International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue:3 Volume No.10 May - June – 2026
DOI:10.46647/ijetms.2026.v10i03.019 ISSN: 2581-4621

FINANCIAL RISK ANALYSIS USING AI

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***Abstract*—** Financial risk analysis is a fundamental component of decision-making in financial institutions such as banks, credit agencies, and lending platforms. It determines the likelihood of a borrower defaulting on a loan and directly influences lending decisions, interest rates, and financial stability. Traditional financial risk assessment methods rely heavily on manual processes, historical rules, and human judgment, which often result in inefficiencies, inconsistencies, and susceptibility to bias and error.With the rapid growth of digital data and advancements in Artificial Intelligence (AI), machine learning (ML) has emerged as a powerful tool to transform financial analytics. Machine learning algorithms can process vast amounts of data, detect hidden patterns, and provide highly accurate predictions in real time.This project presents the design and development of an AI-based Financial Risk Analysis System that uses machine learning techniques to classify users into risk categories: Low, Medium, and High. The system uses key financial indicators such as income, loan amount, and credit score to evaluate risk.A Random Forest algorithm is implemented due to its robustness, accuracy, and ability to handle complex datasets. Additionally, a user-friendly web interface is developed using Streamlit, enabling users to input financial data and receive immediate predictions along with visual insights.This project demonstrates the practical application of AI in finance, offering a scalable, efficient, and reliable solution for risk prediction.

INTRODUCTION

BACKGROUND&OVERVIEW

In today's rapidly evolving digital economy, financial institutions are increasingly shifting toward automation to enhance operational efficiency, reduce costs, and improve the accuracy of decision-making processes. The growing volume of financial transactions and customer data has made traditional manual methods inadequate for handling modern financial demands. As a result, banks, credit agencies, and lending platforms are adopting advanced technological solutions to streamline their operations.One of the most critical tasks in the financial sector is credit risk assessment, which involves evaluating whether a borrower has the capacity and willingness to repay a loan within the agreed timeframe. This process is fundamental because it directly impacts the profitability and stability of financial institutions. An incorrect assessment can either lead to financial losses due to loan defaults or missed opportunities by rejecting eligible customers..Financial risk, in this context, refers to the probability of loss arising from a borrower's failure to meet financial obligations. Traditionally, financial institutions relied heavily on manual verification processes. These processes typically included reviewing physical documents, analyzing credit history reports, verifying employment details, and applying predefined rule-based systems such as minimum income thresholds or credit score cutoffs.

LITERATURE SURVEY

Financial risk prediction has evolved significantly from traditional statistical models to advanced machine learning techniques. Early approaches mainly depended on regression analysis to identify relationships between financial variables. Credit scoring systems were also widely used to evaluate an individual's creditworthiness based on past financial behavior. These methods were simple and

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effective for small datasets but lacked flexibility in handling complex data patterns. They were limited in capturing nonlinear relationships among financial attributes. With the growth of data and computing power, machine learning approaches became more prominent. Today, these advanced methods provide more accurate and reliable financial risk predictions.

Traditional systems are based on:

- Fixed income thresholds
- Credit score limits
- Employment verification

Limitations:

- Lack of flexibility
- Cannot adapt to new data
- Limited accuracy

Modern systems use machine learning models that learn from historical financial data, enabling them to identify hidden patterns and relationships that are not easily visible through traditional methods. These models process large volumes of data efficiently and generate real-time predictions to support faster and more informed decision-making in financial risk analysis.

SYSTEM ANALYSIS

System analysis is a crucial phase in the development of any software project. It involves understanding the existing system, identifying its limitations, and proposing an improved solution. In the context of this project, the goal is to analyze traditional financial risk assessment methods and design an efficient Artificial Intelligence-based alternative.Financial institutions such as banks and lending organizations rely heavily on risk analysis systems to determine whether a customer is eligible for a loan. These systems must be accurate, fast, scalable, and reliable. However, traditional systems often fail to meet these requirements due to their dependency on manual processes.This chapter provides a detailed study of the existing system, its drawbacks, and the proposed AI-based system using machine learning techniques.

