Artificial Neural Network Approach for Credit Risk Management

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INTRODUCTION

- Financial solution to minimize loan decision risks
- Implement various algorithms in artificial neural networks
- Compare algorithm performances and efficiencies
- Create a model assess reasonableness lending to customers
- Estimate probability customer defaulting on loans
- Use customer information, application data, and historical information
- Employ binary classification to predict loan repayment success or failure

Image 1: Credit Application Process with Artificial Neural Networks

METHODS

- Get the Data
  - ✓ Simulate dataset using Python's random function
  - ✓ Various financial features for loan analysis
- Discover and Visualize the Data
  - ✓ Analyse the covariance matrix
  - ✓ Identify key relationships and limitations
  - ✓ Conclude the need for further research
- Prepare the Data for Algorithms
  - ✓ Create dataframe with highly correlated features
  - ✓ Select features and targets, standardize features
  - ✓ Split dataset into training and test sets
- Select and Train Models
  - ✓ Compare Logistic Regression, Random Forest Classifier, Support Vector Machine (SVM), and Artificial Neural Networks (ANN)
  - ✓ Choose Logistic Regression as the primary model
- Models Parameters Configuration
  - ✓ Configure parameters with scikit-learn library
  - ✓ Develop a customized ANN model from scratch
- Make Predictions and Evaluate Models
  - ✓ Use performance metrics to assess models
  - ✓ Employ confusion matrix and classification report for further insights

RESULTS

- Logistic Regression, Random Forest, SVM, ANN
- Assess accuracy, TP, TN, FP, and false negatives
- Logistic Regression, Random Forest, and SVM exhibit similar accuracies but struggle with class imbalance
- ANN has slightly lower overall accuracy but performs better in identifying true positives and true negatives
- ANN is the most suitable model for this binary classification task, as it handles class imbalances better

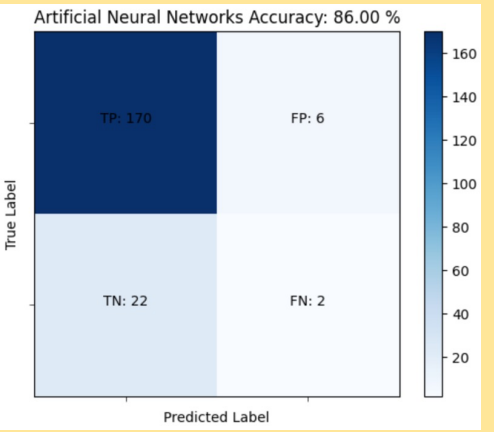

Figure 1 – Confusion Matrix Results

	Precision	Recall	F1-Score	Support
Rejected	0.89	0.97	0.92	176
Approved	0.25	0.08	0.12	24
Accuracy			0.86	200
Macro avg.	0.57	0.52	0.52	200
Weighted avg.	0.81	0.86	0.83	200

Figure 2 – Artificial Neural Networks Reports

LIMITATIONS

- Only evaluates four algorithms for binary classification
- It uses only one dataset
- The dataset suffers from class imbalance
- Focuses on the accuracy, precision, recall, and f1-score metrics only
- Uses default hyperparameters
- Interpretability not explored

FUTURE RESEARCH

- Explore more algorithms
- Evaluate performance on various datasets
- Mitigate class imbalance issues
- Use alternative evaluation metrics
- Tune hyperparameters
- Develop interpretable models

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References: https://github.com/carlos-alves-one/NeuroCredit/CS_Thesis_FinalProject_2023.pdf
Image 1 created with Microsoft Designer. Figure 1 highlights the model's accuracy and precision, and Figure 2 explores the performance metrics from the artificial neural networks algorithm.
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