AMERICAN JOURNAL OF AI CYBER COMPUTING MANAGEMENT
E-ISSN:3069-0102
VOL.5, NO. 4(1)(2025)

PERFORMANCE EVALUATION OF MUTUAL FUNDS

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ABSTRACT
Mutual funds have emerged as one of the most popular investment instruments, offering diversified exposure and professional management to individual and institutional investors. However, evaluating the performance and risk profile of mutual funds is a complex task, traditionally carried out using financial ratios and historical return data. This study aims to enhance the performance evaluation process by leveraging Machine Learning (ML) and Deep Learning (DL) techniques to analyze, classify, and predict mutual fund behavior more accurately and efficiently.The research involves collecting historical Net Asset Value (NAV) data, risk-return indicators, and fund characteristics for a diverse set of mutual funds. Using ML algorithms such as Random Forest, Support Vector Machines (SVM), and K-Means Clustering, the funds are categorized based on risk levels and past performance. Further, Deep Learning models, particularly Long Short-Term Memory (LSTM) networks, are used for time-series forecasting to predict future NAVs and returns, capturing non-linear patterns and market volatility.This AI-driven approach enables the identification of high-performing funds, estimation of potential future returns, and early detection of underperforming assets. It also offers investors and fund managers valuable insights into risk management, portfolio optimization, and decision-making. The findings demonstrate that integrating ML and DL significantly enhances traditional mutual fund analysis by making it more dynamic, predictive, and data-driven.

I.INTRODUCTION

Mutual funds play a vital role in the financial ecosystem by offering investors a professionally managed, diversified, and liquid investment option. With thousands of mutual funds available across various asset classes, sectors, and risk categories, evaluating their performance has become increasingly essential for investors, fund managers, and regulatory bodies. Traditionally, mutual fund performance is measured using statistical indicators like Sharpe Ratio, Alpha, Beta, Standard Deviation, and historical returns. While these tools provide foundational insights, they are often limited in their ability to detect evolving market trends, manage large datasets, and offer forward-looking predictions.In recent years, the advancement of Machine Learning (ML) and Deep Learning (DL) has revolutionized financial analysis by enabling intelligent systems to process complex data, learn from historical patterns, and forecast future trends with high precision. These techniques are especially useful in the mutual fund domain, where fund performance is influenced by numerous dynamic factors such as market volatility, macroeconomic indicators, fund management strategies, and investor behavior.This study explores how ML and DL models can be effectively employed to evaluate and predict mutual fund performance. ML algorithms such as Random Forest, Decision Trees, and K-Means Clustering are utilized to identify key factors affecting fund returns and group funds based on performance characteristics. Meanwhile, DL models like LSTM (Long

Short-Term Memory) networks are applied to time-series NAV data to forecast future returns and volatility. By combining traditional financial metrics with AI-driven predictive tools, this research aims to provide a more accurate, data-rich, and forward-looking evaluation framework for mutual funds.

Definition:

Mutual Fund Performance Evaluation refers to the systematic analysis of a mutual fund's historical and current financial metrics—such as Net Asset Value (NAV), returns, risk ratios, and portfolio composition—to assess how well the fund meets its investment objectives. Traditionally, this evaluation is conducted using financial indicators like the Sharpe Ratio, Alpha, Beta, Standard Deviation, and Treynor Ratio, which help measure risk-adjusted returns and volatility.In the context of this study, Machine Learning (ML) and Deep Learning (DL) techniques are used to enhance mutual fund performance evaluation. ML involves algorithms that learn from data to make predictions or classifications—such as determining fund categories or forecasting future returns based on past performance. DL, particularly models like LSTM (Long Short-Term Memory), is a subset of ML that is designed to process sequential and time-series data, enabling it to capture complex patterns in mutual fund NAVs over time.By applying ML and DL models, performance evaluation becomes more accurate, automated, and predictive—offering investors and analysts a smarter and more data-driven way to identify top-performing funds and mitigate investment risks.

research methodology:

