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Intelligent Financial Analytics by using AI and Machine Learning in Fintech.

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Abstract: Recent advancements in the field of Financial Technology along with Machine Learning have transfigured the financial ecosystem by enhancing the business intelligence solutions that are driven by large scale financial data. Today, financial organizations are increasingly using Machine learning models for extensive financial data analysis in order to produce meaningful insights. This further enhances the operational effectiveness and minimizes the risk and also help in taking correct decisions. Present work explores the manner by which machine learning and advancements in Fintech sway business intelligence. This emphasizes fraud-detection, risk valuation, algorithmic trade-off and economic decision making. This research examines the way by which complex financial data is analysed by machine learning algorithms for predicting financial trends, detecting frauds, assessing risks and supporting automated trading. The work also examines the technological assemblies used in Fintech environments and accentuates the real-time case studies which display the effective application of ML driven Fintech solutions. Along with the advantages there are some challenges in financial related applications- namely data privacy issues, monitoring restrictions and interpretability of models. This work finds that Fintech solutions empowered by machine learning have given a new facet to business intelligence tasks and will escalate the future of digital finance. It also helps the organizations to take wise financial decisions.

Keywords: Business Intelligence, Machine Learning, Fraud Detection, Risk Management, Predictive Analysis.

I. INTRODUCTION

Technological innovations have changed the worldwide financial landscape in past few years. The financial institutions nowadays depend progressively on digital technologies for handling the financial transactions along with examining market trends and supervising financial risks. The credit for this change goes to Machine Learning. Machine Learning is a subset of Artificial Intelligence which aims to make the computer systems learn from past data and improve their performance without any need for direct programming. Thus by combining financial technology or Fintech, ML allows the financial organisations to create smart systems that can analyze large financial datasets resourcefully. Business Intelligence is dynamic tool for financial organisations. BI offer analytical tools that help the decision-makers in comprehending financial information. Business Intelligence aims to gather process and evaluate financial data to generate meaningful insights from the business which draw clear layout of the business strategies. The amalgamation of ML and Fintech applications has raised the functionalities of BI systems by providing financial analytics in real time, Smart Fraud Detection , Automated trading platforms and forecasting of financial models along with sophisticated risk management. Financial transaction, market activities and customer engagement together with the latest online payment systems generate large amount of structured as well as unstructured data for the organizations. Traditional BI tools struggle to handle extensive datasets in an efficient manner. To overcome this drawback ML algorithms have been introduced which help in data analysis by identifying significant patterns with the financial data.

Present work explored the effects of Machine Learning and advancements in Fintech on BI systems by aiming on trading, fraud detection, assessment of risk, predictive analytics and decision making within the financial organisations.

II. LITERATURE REVIEW

Many researchers have studied the application of machine learning technologies in financial systems. Following table shows the literature survey.

S.No.	Author(s) & Year	Contribution	Findings
1.	Dixon, Halperin & Bilokon (2020)	ML & Applications in Finance.	Evaluated the use of Machine Learning in trading, risk management and financial predictions along with practical implications of case studies.

