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A Hybrid AI Model for Automated Credit Scoring and Loan Processing System

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Abstract: ***Credit scoring plays a crucial role in helping financial institutions to make faster decisions. In recent years, due to rapidly growing technology, Artificial Intelligence (AI) has played a crucial role in financial institutions. But many institutions haven't adopted it because of some concerns related to trust, transparency, bias, and data privacy. This study proposes a hybrid AI model for automated credit scoring and loan processing by integrating multiple machine learning algorithms with explainable AI techniques. Primary data were collected from a survey of 135 applicants. Secondary data were obtained from recent research studies to support the analysis. In this study four AI models - Logistic Regression, Decision Tree, Random Forest, and XGBoost were used to make decisions in loan approval. Among them, XGBoost performed the best in providing accurate results. Explainable Artificial Intelligence (XAI) shows the reasons for decision. So, applicants can understand, why their loan was approved or rejected. This improves the trust. AI reduces manual work and increases efficiency. Challenges like bias and data privacy issues were observed. Future research can focus on reducing bias. Finally, the study concludes that hybrid AI models can lead to provide faster credit decisions.***

Keywords: Credit Scoring, Artificial Intelligence, Hybrid, Loan Approval, Machine Learning.

I. INTRODUCTION

In recent years, due to rapidly growing technology, automation has also played a crucial
role in financial institutions. As we know, one of the primary functions of financial institutions is to assess the creditworthiness of the loan applicants. Generally, traditional loan processing involves manual verification and human judgment. We observe that it led to inconsistencies, delays, and errors in loan decision-making. We also see that day by day there were a large number of applicants increasing, so we have to use a data-driven approach is to assess borrowers and manage loan processing for better results.
Credit scoring helps to evaluate the borrowers' likelihood of repaying loans by analysing
their credit history and other relevant data. By combining the use of credit scoring with Hybrid AI Model, financial institutions will be able to reduce the amount of time it takes to process loan applications and reduce costs associated with the loan application process. Also reduce the human bias within the loan evaluation process, because all loan applicants are reviewed and scored based on the same set of evaluation criteria. It improves fairness in the loan approval process.
In this study we utilize some AI models. It helps to assess risk and support loan underwriting decisions. This research aims to develop an automated platform that integrates technology and analytics to modernize traditional loan processing into a faster, smarter, and more secure financial process.

II. LITERATURE REVIEW

In recent years, some banks have started using Artificial Intelligence (AI) to make loan decisions faster and better. Many institutions have not adopted it because of some concerns related to trust, transparency, bias, and data privacy.

1) Mathen, M. P., & Paul (2025), Toward an evolving framework for responsible AI for credit scoring in the banking industry, in their study he found that AI is widely used in banks to improve credit scoring and loan decision speed. Explainable AI(XAI) helps in explaining the reasons for loan decisions. People still need to check AI decisions. Because they are not confident about the decisions. Many AI-based credit scoring systems face bias and fairness issues. Finally, AI should be fair and responsible, not just smart.

2) Gates, N., & Flynn, W. (2025), A Comprehensive Review of Artificial Intelligence Driven Credit Risk Modelling: From Traditional Scoring to Explainable Machine Learning in Modern Banking Systems. in their study he found that AI is used in banks to assess credit risk and decide on loans. In the past, banks use simple methods that used limited data and gave inaccurate results. With AI, banks can study large amounts of data and make better decisions. AI also finds patterns in customer behaviour

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that people may not easily notice. But AI systems can sometimes be biased or unfair. Explainable AI helps banks clearly understand and explain loan decisions. Even with AI, human review is still important to ensure decisions are fair and reliable. The latest AI models can explain their decisions better than old statistical methods.