This study adopts a quantitative and analytical research methodology to evaluate and predict mutual fund performance using historical financial data and advanced machine learning techniques. The data used in the study includes Net Asset Values (NAVs), return percentages, fund category, expense ratios, and risk metrics of selected mutual funds over a period of 5–10 years. The data is sourced from publicly available databases such as AMFI (Association of Mutual Funds in India), MoneyControl, and fund houses' official reports.The research process begins with data collection and preprocessing, where the raw data is cleaned, normalized, and converted into structured datasets suitable for modeling. Key performance indicators are derived and used as features for machine learning algorithms. Machine Learning models like Random Forest, Support Vector Machine (SVM), and K-Means Clustering are applied to classify funds based on risk-return profiles and to identify the most influential features affecting fund performance.For time-series prediction of NAVs and future returns, Deep Learning techniques, particularly Long Short-Term Memory (LSTM) networks, are implemented. These models are capable of learning temporal dependencies in sequential data and can forecast fund behavior under changing market conditions. Model performance is evaluated using metrics such as RMSE (Root Mean Square Error), MAE (Mean Absolute Error), and R^2 Score to ensure accuracy and reliability.

The methodology ultimately aims to combine traditional financial metrics with the predictive power of AI models to offer a more comprehensive and forward-looking mutual fund evaluation framework.

II.LITERATURE REVIEW

- Sharpe, W. F. (1966) introduced the Sharpe Ratio, a foundational metric in mutual fund performance evaluation, which measures risk-adjusted returns and is still widely used in modern financial analysis.
- Treynor, J. L. (1965) developed the Treynor Ratio, helping assess a fund's performance relative to its systematic risk (Beta), laying the groundwork for comparative fund analysis.

- Kumar, A., & Rastogi, R. (2019) explored the use of Random Forest classifiers to evaluate mutual fund returns based on historical NAV data and identified high-performing funds using ensemble methods.
- Singh, M., & Verma, A. (2021) implemented Support Vector Machines (SVM) to categorize mutual funds into risk classes, improving fund recommendation systems for retail investors.
- Jaiswal, R. (2020) utilized K-Means Clustering to group mutual funds based on volatility and return trends, providing investors with clearer fund selection strategies.
- Chakraborty, S., & Roy, T. (2022) applied LSTM (Long Short-Term Memory) networks for NAV forecasting and showed that deep learning models outperform traditional linear models in accuracy.
- Patel, K., & Joshi, N. (2020) used XGBoost for feature importance in mutual fund performance, concluding that expense ratio and historical return consistency are major predictors.
- Bhattacharya, A. (2021) studied the impact of AI on the Indian mutual fund industry and emphasized the importance of data-driven tools in improving investor decision-making.
- Gupta, R., & Mehta, S. (2018) combined time-series forecasting with ML to identify underperforming funds early, enabling investors to shift portfolios proactively.
- OECD Report (2022) highlighted how AI and machine learning are increasingly being used in asset management, especially for predictive analytics and fraud detection in mutual fund operations.
- Aggarwal, V. (2021) proposed a hybrid approach combining financial ratios with ML classification for ranking equity mutual funds more precisely.
- Das, P., & Sinha, R. (2022) developed a DL-based performance scoring system for mutual funds using multi-layer perceptrons, which proved effective in ranking funds.
- · · Choudhary, D., & Prakash, S. (2019) assessed the role of deep learning in predicting returns of index-based mutual funds, emphasizing the temporal strength of LSTM.
- World Economic Forum (2021) noted that AI-enabled mutual fund analysis increases efficiency in detecting market anomalies and helps reduce portfolio risks.
- Nair, A., & Shah, M. (2023) conducted comparative studies of traditional vs. AI-driven mutual fund analysis, concluding that ML/DL models are more adaptable to volatile market conditions.

III.DATA ANALYSIS AND INTERPRETATION

INTERPRETATION:

The application of Machine Learning (ML) and Deep Learning (DL) models to mutual fund performance data has revealed significant insights into fund behavior and investment potential. Using classification models like Random Forest and SVM, mutual funds were effectively grouped by risk-return profiles, helping to identify patterns that would be difficult to detect through traditional analysis. These models showed that factors such as expense ratio, past NAV volatility, and consistency of returns are key indicators of fund stability and long-term performance.

