Real-Time Expense Tracking and Financial Forecasting Through AI and Machine Learning

Neha Kulshrestha [1], Deepanshu Shukla [2], Abhinav Pandey[3] ,Vikas Mishra[4], Vaibhav Shukla[5]

[1]First Author Department of Computer Science and Engineering, Babu Banarsi Das Institute of Technology and Management, Lucknow, Uttar Pradesh

Associate Professor of Babu Banarsi Das Institute of Technology and Management,, Lucknow

3Babu Banarsi Das Institute of Technology and Management, Uttar Pradesh

neha.kulshrestha121@gmail.com

---***---

Abstract - In the modern financial landscape, predictive analytics and machine learning are revolutionizing personal finance management. This paper explores various machine learning techniques, including deep learning and reinforcement learning, applied to personal finance such as expense tracking, budgeting, and financial forecasting. We review significant advancements in predictive models, real-time tracking systems, and anomaly detection for personal finance. The research incorporates multiple contributions from recent studies on the application of AI and machine learning for smarter financial decision-making, automation in expense categorization, and the enhancement of budgeting systems.

Key Words: Predictive analytics, machine learning, personal finance, budgeting, expense tracking, deep learning, AI in finance.

1.INTRODUCTION

The field of personal finance management has witnessed significant transformations with the advent of artificial intelligence (AI) and machine learning (ML). Predictive budgeting, expense categorization, and financial forecasting are essential for efficient financial management. With the increasing adoption of smart devices, personal finance apps have become more sophisticated, integrating AI techniques to predict and optimize financial decisions [1], [2].

In the past, personal finance was largely manual and dependent on static rules or spreadsheets for managing expenses and savings. However, the growing complexity of individual financial behaviors, coupled with the dynamic nature of markets and pricing, has led to an urgent need for intelligent, adaptive systems. Today, individuals seek not only to record their expenditures but to also receive predictive insights, behavioral analysis, and personalized recommendations that enable proactive financial planning.

Machine learning models, particularly deep learning, reinforcement learning, and natural language processing (NLP), have enabled systems to learn from historical financial data, recognize patterns, and adapt to user behaviors over time. These technologies have revolutionized traditional approaches by automating categorization of expenses, detecting anomalies in spending, and forecasting future financial trends with improved accuracy.

Recent studies have focused on improving predictive models for real-time expense tracking, categorization, and anomaly detection using various machine learning approaches, including deep learning and NLP for further advancement [5], [7]. These models help individuals and businesses manage finances more effectively, offering insights into future spending patterns and optimizing budgeting strategies [6].

Additionally, the proliferation of financial technology (FinTech) applications has played a critical role in popularizing these innovations. Mobile-based finance trackers, smart wearable devices, and AI-integrated platforms now offer seamless integration with banking systems, enabling continuous monitoring and smart decision support. This has democratized access to advanced financial tools, allowing users across all income levels to take control of their financial well-being.

This paper synthesizes recent research and provides an overview of the state-of-the-art in predictive modeling and AI applications for personal finance management. It highlights various machine learning techniques and models that have been successfully applied to budgeting, forecasting, expense categorization, and anomaly detection. The ultimate goal is to explore how AI can empower individuals with smarter financial tools that not only assist in daily expense management but also support long-term financial planning and stability.

II. STATSTICAL MODELING IN PERSONAL FINANCE

A. BUDGETING AND FORECASTING

Predictive budgeting is a fundamental tool for personal financial management, enabling individuals to forecast their expenses and adjust their saving habits. Sulaiman et al. (2020) propose predictive budgeting models that rely on historical spending data to forecast future expenditures and suggest budgeting strategies [1]. Similarly, Pérez-Molero et al. (2018) explore models designed for expense tracking, offering individuals personalized advice on managing their finances [2].

Machine learning-based approaches,, have shown promise in forecasting time-series financial data, improving the accuracy of budgeting models [6], [5].

B. EXPENSE CATEGORIZATION

Expense categorization is an essential task for understanding financial behavior. Yang et al. (2021) demonstrate the use of NLP for automatic categorization of expenses, enabling users to easily track where their money is going [7]. This is especially useful for applications designed to automate

financial reporting and reduce the manual effort involved in classifying financial transactions.

III. MACHINE LEARNING TECHNIQUES IN PERSONAL FINANCE

A. REINFORCEMENT LEARNING FOR FINANCIAL DECISION MAKING

Suttle and Singh (2021) applied reinforcement learning (RL) to cost-aware decision-making processes, demonstrating its potential in dynamically adjusting financial plans based on real-time data [8]. RL techniques allow individuals or systems to learn optimal financial strategies over time by interacting with the financial environment.

B. AI RECIPT DETECTION FOR EASY CATAGORIGING EXPENCES

An AI-powered finance tracker can intelligently extract key financial attributes from receipts using Optical Character Recognition (OCR) and Natural Language Processing (NLP). When a user uploads or scans a receipt, the AI analyzes it to identify and categorize crucial data such as the date of purchase, merchant name, item descriptions, individual prices, total amount, payment method, and applicable taxes. This automated extraction not only saves time but also ensures greater accuracy in expense tracking. By organizing these attributes, the finance tracker provides users with real-time insights into their spending habits, enabling better budgeting, financial planning, and decision-making.

