11.000                 | 14714 (0.408, 0.90)                            | 0.253 (0.1760, 0.21                          | 0.4813  | 0.0784     | 1.04  | 4 1           | at (W, YEAP, WAI, HAP, HEY, W, Y, BUY, URAF, BUN, URAF, 1002)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2 34, 54, 54 (04, 56, 5 (04, 54, 55)) 4, 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |
| 11419, 1190                   | 0.8758 (0.809, 0.907                           | 0.050 (0.1700, 0.25                          | 0.4913  | 0.0754     | 106   | 4 1           | 20 (MF, YEAP, WHI, YEAP, WIT, YAF, Y, YUN, UNLAF, YUN/DEAF, YUSP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2 新成市在市区新成市场、市场市场市场市场                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1000   |
| 0.404, 0.100                  | 14718 (1408, 1-10)                             | 0.200 (0.190, 0.0)                           | 0.4823  | 0.0784     | 100   | 2 1           | 30 (107, 15147, 1616, 1607, 167, 167, 167, 168, 17, 169, 10147, 1014/16147, 1010)<br>30 (107, 15147, 1616, 1607, 1617, 161, 17, 1614, 16147, 1614/16147, 1010)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0 (0.4, 0.6, 4.6) (0.4, 140, 4. (0.4, 0.4, 0.4) (0.4, 1<br>0 (0.4, 0.4, 0.4) (0.4, 0.4), 4. (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) (0.4, 0.4) |        |
| 1418.1.100                    | 1.8718 (0.800, 0.002                           | 0.2203 (0.2 Mm, 0.21                         | 0.4553  | 10794      | 100   | 2 1           | BUTHY, TEMP, WHI, HER, WIY, MA, W. BUW, UMAF, BUW/DRAF, TODY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0 34, 54, 54 35, 54, 5 35, 54, 59 34, 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |
| 1428, 1 1981                  | 10710 (1000.000)                               | 8.250 (8.1788, 9.21                          | 0.4823  | 0.0784     | 100   | A 1           | 20 (1W, 18MP, WAC, HER, HOF, MA, W, KUW, URLAF, BUNCHEAF, 1002)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0 364, 64, 64 364, 643, 64, 64, 64, 64, 64, 64, 64, 64, 64, 64                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1.000  |
| 1.424, 1.586                  | 14714 (1408, 1201                              | 8.000 (8.098.0.2)                            | 0.4803  | 0.0754     | 104   | 2 1           | 20 (W, TEMP, WEC, HEF, HCF, MA, Y, YUM, OLAF, WANDARF, TODY)<br>20 (W, TEMP, WEC, HEF, HCF, MA, Y, YUM, UMAF, WANDARF, TODY)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0 04.44.47.04.442.4 04.44.44.04.04.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |
| 0.626.0.080                   | 14714 (1405, 1-10)                             | 0.353 (0.198.0.2)                            | 0.4853  | 10764      | 100   | 2 2           | 20 (197, 100P, WEC, MIR, WET, MIR, W, BUR, UNLAF, BUR/DELF, 1020)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0 04.04.04.04.04.04.04.04.04.04.04.04.04.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |
| 0.834, 0.180                  | 24718 (2406, 2001                              | 8,265 (8,296,4,2                             | 0.4801  | 0.0784     | 100   | 4 1           | 20 [187, 10MP, WEC, 1639, 1677, 168, V, 1639, 10647, 1039/06047, 1002]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0 (0.4, 0.4, 0.4, 0.4, 0.4, 0.4, 0.4, 0.4,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4-624  |
| 1.414, 1.164                  | Large Date Land                                | 8,280 (8,270) 4,21<br>8,280 (8,270) 4,21     | 0.4823  | 0.0784     | 106   | 2 1           | 30 (WY, YEAR, WAR, WAR, WCT, WA, Y, YAW, URLAF, WAR/DEAT, YOUT)<br>30 (WY, YEAR, WAR, WCT, YAR, Y, YAW, URLAF, WAR/DEAT, YOUT)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0 (04, 04, 04, 04) + (04, 04, 04, 04, 04, 04, 04, 04, 04, 04,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |
| 1.414, 1.166                  | LATIN (LAIR, LOUI)                             | 9,3939 (0.1788) 0.21                         | 0.4803  | 11784      | 100   | 2 1           | JE (W. TEMP, WEC, HER, HCF, N. K. BUW, GRAF, BURGHER, TOP)<br>JE (W. TEMP, WEC, HER, HCT, NR, W. BUW, CHAF, BURGHER, TOP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0 10.00 00 00.00 0 00.00 00.00 00.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |
| 11434, 1144                   | 0.4718 (0.408.0.00)                            | 838833838443                                 | 0.4803  | 0.0784     | 106   | R 1           | 30 [164, TEMP, WEC, HOF, WCT, YeA, Y, BUW, UREAT, BUR/DREAT, TODE]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0 (64, 65, 66, 66, 66, 6, 66, 66, 66, 66, 66,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1000   |
| 1.828.0.100                   | CATA LAB LINE                                  | 10.000                                       | 0.4803  | 1104       | 108   | m 1           | 20 TMF, TEMP, WEC, HER, HCT, MR, Y, BUW, DMAY, BUHURDAY, 10201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | N 104 64 55 104 55 5 104 64 59 104 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1000   |
|                               |                                                |                                              |         |            |       |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ······································                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 100    |
|                               |                                                |                                              |         |            |       |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |
|                               |                                                |                                              |         |            |       |               | BELECT CBV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |

In Summary: MILO

- It's super easy to use
- No Machine Learning (ML) expertise needed
- No Programming or software engineering expertise needed
  - MILO is your personal ML & Software engineering Expert Team
- MILO
  - Follows ML Study Best practices
  - Finds your Best ML Model and does it Much Faster
  - Most importantly it's a validated platform

## **Our Studies & Collaborators**

#### **Our AKI & Sepsis ML Team**

- Nam Tran
- Tina Palmieri
- Soman Sen
- Samer Albahra
- Jeff Wajda
- Hooman Rashidi

### **Collaborators for our other validation studies**

- Joe Galante & Shawn Tejiram: MTP
- Imran Khan : TB
- Kuang yu Jen: DGF (transplant)
- Thomas Smith & William Wung (Cath results: Cardiology)
- Erin Griffin, Sharad Jain & Kristin Olson (USMLE step 1 studies)

## MILO's Core Team

Samer Albahra MD

Hooman H. Rashidi MD MS

Nam Tran, PhD

## Thank you for your attention