

MRM Project Proposal

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Topic:

Model Risk Management for Machine Learning Models in Consumer Lending

Motivation and Proposed Research Structure:

Consumer spending/ lending is one of the most important systemic risk and drivers of macroeconomic conditions (Khandani et al., 2010), and the lending decision informed by credit underwriting models could affect the lives of hundreds of millions of Americans. Upon large amounts of potential data, banks are increasingly relying on machine learning models to make better lending decisions in recent years (Aziz & Dowling, 2019). However, the black-box essential of machine learning models makes the transparency and explainability critical problems for fair and responsible use.

In the first part of the project, I will review relevant research of machine learning models in consumer lending. Representative models, including simple models and more complex models, will be selected to conduct complexity classification and verify conceptual soundness. Models will be reviewed with different research scenarios (research data and hypothesis), couple with the result discussions of the research papers.

Secondly, I will implement the chosen models and several popular Machine Learning algorithms (Q-Learning, Proximal Policy Optimization, etc.) with TensorFlow (Keras) and Scikit Learn (if applicable) using Python. Cross validation, different optimization methods (e.g., Adams, AdaGrad, and SGD), and the step-AIC method (for regression) will be conducted to find the best models for each algorithm during model training.

Moreover, besides calculating statistical metrics for summarizing training results, sensitivity analysis and back-testing will be implemented for the outcome analysis. Also, follow the research by Spiess (2022), open-source tools, including LIME, SHAP, and Permutation Importance, will be applied to assess the model transparency and explainability.

Finally, I will end the project with a discussion of the comparison of the popular ML models and the classic models in the field. Model performance and explainability will be the critical points of the discussion.

References:

- Aziz, S., & Dowling, M. (2019). Machine learning and AI for risk management. In *Disrupting finance* (pp. 33-50). Palgrave Pivot, Cham
- Spiess, J. (2022). Machine Learning Explainability & Fairness: Insights from Consumer Lending.

Khandani, A. E., Kim, A. J., & Lo, A. W. (2010). Consumer credit-risk models via machine-learning algorithms. *Journal of Banking & Finance*, 34(11), 2767-2787.