

### Quiz 3 / Oct 28, 2021/ Instructions

- Return answer to quiz as report (.pdf) and GitHub link by 5:00 pm on Tuesday, Nov 2, 2021. Post the report as sub-folder “Quiz3” in your shared folder (e.g., Google folder mentioned in spreadsheet) and confirm it being done by email to [biplav.s@sc.edu](mailto:biplav.s@sc.edu).
- Ask any question by email. Or, office hours and class can be used to clarify questions. Total points = **100**, Obtained =

Student Name:

GitHub link with code in a sub-dir called “Quiz3”:

**Note:** If you are not able to install AIX360 due to system issue, the instructor will make a machine available with the tool for one hour on Tuesday, Nov 2, 2021 to complete the interactive assignments.

#### Theme 1: Understanding of AIX 360 HELOC Tutorial and its Explanation Methods

[10 + 10 + 15 + 15 = 50 points]

#### Instructions

- a. Setup AIX360
- b. Run the tutorial at: <https://github.com/Trusted-AI/AIX360/blob/master/examples/tutorials/HELOC.ipynb> on your machine and check in the notebook.

#### Questions:

1. Consider the explanations generated for data scientist. Can a loan officer make sense from it - Why or why not? Can a customer make sense of this ? [5 + 5 = 10 points 10 points]

Yes, because the models are presented in the form of a Boolean rule model and logistic rule regression model. They look a broader view and loan officers could look at the trends and behavior of the model and compare that to their knowledge. A customer may not make as much sense of it because it looks more at the global view of the model rather than an individual view. This is where expandability comes in for both the loan officer and customer.

2. Give results for loan officer where User id = 3, and  
User id = 2385

Chosen Sample: 3

Prediction made by the model: Good

Prediction probabilities: [[-0.40730566 0.52295953]

Chosen Sample: 2385

Prediction made by the model: Good

Prediction probabilities: [[-0.15256763 0.23113117]]

	0
ExternalRiskEstimate	86
MSinceOldestTradeOpen	315
MSinceMostRecentTradeOpen	16
AverageMinFile	102
NumSatisfactoryTrades	18
NumTrades60Ever2DerogPubRec	1
NumTrades90Ever2DerogPubRec	0
PercentTradesNeverDelq	95
MSinceMostRecentDelq	64
MaxDelq2PublicRecLast12M	6
MaxDelqEver	5
NumTotalTrades	19
NumTradesOpeninLast12M	0
PercentInstallTrades	53
MSinceMostRecentInqexcl7days	0
NumInqLast6M	5
NumInqLast6Mexcl7days	2
NetFractionRevolvingBurden	0
NetFractionInstallBurden	0
NumRevolvingTradesWBalance	1
NumInstallTradesWBalance	1
NumBank2NatlTradesWHighUtilization	0
PercentTradesWBalance	29
RiskPerformance	Good

:

	0
ExternalRiskEstimate	78
MSinceOldestTradeOpen	82
MSinceMostRecentTradeOpen	5
AverageMinFile	54
NumSatisfactoryTrades	33
NumTrades60Ever2DerogPubRec	0
NumTrades90Ever2DerogPubRec	0
PercentTradesNeverDelq	100
MSinceMostRecentDelq	0
MaxDelq2PublicRecLast12M	7
MaxDelqEver	8
NumTotalTrades	41
NumTradesOpeninLast12M	2
PercentInstallTrades	15
MSinceMostRecentInqexcl7days	0
NumInqLast6M	3
NumInqLast6Mexcl7days	3
NetFractionRevolvingBurden	21
NetFractionInstallBurden	11
NumRevolvingTradesWBalance	9
NumInstallTradesWBalance	3
NumBank2NatlTradesWHighUtilization	2
PercentTradesWBalance	50
RiskPerformance	Good

Explain the prototype explanations. [5 + 5 = 10 points]

User 3 is an excellent candidate for a loan. User 2385 is a little unclear.

