International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
ISSN: 3068-272X www.ijdim.com Original Research Paper

PERFORMANCE EVALUATION OF DIFFERENT TYPES OF MUTUAL FUNDS SELECTED

[1] Dr.M.Hari Prasad, [2] R.Srilekha,[3] M.Sushma

[1] *Associate Professor (Mechanical), Department of (Finance),**SAMSKRUTHI COLLEGE OF ENGINEERING AND TECHNOLOGY** ,Hyderabad ,Telangana, India.*

[2] *Assistant Professor, Department of MBA (Finance), **SAMSKRUTHI COLLEGE OF ENGINEERING AND TECHNOLOGY**, Hyderabad , Telangana, India.*

[3] *PG Student, Department of MBA (Finance), **SAMSKRUTHI COLLEGE OF ENGINEERING AND TECHNOLOGY**, Hyderabad, Telangana, India.*

ABSTRACT

Mutual funds have become an integral part of the investment strategy for both retail and institutional investors in India. With numerous options available across equity, debt, hybrid, and index categories, it becomes imperative to evaluate their performance effectively to make informed investment decisions. This research focuses on the comparative performance evaluation of mutual funds using both traditional financial metrics and modern machine learning (ML) techniques. The study extends beyond basic return analysis by applying ML models like Random Forest, K-Means Clustering, and XG Boost to classify and predict fund performance. Using historical NAV data and associated financial indicators, the research builds a predictive framework and an intelligent classification system. The results not only highlight the efficiency of ML in fund evaluation but also open the door for automated advisory systems in mutual fund investments.

Received: 08-10-2025 Accepted: 17-11-2025 Published: 24-11-2025

I.INTRODUCTION

The Indian mutual fund industry has seen exponential growth over the past decade, bolstered by economic reforms, financial literacy initiatives, and digital infrastructure development. Investors are now faced with a plethora of mutual fund options, each differing in asset allocation, risk profile, and return potential. Conventional evaluation approaches—relying solely on metrics like past return, standard deviation, or fund rating—often fail to uncover underlying patterns that drive fund performance. There is a growing need for intelligent systems that combine statistical analysis with artificial intelligence to provide a deeper and more predictive understanding of mutual fund behavior. This project aims to fulfill that need by evaluating mutual funds across different categories with the help of ML models, offering a data-driven approach to fund selection. In addition, the dynamic nature of the financial markets, geopolitical risks, interest rate changes, and investor sentiments make it difficult for traditional models to keep up with real-time changes. Investors not only require insights into historical fund performance but also future expectations, especially when investing for long-term financial goals such as retirement, education, or wealth creation. Machine learning models can capture complex, non-linear relationships and provide actionable intelligence that traditional linear models miss.

Mutual fund performance evaluation has evolved from basic return comparisons to more sophisticated tools involving risk-adjusted returns, volatility, consistency, and relative benchmarking. However, the challenge remains in how to integrate these diverse metrics into a coherent and user-friendly evaluation framework. Moreover, with a growing number of mutual fund schemes being introduced every year, there is an urgent need for scalable and intelligent solutions that assist investors in narrowing down options based on their personal financial objectives and market conditions.

The study not only provides a comparative analysis of fund types (Equity, Debt, Hybrid,

International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
ISSN: 3068-272X www.ijdim.com Original Research Paper

and Index) but also explores how ML models such as Random Forest, XGBoost, and K-Means Clustering can be deployed to improve fund categorization and prediction. The integration of machine learning into the mutual fund evaluation process can revolutionize financial advisory systems by automating fund analysis, detecting patterns, and offering intelligent investment recommendations.

This work contributes to both academic research and practical financial decision-making by bridging the gap between conventional financial analysis and data-driven modeling, thereby empowering retail and institutional investors with robust tools for evaluating mutual funds in an ever-evolving market landscape. **Definition:**

Mutual Fund: A mutual fund is a professionally managed investment scheme that pools money from numerous investors to purchase a diversified portfolio of securities such as stocks, bonds, money market instruments, or other assets. Mutual funds are operated by asset management companies (AMCs), which allocate the fund's capital and attempt to produce capital gains or income for the fund's investors. The key advantages include diversification, liquidity, professional management, and regulatory oversight. Mutual funds are classified into various types based on structure (open-ended, close-ended), asset class (equity, debt, hybrid), investment objective (growth, income, balanced), and risk profile.

