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Artificial Intelligence Models for Investment Decisions in Stock Market: Applications, Risks and Future in India

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ABSTRACT

Artificial Intelligence (AI) has emerged as an important area of research in financial decision-making, particularly in investment analysis, market forecasting, portfolio management, and financial risk assessment. The Indian equity market, represented by the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE), offers a relevant context for investigating these applications, as stock-market movements are influenced by macroeconomic developments, corporate performance, investor behaviour, and prevailing market uncertainties. This study examines existing literature on the application of machine learning, deep learning, hybrid predictive techniques, Natural Language Processing (NLP), and Explainable Artificial Intelligence (XAI) in investment decision-making, with a specific focus on Indian equity markets.. However, the predictive capability of these models does not necessarily translate into superior investment outcomes. Issues such as overfitting, information leakage, transaction expenses, changing market conditions, and inadequate model transparency may affect their practical effectiveness. The review highlights the importance of standardized evaluation procedures that incorporate out-of-sample testing, risk-adjusted performance, transaction costs, and model interpretability. Furthermore, it outlines a framework for assessing AI-assisted investment strategies in the Indian capital market without presuming that any particular model consistently performs better than conventional investment approaches.

KEY WORDS

Artificial Intelligence; Investment Decisions; Machine Learning; Deep Learning; Portfolio Optimization; Financial Forecasting.

INTRODUCTION

The Indian capital market, primarily represented by the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE), has undergone substantial technological advancement in recent years. The growing participation of retail investors, the expansion of demat account ownership across country, and the rapid adoption of fintech services have contributed to a significant increase in the generation and availability of financial data. Consequently, conventional investment approaches based on fundamental and technical analysis are increasingly being complemented by Artificial Intelligence (AI) and Machine Learning (ML) techniques.

Investment decision-making involves the evaluation of diverse and complex information, including historical stock prices, macroeconomic variables such as the Reserve Bank of India's (RBI) repo rate, consumer price index (CPI) inflation, and index of industrial production (IIP), as well as corporate financial results and unstructured information from financial news and social media platforms. AI-based techniques offer the ability to process these heterogeneous data sources efficiently and identify intricate patterns that may be difficult to detect through conventional analytical methods. Nevertheless, the application of these technologies in India requires careful assessment of market-specific characteristics, including substantial retail investor participation, behavioural influences, circuit-breaker mechanisms, and regulatory measures introduced by the Securities and Exchange Board of India (SEBI).

The present study examines the application of AI models in Indian investment markets. It seeks to identify the principal AI techniques employed in existing research, assess the reported performance of these models using NSE and BSE data, and investigate the structural, regulatory, and systemic factors that influence their practical implementation within the Indian capital market.

Literature Review

The conventional stock investment theory is founded on three core principles: the Efficient Market Hypothesis (EMH), technical analysis, and fundamental analysis. EMH, introduced by Fama (1970), claims that stock prices incorporate all accessible information. Markets are divided into weak, semi-strong, and strong forms according to the extent of information absorption, which favours passive investment approaches such as index funds. Nonetheless, this assumption relies on the idea of "perfectly rational individuals" and "seamless markets," which is not realistic. Behavioural finance demonstrates that biases in investors (such as overreaction and herding) can lead to price differences from fundamental values. Technical analysis employs past price and trading volume information to forecast trends, founded on the principle that "history tends to repeat" (Dow Theory). Instruments such as moving averages (MA) and the Relative Strength Indicator (RSI) are frequently utilized (Murphy, 1999). In highly efficient markets, the predictive ability of technical indicators is constrained, and strategies such as "head-and-shoulders" patterns become less useful as market efficiency increases.