Time-series forecasting using LSTM networks demonstrated high accuracy in predicting future NAV trends, which is crucial for both fund managers and investors aiming to optimize their portfolio strategies. The ability of LSTM to capture temporal dependencies and nonlinear fluctuations made it more effective than conventional linear models. Moreover, clustering algorithms like K-Means allowed the

grouping of funds into meaningful categories—such as high-growth, stable-income, and high-volatility—thereby assisting in informed decision-making.These interpretations underscore the advantage of integrating AI techniques into financial analysis. ML and DL not only enhance precision and predictive capability but also offer dynamic, real-time insights that traditional tools cannot, empowering stakeholders with better risk assessment and investment planning.

INTERPRETATION:

The implementation of Machine Learning (ML) and Deep Learning (DL) techniques in mutual fund performance evaluation has significantly advanced the way investment insights are generated. Through the use of Random Forest and XGBoost models, this study was able to rank mutual funds by their performance, revealing that key features like historical return patterns, fund size, expense ratio, and portfolio turnover rate play a dominant role in influencing future returns. These models showed high accuracy in identifying top-performing funds, especially when compared to traditional statistical models, which often fail to account for nonlinear relationships and complex interactions among variables.Using K-Means Clustering, mutual funds were successfully grouped into clusters based on their risk-return profiles. This allowed for better fund segmentation and provided investors with a clearer understanding of which funds aligned with their financial goals—whether conservative, moderate, or aggressive. Moreover, clustering highlighted hidden patterns such as seasonal performance peaks or underperformance trends during volatile market conditions.

IV.FINDINGS

The study found that integrating Machine Learning and Deep Learning techniques significantly improves the accuracy and efficiency of mutual fund performance evaluation. Deep learning models, particularly LSTM (Long Short-Term Memory), were highly effective in forecasting future Net Asset Values (NAVs) by learning complex temporal patterns and adjusting dynamically to market fluctuations. These models outperformed traditional forecasting tools and provided investors with a reliable method for anticipating fund behavior.Further, feature importance analysis using Random Forest and XGBoost revealed that certain financial variables—such as expense ratio, fund size, historical return consistency, and volatility—have the most substantial impact on fund performance. These features consistently appeared as top contributors across models, indicating their relevance in determining risk-adjusted returns. In addition, unsupervised learning via K-Means Clustering allowed mutual funds to be grouped into risk-based categories, enabling more tailored investment strategies and easier fund comparison.

Supervised models such as Support Vector Machines (SVM) and Random Forest classifiers also performed well in classifying mutual funds according to their risk levels. These models offered high accuracy and could be used to develop intelligent recommendation systems for investors with varying risk appetites. Moreover, the intelligent systems were capable of detecting early warning signs of performance decline or increased risk, thereby supporting proactive decision-making by investors and fund managers.

V.CONCLUSION

This study successfully demonstrated that the integration of Machine Learning (ML) and Deep Learning (DL) techniques significantly enhances the traditional methods of evaluating mutual fund performance. By using advanced algorithms like Random Forest, SVM, and LSTM, we were able to go beyond static ratio analysis and develop predictive models that capture dynamic financial patterns. These models proved effective not only in forecasting Net Asset Values (NAVs) but also in identifying

risk levels, fund behavior, and investment suitability across a variety of mutual fund schemes.

The findings confirmed that expense ratio, historical return trends, and fund size are key predictors of performance. Techniques like K-Means clustering and LSTM time-series forecasting empowered the analysis with deeper insights, allowing segmentation of funds into performance-based groups and providing accurate projections of future returns. Moreover, the ability to detect early signs of volatility or underperformance offered fund managers a proactive tool for decision-making.

In conclusion, this research affirms that ML and DL technologies hold transformative potential in the mutual fund domain. They not only improve analytical precision and forecasting capabilities but also offer automated, scalable, and intelligent frameworks for investors and analysts alike. As financial markets continue to evolve, the adoption of AI-driven methodologies will be essential for achieving smarter, data-informed investment strategies and maintaining a competitive edge in portfolio management.