3) Min, L. L. J., & Chin, T. S. (2025), Artificial Intelligence in Loan Prediction Models: A Comprehensive Review of AI Models and Their Implications for Trust, Ethics, and Fairness. Artificial Intelligence (AI) is used in banks to improve loan prediction and credit risk assessment. Traditional loan evaluation methods lead to errors and may be biased. It affects fair decision-making. Recent studies show that AI and machine learning models can improve accuracy and speed in loan decisions. Also, problems such as poor data quality, lack of transparency, and ethical concerns still exist. Many researchers highlight the importance of explainable AI to help banks and customers understand loan decisions. Studies also warn that AI systems can repeat social bias or be misused for fraud if not properly controlled.

4) Raziyeva, S., & Meraliyev, M. (2025), Bias and Fairness in Automated Loan Approvals: A Systematic Review of Machine Learning Approaches. AI is now widely used in banks to approve loans and assess risk quickly. While it helps process many applications efficiently, concerns about fairness and bias have increased. These problems generally come from using old data. Certain model choices that can repeat social and economic inequalities. This study explains that different types of bias were in AI-based loan systems. machine learning tries to reduce them. It also discusses solutions such as explainable AI and keeping humans involved in decisions. Overall, the study highlights the need for fair, transparent, and responsible AI systems in banking. sometimes AI can be biased if the data is not proper.

5) Vrincianu (2025), Machine Learning and Artificial Intelligence in Credit Scoring and Fraud Detection. in his study he found that AI and machine learning models give better results than traditional methods in credit scoring and fraud detection. These models can handle large and complex financial data more easily. Advanced AI techniques improve prediction accuracy, especially for transaction-related data. But many AI models are difficult to understand and explain. This lack of transparency creates trust and regulatory problems. Therefore, the studies highlight the need for explainable and trustworthy AI systems in banking.added that combining both AI and fraud checks makes the loan process safer. These studies found that AI must be used carefully. So, it is both smart and fair.

III. RESEARCH METHODOLOGY

1) Need for the Study: The study is needed because traditional loan approval process in banks takes more time and involves a lot manual work. Sometimes human judgement may lead to errors or unfair decisions. Now-a-days, many people are applying for loans, so banks need faster and more methods. Artificial Intelligence (AI) helps to understand customer data quickly and gives better credit scoring results. It reduces paper work and saves time for both banks and customers. This study helps to know people's trust and opinion about using Artificial Intelligence in banking.

2) Scope of the study: This study mainly focuses on how AI models help banks to make faster loan approval decisions. It includes combination of different AI models. The study also finds people's opinions and trust towards AI-based loan approval systems. The study is based on survey responses collected from loan applicants. It helps to understand the benefits and challenges of using AI in modern banking services.

3) Objectives of the study:

- To study how AI models is used for credit scoring and loan approval.
- To analyse people's views and level of trust in using AI for banking services.
- To identify the challenges and limitations of using AI in credit scoring.

4) Sample of the study: The sample of the study consists of 135 respondents. These respondents are people who have applied for loans or have knowledge about loan processes. The data was collected using a Google Form survey. The sample was selected using convenience sampling method. This sample is used to understand people's opinion about AI in credit scoring and loan approval.

5) Research Design: This study uses Descriptive Research Design. It helps to describe the present situation of Artificial Intelligence (AI) in credit scoring and loan processing system. It also helps to explain how AI models help in loan approval decisions. This design is used because the study focuses on understanding people's opinions, trust and awareness of AI in banking.

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6) Source of data and Data Collection: The study is based on both primary data and secondary data. Primary data is collected from 135 respondents who have knowledge about loan process and AI in banking. The data is collected through survey using Google Form. Secondary data is collected from recent journals, books, research papers, and websites related to Artificial Intelligence in credit scoring and loan approval. These sources help to understand the concept, benefits, and challenges of AI in banking sector. Both types of data help to understand the topic clearly.

