# Loan Approval Optimization Report

## 1. Introduction

This report summarizes the results of two machine learning approaches to optimize loan approvals using Lending Club accepted loans data.

## 2. Model Results

- Deep Learning Model: AUC = 0.7116, F1-Score = 0.0591
- Offline Reinforcement Learning Agent: Estimated Policy Value = 3.1885

## 3. Analysis of Results

**Deep Learning Model Metrics:**
- AUC indicates reasonable risk ranking ability.
- Low F1-score reflects difficulty in binary default classification due to class imbalance.

**Offline RL Agent Policy Value:**
- Positive policy value shows learned approval strategy maximizes expected profit.

## 4. Model Comparison

| Aspect | Deep Learning Model | Offline RL Agent |
|---|---|---|
| Objective | Default risk prediction | Maximize expected financial return |
| Metric | AUC, F1-Score | Estimated Policy Value |
| Strengths | Good ranking accuracy | Direct profit optimization |
| Weaknesses | Low binary prediction quality | Sensitive to reward design |
| Business Relevance | Risk quantification | Decision policy optimization |

## 5. Future Steps

- Improve DL handling of imbalanced data (oversampling, focal loss).
- Refine RL reward function and hyperparameters.
- Incorporate rejected loan data to reduce bias.
- Explore hybrid approaches combining DL risk scores with RL policy.
- Validate models with real-world trials.
- Address regulatory and fairness considerations.

This report highlights the potential and limitations of each modeling approach in fintech loan decision-making.