SYSTEM DESIGN

System Architecture

User → Input → ML Model → Prediction → Output

Modules

Input Module

Takes user data

Processing Module

Prepares data

Prediction Module

Applies ML model

Output Module

Displays results

Data Flow Diagram

Level 0:

User → System → Output

Level 1:

User → Input → Processing → Model → Output

4.4 UML Diagrams (Add Drawings in Word)

- Use Case Diagram
- Activity Diagram

IMPLEMENTATION

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Tools and Technologies

Tool	Purpose
Python	Programming
Pandas	Data handling
Scikit-learn	ML model
Streamlit	UI
Matplotlib	Graphs

PERFORMANCE METRICS

Performance metrics are used to evaluate the effectiveness and reliability of the machine learning model used in the Financial Risk Analysis System. These metrics help in understanding how well the model performs in predicting financial risk categories such as Low, Medium, and High risk.Since this project is based on classification, evaluation is done using standard classification metrics such as accuracy, precision, recall, F1-score, and confusion matrix. These metrics ensure that the model is not only accurate but also consistent and reliable in real-world financial decision-making.

TEST CASES & OUTPUT

TEST CASES

Test Case 1: High Risk Scenario

Input Parameter	Value
Income	20,000
Loan Amount	15,000
Credit Score	600

Expected Output:
High Risk
Explanation:

- Low income
- High loan burden

Low credit score
Indicates high probability of loan default

Test Case 2: Medium Risk Scenario

Input Parameter	Value
Income	50,000
Loan Amount	25,000
Credit Score	700

Expected Output:
Medium Risk
Explanation:

- Moderate income
- Moderate loan amount
- Average credit score

Balanced financial condition with some risk

Test Case 3: Low Risk Scenario

Input Parameter	Value
Income	80,000
Loan Amount	20,000
Credit Score	750

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Expected Output:
Low Risk
Explanation:
- High income
- Low loan burden
- Good credit score

Strong repayment capability

Test Case 4: Very High Risk Scenario

Input Parameter	Value
Income	15,000
Loan Amount	25,000
Credit Score	550

Expected Output:
High Risk
Explanation:
- Very low income
- Loan exceeds income capacity
- Poor credit score

Very high chance of default

Test Case 5: Safe Customer Scenario

Input Parameter	Value
Income	100,000
Loan Amount	10,000
Credit Score	800

Expected Output:
Low Risk
Explanation:
- Very high income
- Very low loan amount
- Excellent credit score

Very safe customer for lending

7.3 OUTPUT RESULTS

The system provides output in the form of a **risk classification label** along with optional visual representation.
Sample Outputs:
Input:
Income = 20,000
Loan = 15,000
Credit Score = 600
Output:**High Risk**

CONCLUSION

The Financial Risk Analysis using Artificial Intelligence project successfully demonstrates how machine learning techniques can be effectively applied in the financial domain to automate risk prediction. The system was designed to classify individuals into three categories: Low Risk, Medium Risk, and High Risk based on key financial parameters such as income, loan amount, and credit score.The implementation of the Random Forest algorithm has proven to be effective due to

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its high accuracy, stability, and ability to handle complex datasets. The model provides reliable predictions that can assist financial institutions in making better lending decisions.The integration of a web-based interface using Streamlit enhances the usability of the system by allowing users to input data easily and receive real-time predictions. This makes the system interactive, user-friendly, and suitable for demonstration purposes.From the results and testing phase, it is observed that the system performs well across different scenarios and is able to correctly classify risk levels based on input data. The model reduces dependency on manual evaluation, minimizes human error, and improves efficiency in decision-making.Overall, this project highlights the importance of Artificial Intelligence in the financial sector and demonstrates how machine learning can be used to build intelligent, automated, and scalable solutions for real-world problems.

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