7) Tools and Techniques:

- Percentage method
- Tables
- Bar chart
- Accuracy
- Descriptive statistics
- Comparison method

8) Research Gap: Many previous studies explained how Artificial Intelligence (AI) helps in credit scoring and loan approval. But most studies focused only on one AI model and did not compare multiple models together. Some studies did not clearly explain the reasons behind loan approval decisions. There is still lack of research on combining different AI models (hybrid model) for better accuracy. Previous research also gave less importance to people's trust and opinion about AI in banking. Issues like bias, fairness, and data privacy are not fully solved. So, there is a need to study hybrid AI models with Explainable AI (XAI). This study helps to fill the gap by comparing different AI models and analysing people's views on AI-based loan systems.

9) Limitations of the study:

- Convenience sampling method was used, so data may not fully correct.
- The study is limited to selected AI models only.
- Some respondents may not have full knowledge about AI in banking.
- The study focuses only on banking sector.

A. A Hybrid AI Model used in this study

This study uses both traditional and multiple AI models and also Explainable AI(XAI) to improve the accuracy of credit scoring and loan approval decisions.

B. Traditional model

- Logistic Regression: It is a statistical model. It helps to predict if a person can repay a loan or not. Based on details like income, age, and past credit history. This model gives results in binary form.

C. AI Models

- Decision Trees: It is a rule-based model that helps to decide if a person should get a loan or not. A decision tree makes decisions step by step using simple rules.
- Random Forest: It is an ensemble learning technique that helps to decide if a person should get a loan or not. Random Forest uses multiple trees together to give correct results.
- XGBoost: It is an advanced boosting algorithm powerful that helps to predict whether a loan should be approved or not. By combining many simple models, it provides better and faster predictions.
- Explainable AI(XAI): It explains why a loan is approved or rejected. It helps to take fair decisions. Their performance was evaluated using prediction accuracy.

IV. RESULTS

The study analysed responses from 135 loan applicants using survey data. Demographic factors such as age, gender, education, income level, and loan experience were examined. The results indicate how different AI models performed in predicting loan approvals and felt about AI in banking. 135 applicants were surveyed through google form.

Table 1: The following table shows the results of above table. The following data was collected through google form.

Category	Sub-Category	No. of Respondents(N=135)
Gender	Male Female	75 60
Age Group	Below 25 25-40 40-60 Above 60	33 50 32 20
Monthly Income	Below 25,000/- 25001/- to 50000/- 50001/- to 75000/- Above 75000/-	37 41 31 26
Education Level	Illiteracy Up to 12th Graduate Postgraduate	21 37 51 26

Interpretation: Majority of the respondents were males. They are aged between 25-35. Most of them were graduates and earned between 25001/- to 50000/-.

Table 2: Respondents' Opinion on AI in Credit Scoring

Question	Response Options	No. of Respondents	Percentage (%)
Have you heard about AI-based loan approval?	Yes No	81 54	60 40
Do you think AI makes loan approval faster?	Yes No Not sure	93 9 33	68.9 6.7 24.4
Do you believe AI gives fair decisions?	Yes No Not sure	81 16 38	60 11.9 28.1
Would you trust a bank using AI for loan approval?	Yes No Maybe	65 41 29	48.1 30.4 21.5

Interpretation: Majority of responses heard about AI-based loan approval. They believe it makes loan approval faster and give fair decisions.