Artificial intelligence (AI) is increasingly reshaping investment strategies and decision-making processes within the financial industry. Machine learning techniques have shown considerable potential in forecasting stock prices, with studies suggesting that integrating different algorithms can improve predictive performance (Atsalakis & Valavanis, 2009; Huang et al., 2005). Deep learning methods, particularly Long Short-Term Memory (LSTM) networks, have also gained prominence because of their ability to capture temporal patterns in financial time-series data (Fischer & Krauss, 2018). Furthermore, Natural Language Processing (NLP) enables investors to extract useful insights from unstructured textual information, such as financial news and social media posts. Transformer-based models, including BERT, have proved valuable in assessing market sentiment. For instance, Li et al. (2020) reported that a Twitter-based sentiment index could forecast next-day movements in the Nasdaq with an accuracy of 68.5%. Meanwhile, Reinforcement Learning (RL) is contributing to the development of high-frequency trading systems by enabling algorithms to adapt their decisions to changing market conditions. Deep Q-Networks (DQN), for example, have been explored for developing trading strategies through simulated order-book environments and statistical arbitrage. Nevertheless, the practical application of AI in financial markets remains challenging, particularly because of its sensitivity to data quality and the possibility of overfitting historical market patterns, which may reduce its effectiveness under changing market conditions (Dixon et al., 2020).

Persio et al. (2023) integrated AI-based stock price forecasting techniques with portfolio management and showed that a forward-looking risk parity approach can be effective in portfolio construction. This highlights the growing role of artificial intelligence in automating stock selection and improving investment decisions. Similarly,

Singh et al. (2023) proposed a hybrid model that combines Convolutional Neural Networks (CNNs) with Long Short-Term Memory (LSTM) networks to identify promising stocks. When the selected stocks were incorporated into a portfolio using mean-variance optimisation, the resulting strategy performed better than both random stock selection and approaches based on CNN or LSTM models individually. These findings suggest that combining AI-based forecasting techniques with portfolio optimisation methods may enhance investment performance.

Applications of AI in Stock Investment Decision-making

1. **Stock Price and Return Forecasting:** Artificial intelligence techniques can be used to predict stock prices and potential returns by analysing historical price movements, trading volumes, financial ratios, corporate earnings, and macroeconomic variables. These predictions can assist investors in screening securities, identifying potential investment opportunities, and supporting research. However, forecasting financial markets remains challenging because of market volatility, unpredictable events, and changing relationships between variables.
2. **Portfolio Optimisation:** AI contributes to portfolio optimisation by helping investors evaluate potential returns and assess different sources of investment risk. Machine learning models can estimate expected returns, volatility, asset correlations, and downside risk, which can subsequently be incorporated into traditional portfolio optimisation techniques. For example, a hybrid investment framework may use gradient boosting to forecast expected returns, statistical models to estimate covariance between assets, and mathematical optimisation techniques to determine appropriate portfolio allocations.
3. **Risk Management:** AI plays an important role in identifying and evaluating financial risks by detecting unusual market movements, forecasting volatility, monitoring liquidity conditions, and estimating potential portfolio losses. Machine learning algorithms can also be applied to assess credit risk, predict default probabilities, and identify changes in relationships between financial assets. These capabilities may enable investors to recognise emerging risks and adjust their investment strategies accordingly.
4. **Sentiment-Based Investment Analysis:** Natural Language Processing (NLP) enables AI systems to analyse textual information from financial news, corporate announcements, earnings-call transcripts, and social media platforms to identify investor sentiment and market-relevant developments. The resulting sentiment indicators can complement conventional financial analysis by providing additional insights into market expectations and investor behaviour. However, sentiment analysis must be interpreted carefully because negative news does not always lead to declining stock prices. If the information has already been anticipated by investors and incorporated into market prices, its subsequent impact on returns may be limited.
5. **Automated and Personalised Investment Services:** AI-powered investment platforms can automate several aspects of investment management, including portfolio monitoring, asset allocation, risk assessment, and portfolio rebalancing. These systems can also personalise investment recommendations according to an individual's financial objectives, investment horizon, liquidity requirements, and risk tolerance. By processing financial information and adapting to changing circumstances, AI-based services may improve the efficiency and accessibility of investment management.

