AI and Finance: Innovating the Loan Approval Process with Machine Learning

By: Aria Zand, Melissa Parada-Quinatoa, Cathy Fan, John Carl Tagbor

---

Project Description

There are notable gaps in the way many banks and financial institutions handle loan approval processes. Traditional systems often lack transparency, consistency, and the ability to adapt to nuanced applicant profiles. Our goal is to develop an AI-powered loan approval model that can assess client data and predict whether or not an applicant is likely to be approved based on multiple financial and personal criteria.

Project Scope

This project focuses on building and evaluating supervised machine learning models to predict loan approval outcomes using publicly available data. The dataset we used includes applicant features such as income, credit history, education level, marital status, and loan amount.
This project does **not** include deployment into a live banking environment or integration with real-time credit scoring APIs. The focus remains on model development, interpretability, and ethical AI practices using a structured and reproducible workflow.

Project Details

Why

As Generative AI becomes more prevalent, the need for institutions to adapt and incorporate it grows. Financial institutions are seeing benefits in streamlining operations with AI. This project is focused on banks and financial service providers and the development of AI-powered systems that assist in loan decision-making with greater accuracy, speed, and transparency.

We took inspiration from the article accepted at the 2022 International Conference on AI in Finance:
Monotonic Neural Additive Models: Pursuing Regulated Machine Learning Models for Credit Scoring

Using a Kaggle loan dataset, we aimed to evaluate client profiles holistically to better recognize patterns across financial, educational, and demographic indicators. This project is a prototype for how financial institutions can integrate AI tools to better serve their clients and communities.

Research Papers

Monotonic Neural Additive Models: Pursuing Regulated Machine Learning Models for Credit Scoring

This article by Dangxing Chen and Weicheng Ye introduces Monotonic Neural Additive Models (MNAMs), which combine the predictive power of neural networks with the explainability and fairness needed in financial services. This inspired our design for a transparent and equitable loan approval model.

Disentangling Fairness Perceptions in Algorithmic Decision-Making

This article focuses on public perception of fairness in AI systems, especially in financial decisions. It highlights the need for human oversight and transparency, especially in high-stakes decisions such as loan approvals, to ensure user trust and minimize algorithmic bias.

Methodology

This project was developed using a Python-based machine learning model, a front-end interface, and a backend system with the help of AI tools. The solution included:

- A **web-based questionnaire** for collecting customer data
- A **Google Sheets backend** for structured data storage
- A **Python ML model** for predictive analysis

- An **administrative dashboard** to present results and document the process

---

I. Planning

We structured our workflow into four parts:

1. Collect customer loan application data through a front-end form
2. Store the data in Google Sheets in a structured format
3. Analyze the data using a trained ML model
4. Display results and insights through an administrative dashboard

---

II. Front-End Interface

We designed an HTML questionnaire to collect customer data. This form uses Google Apps Script to instantly send submitted data to Google Sheets for further analysis.

III. Back-End Interface

The backend is the core of our project, integrating the data collection system with the machine learning model. It was built using a combination of Google Apps Script and Python:

1. **Data Extraction**: Pull data from Google Sheets
2. **AI Model Integration**: Run the data through a trained ML model coded in Python
3. **Result Handling**: Display predictions and allow human reviewers (bank staff) to confirm and send results to applicants

---

AI Considerations

Loan decisions significantly impact individuals' lives. From our research, we emphasized:

- **Fairness**: Avoiding discrimination in decision-making
- **Transparency**: Explaining model outcomes in clear, non-technical language
- **Bias Identification**: Recognizing biased data sampling or demographic imbalances

Ethical AI must include human accountability, especially when the outcomes affect lives and communities.

What's Next?

We are looking ahead to enhance both the model and user experience. Our top areas for development include:

1. **Model Refinement** – Improving performance and fairness
2. **Transparency & Explainability** – Keeping predictions understandable
3. **Deployment Experience** – Improving the user interface and accessibility
4. **Data Privacy & Security** – Strengthening protections for sensitive information
5. **Human Oversight & Accountability** – Ensuring responsible decision-making

---

References

This project was made possible through a combination of publicly available data, academic research, and AI development tools.

- Kaggle Loan Training Dataset

- Test Dataset
- Professor Chung
- ACM Digital Library
- ChatGPT (OpenAI)
- Claude (Anthropic)
- Google Colab
- Google Apps Script