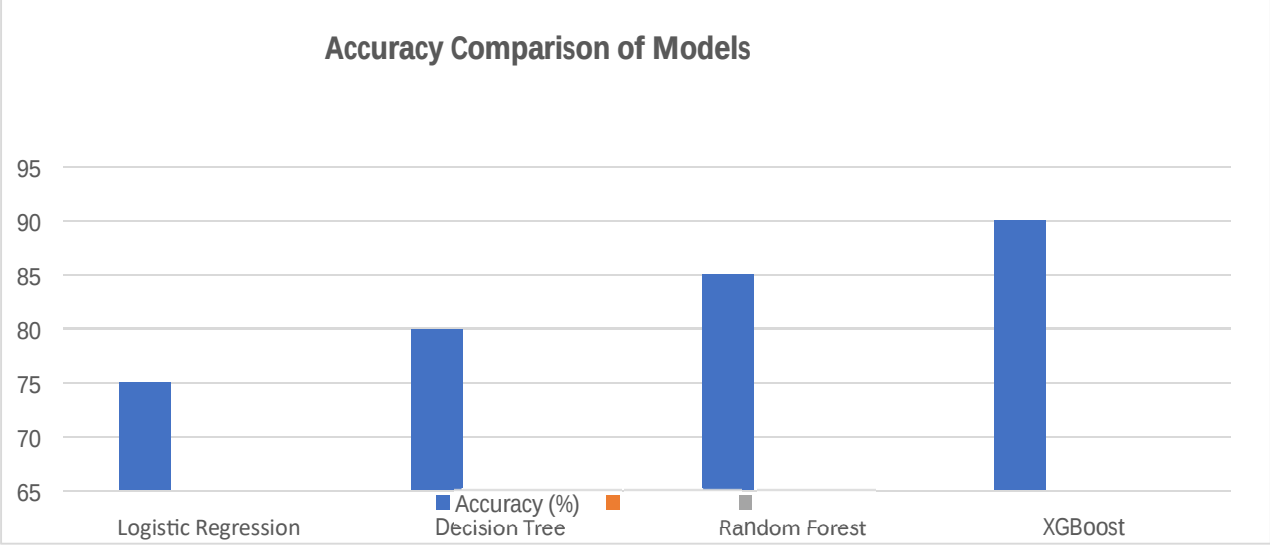
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Table 3: The following table indicate how different AI models Performed in predicting loan approvals and felt about AI in banking.

AI Model	Accuracy (%)	Key Observation
Logistic Regression	75	It works well when the data is simple. For complex data, its predictions are less accurate.
Decision Tree	80	Better than logistic Regression.
Random Forest	85	It combines many trees to reduce errors.
XGBoost	90	It gives very accurate results for large datasets.
Explainable AI (XAI)	-	Shows reasons for decisions and maintains fairness.

Interpretation: The study shows that AI helps banks process loan applications faster than manual methods. Out of them, XGBoost performs the best because it uses small models together. This helps to handle large data sets quickly.

A. Graphical Analysis



V. DISCUSSION AND IMPLICATIONS FOR FURTHER RESEARCH

A. Discussion

This study shows that AI can improve the process of loan approvals in banks. AI models help in analysing applicant data quickly. Out of them, XGBoost performs the best because it uses small models together. This helps to handle large data sets quickly. Explainable AI (XAI) is very important because it shows the reason why a loan is approved or rejected. This makes the system transparent and fair. Most respondents in the study trusted AI because it provides fair decisions. It also reduces the chance of biased outcomes. But they are not willing to adopt it. Because, there are also some challenges in using AI for credit scoring. One of the most common issues is data privacy and potential bias. Banks must carefully monitor AI systems to ensure fairness. This study also found that the applicants who understand credit scoring give more accurate responses in surveys. This shows the importance of user awareness in adopting AI based systems. Training bank staff and educating customers can improve trust.

B. Implications for Further Research

- Make AI models easier to understand.
- Reducing bias in AI decisions.
- Protecting financial data.
- AI for fraud detection.