Overall, it is clear that user 3 is a great candidate.

Marking User 2385 as good is either an oversight by the prototype or some factors in their profile weigh more than others when determining.

User 3: External risk - 86 (higher than mean, allowing extra boost)

Low ratio of revolving debt balance to credit limit (0%, meaning way less revolving debt than their credit limit)

0 accounts with high utilizations

1 revolving trade with balances

95% of their trades have never been delinquent

The severity of this applicant's worst delinquency from last 12 months is 6 (above 5, good)

64 months since most recent delinquency (over 21 month mark)

User 2385: External risk – 78 (higher than mean, allowing extra boost)

21% revolving debt balance (lower than jump around 50%)

2 accounts with high utilization (not great, not terrible)

2 revolving trade with balances (lower than 5, gives bonus)

100% of their trades have never been delinquent

The severity of this applicant's worst delinquency from last 12 months is 7 (above 5, good)

0 months since the last delinquency (looking for over 21 months)

The main rule on how classifiers were trained in Data Science section:  $\text{ExternalRiskEstimate} \leq 75.00$  AND  $\text{NumSatisfactoryTrades} \leq 17.00$  OR  $\text{ExternalRiskEstimate} \leq 72.00$  AND  $\text{NumSatisfactoryTrades} > 17.00$

Making User 3 set to 1 and User 2385 set to 1 just based on how the classifiers were trained.

3. For customers, do contrastive explanations for Users with IDs: 2344, 449, 1168 [5 + 5 + 5 = 15 points]

The model predicts that user 2344, 449, 1168 will not be granted a loan.

User 2344's application would have been accepted if their consolidated risk marker score increased from 72 to 78 and if their application was on file for 69 months.

User 449's application would have been accepted if their consolidated risk marker score increased from 77 to 87, if their application was on file for 118 days, and their number of satisfactory trades increased from 10 to 13.

User 1168's application would have been accepted if their consolidated risk marker score increased from 61 to a little over 68 and their application was on file for 102 days.

4. The same classification method is not used for all the three types of explanations. Try any one classification method (e.g., RandomForest, Neural Classifier, ..) and run the explanation methods for decisions by all three roles – Data Scientist, Loan Officer and Customer [15 points]

Trained classifiers at beginning of notebook – Seen in HELOC copy 2

## Theme 2: Understanding of ProtoDash Method and Run the CDC Notebook

[20 + 30 = 50 points]

### Instructions:

1. Run the tutorial at:

<https://github.com/Trusted-AI/AIX360/blob/master/examples/tutorials/CDC.ipynb>

on your machine and check in the notebook. (Important:

### Questions:

5. Explain how prototypical explanations are helping understand the survey responses. What roles is (are) the notebook best suited for? [20 points]

The manner in which this is accomplished is by finding prototypical individuals for each of the questionnaires and then evaluating how well they represent the income questionnaire

6. Read the ProtoDash paper: [10 + 10 + 10 = 30 points]

Efficient Data Representation by Selecting Prototypes with Importance Weights, Karthik S. Gurumoorthy, Amit Dhurandhar, Guillermo Cecchi, Charu Aggarwal, ICML 2019,  
<https://arxiv.org/abs/1707.01212>

Explain the problem (section 2) and algorithms (ProtoGreedy and ProtoDash: section 4) in one paragraph each.

Problem: Find the set that best represents the target

ProtoGreedy: Greedily selects the next element that maximizes the increment of the scoring function. Given the current set  $L$ , ProtoGreedy selects that element  $j_0$  that produces the greatest increase in objective value  $f(\cdot)$ . ProtoGreedy also determines the unequal non-negative weights for each of the selected prototypes. Requires solving a quadratic program of hefty time complexity to select the next best element.

ProtoDash: Choose an element  $j_0$  whose gradient is the highest over the set of candidates. As the chosen element may not be the one with the highest increment in  $f(\cdot)$ . Advantage over ProtoGreedy: computational speedup of two orders of magnitude