

**Analysis of ML Methods for Credit Risk Assessment** (Amirkabir University of Technology, Fall 2018) I worked with Dr. Erfan Salavati<sup>4</sup>, Assistant Professor of Statistics at Amirkabir University of Technology, on an independent research project focused on assessing credit risk using machine learning methods. Our study aimed to predict credit default among bank loan customers, comparing machine learning techniques to traditional statistical methods. By working with a dataset of 356 loan applicants, categorized into performing and non-performing loan groups based on loan repayment history, I was involved in data preprocessing and implementing various machine learning models, including logistic regression, support vector machines, artificial neural networks, and random forests.

For this analysis, I applied several preprocessing steps: categorical features were transformed using numerical features that underwent log-transformation or standardization, and correlated features were examined to identify the most predictive variables. All the analysis was conducted using Python, utilizing libraries such as Pandas and scikit-learn to streamline the modeling process. The models were trained and validated through a 5-fold cross-validation approach, ensuring robust performance evaluation. During model tuning, I utilized grid and randomized search techniques to optimize each model's hyperparameters.

Our findings revealed that the Random Forest classifier achieved the highest overall accuracy (70%) and performed well in balancing precision and recall. However, the SVM model, using a linear kernel, demonstrated the highest area under the curve (AUC), making it particularly valuable for diagnosing risk with a reasonable trade-off between sensitivity and specificity. Additionally, I explored the interpretability of the decision tree, extracting simple, understandable rules from the model. For instance, one insight was that applicants under 47.5 years of age with an annual income exceeding 40.2 had a higher likelihood of fulfilling their loan obligations.

Through this research, I gained experience in model selection and hyperparameter tuning, as well as an understanding of the practical challenges in applying machine learning to real-world financial data.<sup>5</sup>

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<sup>5</sup>Ebrahimi, N., & Salavati, E. (2018). Comparative analysis of ML methods for credit risk assessment. The 5th National Conference on Financial and Actuarial Mathematics (FINACT), Khatam University.