AI Models Uded in Stock Investment Decision-making & Risk

AI Model	Key Features	Major Risks
Linear Regression / ARIMA	Predicts stock prices and trends	Limited for complex patterns
Random Forest	Stock selection and pattern detection	Overfitting
XGBoost	Predicts returns and ranks stocks	Data bias and overfitting
Deep Learning (LSTM)	Analyses historical price sequences	Needs large datasets
NLP	Analyses financial news and sentiment	Misinterprets context
LLMs (GPT, Claude, Gemini)	Summarizes reports and supports research	Hallucinations and inaccurate data
Reinforcement Learning	Optimizes trading and portfolio allocation	Unstable strategies and financial losses
Ensemble AI	Combines multiple models for decisions	Complexity and correlated errors

SEBI Guidelines for Responsible Usage of Artificial Intelligence /Machine Learning in Indian Securities Markets

Area	SEBI requirement / guidance
AI/ML reporting	Applicable regulated entities must comply with relevant AI/ML reporting requirements.
Accountability	Regulated entities remain responsible for the use of AI tools in their operations and services.
Investor protection	AI-based investment products must not misrepresent their benefits or capabilities.
Risk management	Identify risks such as biased predictions, errors, and unreliable model outputs.
Transparency	Communicate relevant information about AI-based products and their limitations.
Human oversight	Monitor AI systems and maintain appropriate controls over their use.

Future of AI Models Use in Indian Stock Market

Artificial Intelligence is likely to become one of the most important technologies in the Indian stock market over the next decade. It will influence how investors analyse companies, how traders execute orders, how mutual funds manage portfolios, and how SEBI detects market manipulation. Key Factors Driving AI Adoption in the Indian stock Market -

1. **Algorithmic and High-Frequency Trading (HFT):** Automated and algorithm-based trading systems play a significant role in India's financial markets, reportedly contributing approximately 50% of NSE cash-market turnover and up to 70% of overall trading volume.
2. **Integration of Institutional and Retail Investors:** Trading platforms such as Shoonya, Angel One, and Paytm Money are incorporating AI-driven market insights, multilingual chatbots, and advanced analytical tools to make financial information more accessible and reduce language and information gaps for retail investors.
3. **Sophisticated Predictive Analytics:** Advanced machine learning techniques, including Long Short-Term Memory (LSTM) networks and transformer-based models, are being explored to analyse historical data, identify complex market trends, and forecast movements in indices such as the BSE Sensex and NSE Nifty 50. These models may offer advantages over conventional statistical methods, depending on the data and evaluation criteria.

According to SEBI's FY2025–26 study, released on August 20, 2026, 87.7% of individual traders in equity derivatives suffered losses. Reuters also reported that algorithmic trading accounted for 99% of gross profits among proprietary traders and foreign investors. However, these figures relate to different groups and do not establish that AI itself was responsible for the difference in performance. These findings highlight three key lessons:

1. **Technology Alone is not Enough:** Success depends not only on access to advanced tools but also on data quality, execution costs, available capital, research, and effective risk management.
2. **AI may Intensify Competition:** Strategies that generate profits today may lose their effectiveness as more market participants adopt similar technologies and approaches.
3. **Risk Management can Provide a Lasting Advantage:** A system that controls losses and filters out low-probability trades may be more valuable than one that simply produces a larger number of trading signals.

CONCLUSION

AI models provide great opportunities for investment analysis in Indian equities markets, especially in the areas of risk monitoring, sentiment analysis, price forecasting, and security screening. The literature now in publication shows significant methodological variation, but it does not support the widespread assertion that a single AI design is optimal for making investment decisions. Stronger proof of the usefulness of AI-assisted investment

would come from a system that included human oversight, explainability, realistic trading costs, portfolio-level risk measures, and chronological validation. The ultimate conclusion is that rather than being a sure fire assurance of higher investment returns, AI should be assessed as a decision-support system.

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