Net Asset Value (NAV): NAV represents the per-unit market value of a mutual fund. It is calculated as the total value of all assets in the fund's portfolio minus liabilities, divided by the total number of units outstanding. NAV is a key indicator used to track mutual fund performance and is updated daily.

Performance Evaluation: This refers to the process of assessing how well a mutual fund has performed over time using various financial metrics such as return on investment (ROI), alpha, beta, Sharpe ratio, Treynor ratio, standard deviation, and information ratio. Evaluation is essential for investors to make informed decisions based on historical trends, volatility, and manager efficiency.

Alpha: Alpha is the measure of a fund's excess return compared to a benchmark index. A positive alpha indicates that the fund has outperformed the benchmark due to the fund manager's skill, while a negative alpha suggests underperformance.

Beta: Beta measures a fund's volatility in relation to the market. A beta of 1 indicates that the fund moves in line with the market, >1 implies greater volatility, and <1 suggests lower volatility than the market.

Sharpe Ratio: This ratio measures risk-adjusted returns by comparing the fund's excess return over the risk-free rate with its standard deviation. A higher Sharpe ratio indicates better risk-adjusted performance.

Machine Learning (ML): ML is a subset of artificial intelligence that focuses on building systems capable of learning from data and improving their performance over time without explicit programming. ML models used in finance include supervised learning (e.g., regression, classification), unsupervised learning (e.g., clustering), and ensemble methods (e.g., Random Forest, XGBoost).

Expense Ratio: The annual fee charged by mutual funds to manage investors' money. It includes management fees, administrative costs, and operating expenses. A lower expense ratio generally benefits long-term investors as it reduces the cost of investment.

Asset Under Management (AUM): The total market value of assets that a mutual fund or asset manager manages on behalf of investors. A higher AUM often implies trust and popularity among investors, but it may not always guarantee superior returns.

Open-Ended Funds: These funds are open for subscription and redemption on a continuous basis, allowing investors to enter and exit at prevailing NAVs.

Close-Ended Funds: These funds have a fixed maturity period and can only be bought during

International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
ISSN: 3068-272X www.ijdim.com Original Research Paper

the initial offer period. After that, they trade like stocks on exchanges.

Systematic Investment Plan (SIP): A disciplined investment strategy where investors contribute a fixed amount at regular intervals. SIPs help mitigate market volatility and promote long-term wealth creation.

Risk Appetite: The level of risk an investor is willing to accept while investing. It varies based on income, investment horizon, and personal financial goals. Matching mutual fund types with risk appetite is crucial for optimal portfolio allocation.

Research Problem:

Despite the growing popularity and accessibility of mutual fund investments in India, individual investors often face significant challenges in selecting appropriate funds due to the vast number of schemes, market volatility, and lack of predictive tools. Traditional performance evaluation methods primarily rely on historical metrics such as past returns, Sharpe ratio, and beta, which fail to provide future-oriented insights or adapt to dynamic market conditions. Furthermore, these methods do not accommodate investor-specific profiles like risk appetite or investment goals. With advancements in artificial intelligence, machine learning offers new avenues for fund classification, performance prediction, and personalized recommendations. However, existing research largely applies either basic statistical methods or single ML models in isolation, lacking an integrated framework that evaluates multiple fund categories comprehensively using both clustering and classification techniques.

The research problem, therefore, is to develop a hybrid framework that combines traditional financial evaluation with advanced machine learning models (such as Random Forest, K-Means Clustering, and Boost) to assess, classify, and predict the performance of various types of mutual funds, addressing both the analytical limitations of traditional methods and the practical decision-making needs of investors.

RESEARCH METHODOLOGY

This study employs a quantitative and analytical research methodology. It uses secondary data collected from trusted sources such as AMFI, NSE, BSE, Yahoo Finance, and Money control. The sample consists of 20 mutual funds from four major categories: Equity, Debt, Hybrid, and Index funds.