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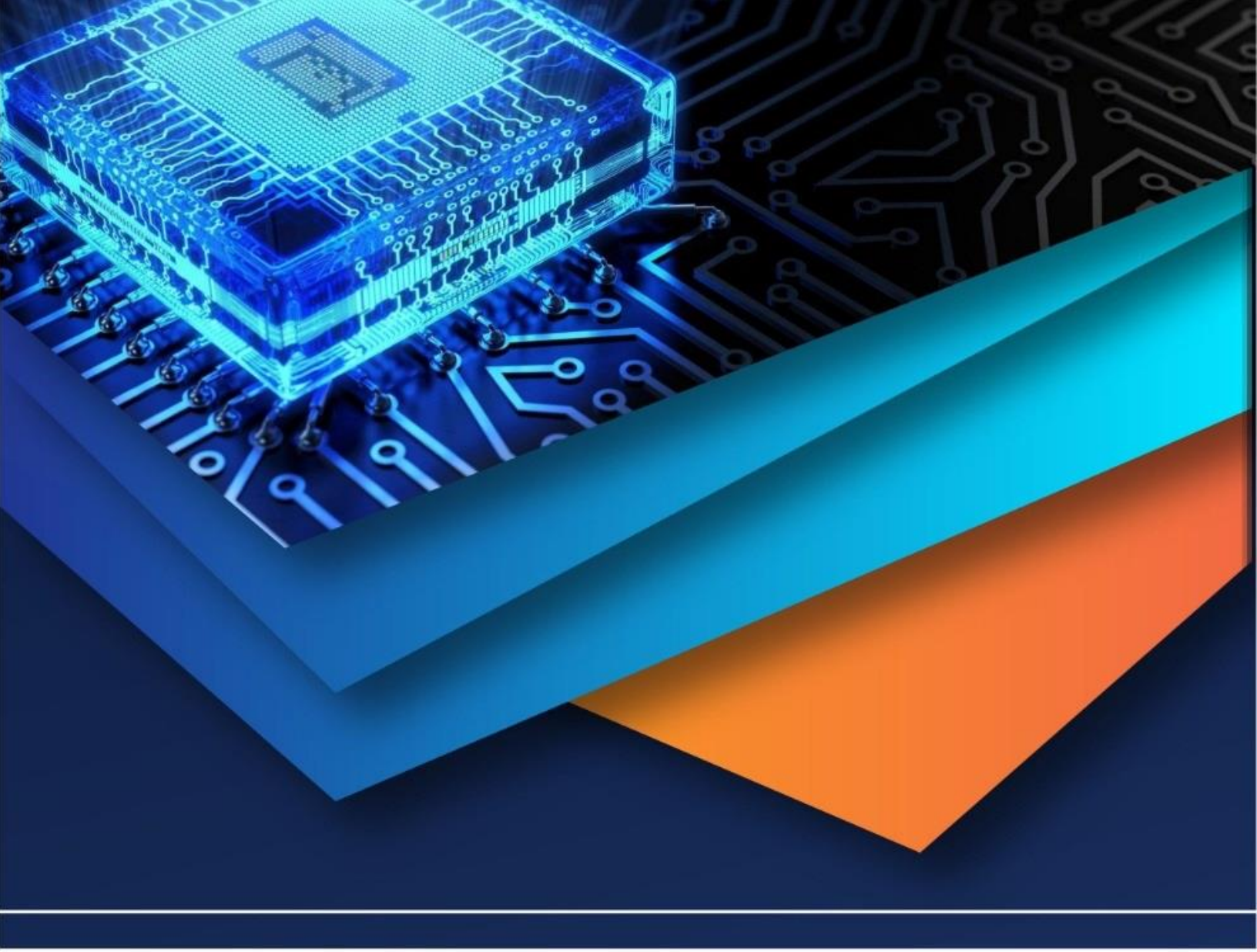
VI. CONCLUSION

This study shows that hybrid AI model can greatly improve the loan approval process in banks. Because, we use multiple AI models. They are Logistic Regression, Decision Tree, Random Forest, and XGBoost. Out of them, XGBoost performed the best for large data sets. Explainable AI (XAI) also used to show the reasons for decisions. So, applicants can understand why their loan was approved or rejected. The results also highlight that AI reduces manual work in banking operations. Challenges like bias and data privacy concerns need careful attention. Future research can focus on making AI fairer. Finally, AI can lead to provide faster credit decisions.

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