2.	Heaton, J., Polson & Witte (2020)	Deep Learning in Finance.	Explored deep learning applications in financial forecasting, optimization of portfolio and automated trading strategies. .
3.	Hull, J., (2022)	Risk management in financial institutions.	Highlighted the Highlights background and ML integration for market, operational and credit risk management.
4.	Sharma, P., & Kumar, R. (2019)	Credit risk prediction in Indian Banks	Explored that ML models outperform traditional statistical methods for credit risk assessment in Indian banking.
5.	Singh, A., Gupta, V., (2020)	Fraud detection in online payments.	Found that AI models can detect fraudulent transactions in real time Indian digital payment systems.
6.	Reddy & Narayan, P. (2021)	Stock Market predictive analysis	Explored that LSTM models improve accuracy in predicting Indian stock market trends compared to linear models.
7.	Verma, K., & Joshi (2022)	Risk assessment in Indian Banks	Demonstrated enhanced risk management using ML for operational and market risks in Indian financial institutions.
8.	Agarwal,N., & Bansal (2023)	AI in FinTech business intelligence	Found that ML enables fraud detection, customer segmentation and predictive decision-making in Indian Fintech startups.
9.	Wang,X., Li, & Zhao, J. (2021)	AI in financial trading.	Explored RL-based trading systems augment portfolio returns and reduce marketplace risk using AI-driven strategies.
10.	Patel, D., & Shah, A. (2023)	Predictive fraud analytics in banking.	Highlighted efficacy of ML in reduction of fraud losses and improving detection in modern banking system.
11.	Kumar,S., & Rathi, P.(2021)	AI for risk-based lending in Indian banking sector,.	Found that AI models augment credit risk evaluation, improve loan approval accuracy and reduce default rates.
12.	Li, J., Zhang, Chen, F. (2020)	Financial fraud detection using AI	Explored AI-based systems significantly improve real-time fraud detection and reduce false positives in financial transactions.
13.	Mehta, R., & Singh, V. (2022)	Predictive analytics for making investment decisions in Indian Stock Market	Explored that ML models outtake traditional methods of predicting stock trends and supporting investment strategy decisions.
14.	Das, A., & Chaterjee, S. (2023)	AI-powered FinTech business intelligence	Demonstrated effectiveness of ML in augmenting decision-making, risk mitigation and customer segmentation in Indian Fintech firms.
15.	Zhang, L., Wu, J., & Li, K. (2021)	ML in automated trading systems.	AI-driven trading systems improve trading efficacy, reduce human errors and optimize portfolio returns.

III. METHODOLOGY

A. Framework of Smart Systems for Machine Learning in FinTech

Machine Learning powered Fintech systems follow a layered architecture that integrates data collection, storage, processing followed by analysis and decision-making. Figure 1 shows the architecture of Machine Learning Driven business intelligence systems.



Figure 1. Architecture of ML-Based FinTech Business Intelligence Systems

Fig. 1 shows how financial institutions can transform raw financial data into actionable business intelligence insights. Data from various financial sources are refined and analysed. Machine Learning models provide forecast and insights whereas Business Intelligence dashboards display outcomes to assist in decision-making, risk assessment, strategic financial planning and fraud identification.

B. Smart Finance with Machine Learning

Intelligent finance uses ML to enhance the algorithmic trading, identify frauds, control financial risks thereby facilitating decision making based on data insights. These are discussed below:

C. Machine Learning in Algorithmic Trading

Algorithmic Trading is popularly known as AI-Driven trading or Quantitative trading. It is one of the most advanced applications of ML in Fintech. Computer programs execute financial trades based on predefined conditions like price fluctuations, trading volumes and market indicators. Machine learning improves algorithmic trading examining intricate financial trends and predicting upcoming price changes.

Advantages of ML in Trading

- Quicker trade execution
- Minimized human mistakes
- Enhanced trading precision
- Immediate market assessment.

However, automated trading systems require close supervision to avoid market disruption.

D. Machine Learning for Fraud Detection

Due to massive upsurge in digital financial transactions, major concern of financial organizations is detection of fraud. Common types of financial frauds are Credit Card Fraud, Identity theft, Money laundering, insurance fraud, online payment fraud.

Transaction data are analysed by ML algorithms to detect the anomalies that indicate fraudulent activities. These algorithms continuously learn from past transaction patterns and detect unusual behaviour.

E. Machine Learning in Risk Analysis

In order to ensure financial stability and minimize losses, it is essential for financial institutions to manage the risk. Major financial risks are Credit risk, market risk, operational risk and liquidity risk.

Machine Learning models analyse financial indicators like transaction behaviour, customer credit history and economic trends. Thus ML learning based risk models provides more accurate risk assessments as compared to conventional statistical methods.

1) Predictive Analytics in Financial Business Intelligence

Predictive analytics connects data, machine learning as well as financial tactics to transform raw financial data to presentable and insightful data that enhances trading effectiveness, fraudulent behaviour and risk management. Predictive analytics is used for stock price prediction, customer churn prediction, stock price prediction and investment portfolio optimization.

Thus predictive analytics helps the organizations to make proactive decisions rather making than reactive decisions.