VI.REFERENCES

- Sharpe, W. F. (1966). Mutual Fund Performance. The Journal of Business, 39(1), 119–138.
- Treynor, J. L. (1965). How to Rate Management of Investment Funds. Harvard Business Review.
- Kumar, A., & Rastogi, R. (2019). Application of Random Forest in Mutual Fund Performance Prediction. International Journal of Finance and Data Science, 7(2), 85–94.
- Singh, M., & Verma, A. (2021). Risk Classification of Mutual Funds using SVM. Journal of Financial Technology, 6(3), 140–151.
- Todupunuri, A. (2022). Utilizing Angular for the Implementation of Advanced Banking Features. Available at SSRN 5283395.
- Jaiswal, R. (2020). Clustering of Mutual Funds using K-Means Algorithm. Financial Data Analytics Journal, 4(1), 33–42.
- Chakraborty, S., & Roy, T. (2022). Forecasting NAVs using LSTM Networks. International Journal of Artificial Intelligence in Finance, 8(1), 55–70.
- Patel, K., & Joshi, N. (2020). Performance Analysis of Mutual Funds using XGBoost. Journal of Computational Finance, 5(3), 76–89.
- Bhattacharya, A. (2021). Artificial Intelligence in Indian Mutual Fund Evaluation. Finance and Technology Review, 9(2), 122–134.
- G. KOTTE, “Overcoming Challenges and Driving Innovations in API Design for High-Performance AI Applications,” JOURNAL OF ADVANCE AND FUTURE RESEARCH, vol. 3, no. 4, 2025, doi: 10.56975/jaafr.v3i4.500282.
- Gupta, R., & Mehta, S. (2018). Time-Series Models for Fund Performance Evaluation. International Journal of Investment Research, 3(4), 90–102.
- OECD. (2022). AI and Machine Learning in Finance. https://www.oecd.org
- Das, P., & Sinha, R. (2022). Deep Learning for Mutual Fund Ranking. Journal of Applied Data Science, 6(1), 77–88.
- Todupunuri, A. (2025). The Role Of Agentic Ai And Generative Ai In Transforming Modern Banking Services. American Journal of AI Cyber Computing Management, 5(3), 85-93.
- · · Aggarwal, V. (2021). Hybrid ML Models for Financial Analysis. Financial Modeling Review, 10(2), 115–124.
- G. Kotte, “Enhancing Cloud Infrastructure Security on AWS with HIPAA Compliance Standards,” SSRN

Electronic Journal, 2025, doi: 10.2139/ssrn.5283660.

- Choudhary, D., & Prakash, S. (2019). LSTM for Predicting Equity Fund Returns. International Journal of Deep Finance, 4(2), 45–57.
- World Economic Forum. (2021). Machine Learning in Asset Management: Trends and Challenges. https://www.weforum.org
- Nair, A., & Shah, M. (2023). Comparative Study of AI and Traditional Models in Mutual Fund Evaluation. Journal of Financial Engineering, 11(1), 99–111.
- Jain, A., & Sharma, N. (2022). Predictive Modeling of Mutual Fund Performance Using Artificial Neural Networks. Journal of Intelligent Investment Analytics, 7(3), 110–122.
- Rao, V., & Banerjee, S. (2020). Application of Machine Learning in Retail Mutual Fund Recommendation Systems. International Journal of FinTech Research, 5(4), 89–100.
- Thomas, L., & Kapoor, M. (2021). Using LSTM and GRU for NAV Forecasting in Equity Funds. Journal of Financial AI, 9(1), 66–77.
- Mehta, R., & Iqbal, F. (2022). An Empirical Study of Mutual Fund Ranking Using Deep Learning Models. International Journal of Data and Finance, 11(2), 58–70.
- FSB (Financial Stability Board). (2021). The Use of AI and Machine Learning by Financial Institutions. Retrieved from https://www.fsb.org