IV. ANOMALY DETECTION IN FINANCIAL DATA

Anomaly detection is crucial for identifying unusual transactions that could indicate fraud or unanticipated financial events. Kim and Lee (2022) present a comparative analysis of deep learning techniques for anomaly detection, highlighting their effectiveness in identifying outliers in financial data, which can significantly enhance security in financial applications [9]

V. SMART DEVICES AND REAL-TIME TRACKING

The integration of smart devices has enabled real-time expense tracking.

Kumar and Sharma (2024)describe the application of smart devices in expense tracking systems, providing users with up-to-the-minute financial information and recommendations for better financial management [16]. These systems have gained popularity due to their ability to offer personalized financial advice based on real-time data inputs.

VI. RECENT ADVANCEMENTS AND TRENDS

Recent advancements in AI for financial management include AI-powered personal finance trackers, which combine machine learning algorithms with smart devices to predict and categorize financial data automatically. Sun and Gao (2023) describe how AI-enhanced finance trackers can predict user behavior and offer real-time financial insights [14]

VII. CONCLUSION

The integration of predictive modeling and machine learning in personal finance has led to significant advancements in budgeting, expense tracking, and financial forecasting. Technologies have shown great promise in improving the accuracy and efficiency of financial decision-making. As AI and machine learning techniques continue to evolve, future developments will likely make personal finance management even more seamless and automated.

.

REFERENCES

[1] Sulaiman, S., et al., "Predictive Budgeting for Personal Finance," Journal of Financial Technology, vol. 12, no. 3, pp. 125–135, 2020.

[2] Pérez-Molero, M., et al., "Predictive Models for Expense Tracking," Finance Journal, vol. 9, no. 4, pp. 210–222, 2018.

[3] Zhou, L., et al., "Machine Learning in Financial Prediction," Financial Technology Review, vol. 15, no. 2, pp. 75–89, 2018.

[4] Mohammed, A., et al., "Predicting Personal Expenses Using Machine Learning," International Journal of Financial Analytics, vol. 11, no. 1, pp. 44–58, 2019.

[5] Cheng, Y., et al., "Deep Learning for Time-Series Forecasting in Personal Finance," Computational Finance Journal, vol. 18, no. 2, pp. 109–120, 2019.

[6] Gupta, R., & Sharma, N., "Using LSTM for Personal Finance Forecasting," AI in Finance, vol. 7, no. 3, pp. 145–155, 2020.

[7] Yang, H., et al., "Automatic Expense Categorization Using NLP," Journal of Finance and Technology, vol. 10, no. 2, pp. 200–212, 2021.

[8] Suttle, J., & Singh, A., "Reinforcement Learning for Cost-Aware Markov Decision Processes," Proceedings of the 38th International Conference on Machine Learning (ICML), PMLR Vol. 139, 9989–9999, 2021.

[9] Kim, H., & Lee, J., "Anomaly Detection in Financial Data Using Deep Learning: A Comparative Analysis," Proceedings of the IEEE International Conference on Data Science and Advanced Analytics (DSAA), 2022.

[10] IEEE, "Using AI for Predictive Analytics in Financial Management," IEEE Conference on Financial Management, 2024.

[11] IEEE, "Machine Learning-based Predictive Analytics for Financial Planning and Budgeting," IEEE Xplore Conference Proceedings, 2024.

[12] Hoang, D., "Machine Learning Methods in Finance: Recent Applications and Prospects," European Financial Management, 2023.

[13] TrackEZ, "Expense Tracker," IEEE Conference Publication, 2024.

[14] Sun, W., & Gao, Z., "Smart Personal Finance Tracker with AI and Machine Learning," Journal of Financial Technology, vol. 10, no. 2, pp. 117–129, 2023.

[15] Shadcn, "UI for Designing Charts/Graphs," 2024.

[16] Kumar, A., & Sharma, S., "Real-Time Expense Tracking Using Smart Devices: A Financial Management Approach," International Journal of Personal Finance, vol. 19, no. 4, pp. 240–257, 2024.

[17] Kaplan, B., et al., "AI Empowers Smarter Finance Decisions," 2024.

[18] Phat Tran, "Full Stack for Finance Management," 2023.

[19] Praphulla S. Kherade, et al., "Proposed System," 2021.

[20] Dadhich, A., et al., "Finance Tracker," 2023.

[21] Bhardwaj, S., et al., "Project Structure," 2024.

[22] Clerk, "Authentication in Full Stack Technologies," 2024.

[23] Shadcn, "UI for Designing Charts/Graphs," 2024.

[24] Accenture, "AI Empowerment in Wealth Management: From Experimental to Exponential," 2024.

[25] Liu, Z., Zhang, Y., & Wang, J., "Machine Learning for Personal Finance: An Overview," International Journal, 2021.