F. Case Studies

Case Study 1: Detecting Fraud in Online Transactions

To identify credit card fraud instantly, a major international payment firm used ML algorithms. The company employed neural networks trained on millions of transaction records. The system could identify suspicious transactions in milliseconds and decreased fraud losses by around three percent.

Case Study 2: Hedge Fund Algorithmic Trading

Multiple hedge funds employ algorithmic trading systems based on ML that examine substantial amount of financial data, such as market trends, new sentiments and economical signals. These systems autonomously carry out transactions driven by predictive models enhancing investment profits.

Case Study 3: Risk Assessment in Banking

A prominent global bank implemented ML algorithms to analyse loan applications and assess borrower risk. The model examined credit records, income rates as well as spending habits to forecast the likelihood of loan default. This system greatly enhanced the precision of credit risk forecasting.

G. Challenges & Limitations

Major challenges include Data Privacy, Biased algorithms, model interpretability and data quality issues. Fig. 2. shows the challenges and limitations of ML in Fintech.

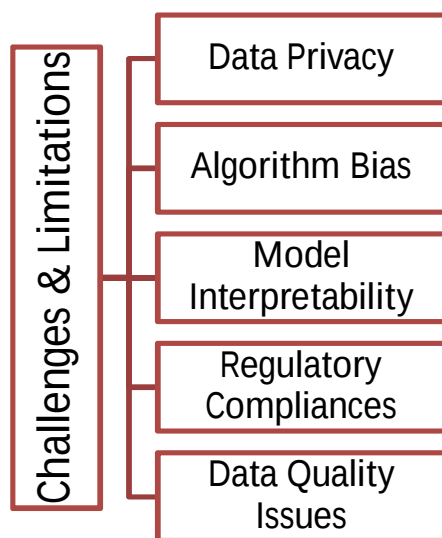


Figure 2. Challenges & Limitations of ML in Fintech

- Data Privacy: It implies that sensitive data of the organization must be protected.
- Algorithm Bias: Biased results may mislead to unfair decisions.
- Model Interpretability: Complex models are difficult to explain.
- Regulatory Compliances: Financial Rules must be followed strictly.
- Data Quality Issues: Low quality data reduces accuracy.

IV. FUTURE TRENDS IN MACHINE LEARNING & FINTECH

Future of machine learning and Fintech is bright and are likely to bring exciting new developments as follows:

- 1) Explainable AI – AI systems which clearly show how they make decisions, help the financial organisations to stay transparent.
- 2) Block Chain & AI- Combining block chain with AI for safer and more efficient financial operations will help the organisations to a greater extent.
- 3) AI financial advisors- Smart digital advisors provide personalized investment and financial advice.
- 4) Quantum Computing- Extremely fast computing that can improve financial analysis and predictions.
- 5) *Real-Time Fraud Detection*- Systems that can spot fraud instantly across the globe.

These technologies will make business intelligence smarter, faster and more reliable in the financial organizations

V. IMPLICATIONS & CONCLUSIONS

A. Implications

The amalgamation of ML and Fintech significantly impacts financial organizations. By facilitating advanced data analysis, these technologies enable the organizations to quickly spot market opportunities, improve trading strategies and reduce financial risks. Additionally, automating routine analytical tasks allow human expertise to focus on more strategic and complex decision-making thereby enhancing overall efficacy.

However, financial organizations need to manage regulatory adherence, data protection and algorithmic clarity to guarantee ethical and legal implementation. Embracing explainable AI systems and strong governance organisations will be essential for harmonizing innovation with responsibility.

B. Conclusion

Fintech innovations powered by Machine Learning are revolutionizing business intelligence with financial institutions. These innovations enhance the processes to be smarter, quicker and more predictive.

Using large datasets and advanced algorithms, the financial organizations can improve decision making, identifying anomalies and predict market trends instantaneously. Although issues related to regulation, privacy and transparency remain, continuous technological progress is expected to enhance Fintech driven business intelligence systems. The future of financial intelligence rests on AI-powered, real-time analytics systems that merge predictive insights with automated decisions thereby enabling institutions to stay competitive in a more data focussed financial environment.

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