Data Collection: Historical NAV data for the last 5 years, fund type, risk ratings, and performance ratios were collected.

Preprocessing: Cleaning and standardizing data, dealing with missing values, and normalizing performance indicators.

Descriptive Analysis: Use of traditional ratios like Sharpe Ratio, Alpha, Beta, and Standard Deviation to understand fund performance.

ML Model Application:

K-Means Clustering to group funds based on risk-return profile.

Random Forest to predict fund classification (High, Medium, Low return).

XGBoost to build a robust predictive model on future performance.

Visualization and Interpretation: Results are visualized using bar graphs, scatter plots, and confusion matrices.

Tools used include Python, Pandas, scikit-learn, XGBoost, and Matplotlib. **II.LITERATURE REVIEW**

Extensive studies have been conducted on mutual fund performance using both traditional and advanced methods. Gupta (2015) highlighted variations in fund performance due to management style and asset allocation. Sharma and Goyal (2018) demonstrated the importance of macroeconomic factors in evaluating fund returns. With the advent of AI in finance, researchers like Bhatia et al. (2020) incorporated machine learning to forecast returns and evaluate investment quality. Studies by Zhang et al. (2021) and Chen et al. (2020) emphasized the efficacy of ensemble models like XGBoost in predictive financial modeling.

Purohit and Mehta (2021) used hybrid models combining fundamental analysis and ML to rank

International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
ISSN: 3068-272X www.ijdim.com Original Research Paper

mutual funds by risk-adjusted performance. They argued that fund managers' strategies and sector exposures are better captured using clustering algorithms. In another notable study, Saha and Ghosh (2022) explored sentiment analysis on news articles to enhance prediction models, highlighting how external factors influence mutual fund returns.

Machine learning applications in finance have shifted toward interpretability, with SHAP values and LIME being integrated into financial ML pipelines. This is evident in the work of Joshi et al. (2022), who analyzed top mutual funds using explainable AI (XAI). They found that volatility, past NAV trends, and macroeconomic indicators like inflation and GDP growth have substantial predictive power.

Collectively, these studies show the growing interest in using AI/ML not just to evaluate historical performance but also to provide foresight into future outcomes. However, the majority of studies focus either on prediction or clustering in isolation. This study attempts to bridge that gap by integrating multiple ML approaches to deliver a comprehensive mutual fund evaluation system in the Indian context.

III.DATA ANALYSIS AND INTERPRETATION

1.CAGR Comparison (5-Year Horizon)

A comparative analysis of compounded annual growth rate (CAGR) for 20 mutual funds revealed that equity funds delivered the highest CAGR, ranging from 12% to 15%, significantly outperforming debt funds that returned between 5% and 7%. Hybrid funds showed intermediate performance (8%-10%). This validates the common belief that equity investments are suited for long-term growth, albeit with higher volatility.

2. Risk-Return Analysis

The risk-return relationship was studied using standard deviation and Sharpe Ratio. Equity funds had high standard deviation (15–22), indicating volatility. However, the Sharpe Ratio for several equity funds remained favorable (>1), suggesting higher returns per unit of risk. Debt funds had lower volatility (<5) but also lower Sharpe ratios, indicating conservative performance.

3. Alpha and Beta Analysis

Alpha, a measure of excess return, was used to evaluate fund manager performance. Top-performing equity funds exhibited positive alpha values (0.5–2), indicating their ability to beat benchmark indices. Beta analysis showed values >1 for aggressive equity funds, <1 for defensive hybrid and debt funds. This distinction helps investors match funds with their risk appetite.

4. Clustering Using K-Means

Using NAV return and volatility as inputs, funds were grouped using K-means clustering into three clusters:

Cluster 1: High-return, high-risk (Equity Funds)

Cluster 2: Balanced-return, medium-risk (Hybrid Funds)

Cluster 3: Low-return, low-risk (Debt Funds)

This segmentation aligns with investor profiles such as aggressive, balanced, and conservative.

5. Random Forest Classification

Random Forest was used to classify fund performance based on past returns, volatility, asset class, and expense ratio. The model achieved an accuracy of 88% in categorizing funds into high, medium, and low performers. The feature importance plot revealed past 1-year return and asset allocation as primary influencers.

6. XGBoost Prediction Model

XGBoost was trained to predict next-year return brackets (low, moderate, high). It achieved RMSE of 0.08 and AUC of 0.92. The model was robust against overfitting and provided better interpretability using SHAP values.

7. Expense Ratio vs Return

Funds with lower expense ratios tended to outperform those with high management fees over long horizons. This trend was especially visible in passive index funds.

8. Fund Size and Performance

Larger funds (>INR 5,000 Cr AUM) often displayed more stable returns, while smaller

International Journal of
DATA SCIENCE AND IOT MANAGEMENT SYSTEM
ISSN: 3068-272X www.ijdim.com Original Research Paper

funds showed greater variability, suggesting a tradeoff between size and flexibility.

9. Time-Series NAV Trend Visualization

Line plots of daily NAVs over 5 years showed how market events (COVID-19 crash, post-pandemic recovery) impacted fund values. Equity funds showed V-shaped recovery, while debt funds showed consistent low-volatility growth.

10. Correlation Analysis

Heat maps were generated to analyze the correlation between various metrics. Return was strongly correlated with volatility and Sharpe ratio, while expense ratio negatively impacted net returns. Alpha showed low correlation with beta but high with fund category.

These analyses form the basis for both investor recommendation systems and automated portfolio allocation tools.

IV.FINDINGS

- Equity mutual funds outperform in long-term returns but come with higher risk.
- Hybrid funds serve as a good balance between risk and reward.
- ML models like Random Forest and XG Boost significantly improve classification and forecasting of fund performance.
- Clustering helps segment funds by investor preference (aggressive, moderate, conservative).
- Important features in predicting fund success include past returns, volatility, and allocation strategies.

V.CONCLUSION

This study successfully integrates machine learning with traditional financial analysis to evaluate mutual fund performance. By applying models like K-Means, Random Forest, and XGBoost, the system not only evaluates past performance but also predicts future outcomes. This hybrid approach allows investors and advisors to make informed, data-driven decisions tailored to risk profiles. As the financial landscape evolves, intelligent investment advisory systems that include AI will become indispensable. Further research can involve deep learning models and sentiment analysis from financial news and social media to enrich predictions.

VI.REFERENCES

- Gupta, S. (2015). "Performance Evaluation of Mutual Funds in India." Journal of Financial Services Marketing.
- Sharma, V., & Goyal, P. (2018). "Sector-Wise Analysis of Indian Mutual Funds." International Journal of Economics and Finance.
- Todupunuri, A. (2022). Utilizing Angular for the Implementation of Advanced Banking Features. Available at SSRN 5283395.
- Bhatia, A., Verma, S., & Goyal, M. (2020). "Prediction of Mutual Fund Returns Using Machine Learning." Procedia Computer Science.
- GIRISH KOTTE, “Leveraging AI-Driven Sales Intelligence to Revolutionize CRM Forecasting with Predictive Analytics,” Journal of Science & Technology, vol. 10, no. 5, pp. 29–37, May 2025, doi: 10.46243/jst.2025.v10.i05.pp29-37.
- Sharpe, W.F. (1966). "Mutual Fund Performance." Journal of Business.
- Jensen, M.C. (1968). "The Performance of Mutual Funds in the Period 1945–1964." Journal of Finance.
- 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.
- Chen, Y., et al. (2020). "Clustering Mutual Funds Using K-Means and Financial Indicators." IEEE Access.
- G. Kotte, “Securing the Future with Autonomous AI Agents for Proactive Threat Detection and Response,” SSRN

Electronic Journal, 2025, doi: 10.2139/ssrn.5283830.

- Zhang, Y., & Zhou, L. (2021). "Financial Portfolio Optimization Using XGBoost." Expert Systems with Applications.
- AMFI India (2024). www.amfiindia.com
- Moneycontrol.com (2024). Mutual Fund NAV Database.
- Brown, K.C., Harlow, W.V., & Starks, L.T. (1996). "Managerial Incentives in the Mutual Fund Industry." Journal of Finance.