



Role of AI in Risk and Portfolio Management

Ms. Deepti Kaushik

Lecturer,

School of Business and Management, Institute of Advanced Research, The University for Innovation, Koba Institutional Area, Gandhinagar, Gujarat, India.

Email: deepti.kaushik@iar.ac.in

Dr. Suman Ramapati

Assistant Professor

School of Business and Management, Institute of Advanced Research, The University for Innovation, Koba Institutional Area, Gandhinagar, Gujarat, India.

Email: suman.ramapati@iar.ac.in

Abstract

The authors of this chapter, which focuses on risk and portfolio management, attempt to draw attention to the part artificial intelligence (AI) in managing finance. In recent years, artificial intelligence (AI) has disrupted various industries across all sectors. In addition to increasing the potential for alpha generation, artificial intelligence can assist with portfolio management in several ways, offsetting some of the shortcomings of conventional portfolio-building techniques. The study also emphasized the traditional and modern theories of portfolio and risk management in association with AI tools. Compared to conventional theories, the study's comparative analysis showed that AI benefits in more logical decision-making. Markowitz's theory developed a formula qualifying investors to mathematically address both risk acceptance and reward expectations, thus deriving an optimal portfolio. In today's scenario, AI is trying to compile all the historical evidence, data, and

cases and generate reports with the help of its various tools for the portfolio managers. Advanced algorithms and data science are used by AI portfolios to make decisions. They can analyse enormous amounts of data from multiple sources, finding trends and connections that human funds manager might overlook. AI has made it easier to analyse large and diverse data sets, which have improved decision-making significantly by offering insightful information about market trends and possible investment opportunities. Because of its ability to adjust to quickly shifting market conditions, AI has become an important tool for trading companies, helping them to manage risk, navigate volatility, and ultimately improve performance and profitability. In recent years, artificial intelligence (AI) has deranged most industries, including the financial sector. For instance, machine learning (ML) can develop systems capable of learning from past experiences and be used for asset price prediction. Reinforcement learning (RL) is one of the utmost promising tools for



developing a sequential and dynamic portfolio optimization theory. AI in asset management examines huge amount of data to find asymmetry, possible fraud, or operational mistakes. Operational risk can be reduced by using these algorithms to spot abnormal transaction patterns or staff activity that might point to fraud. This data-centric strategy guarantees that investment decisions are always based on impartial analysis. The study found that AI is a big part of mitigating various kinds of risks in investment portfolios. While AI solutions generally feature less management fees than usual alternatives, it's vital to know how these fees could influence overall returns. As we approach a new era in portfolio management, the utilization of AI is not just a fad, it is a crucial tactic for anyone hoping to maintain their lead in the cutthroat world of finance. There will be tremendous AI developments and breakthroughs in the future, offering people who use AI in portfolio management previously unheard-of opportunities. AI has a big impact on how investment portfolios handle different risks. It's challenging to fully grasp that AI algorithms and measures in the financial sector offer sophisticated solutions for assessing, mitigating, and making decisions regarding risks.

Keywords: AI in risk and portfolio management, traditional vs Markowitz theory, AI tools & techniques, AI risk, and its mitigation process, etc.

1. Introduction

Portfolio management involves the selection and oversight of a collection of investments tailored to fulfill the precise financial objectives of either an individual or a company. Behind this endeavour lies a structured approach to curating an optimal investment blend, taking into account the

client's risk tolerance. Essentially, it concerns the allocation of assets across various investment categories.

In their 2017 study, Zhang, X., & Chen, Y., examined the area of artificial intelligence (AI), which aims to both augment and eventually replace most human-performed activities. Artificial Intelligence is used in many different industries and is driven by external forces and technological breakthroughs. AI in finance shows a great deal of promise within these domains for the future. Their analysis looks at the many industries that employ AI, especially banking, and highlights the key techniques and noteworthy uses. Additionally, it offers an illustration of how artificial intelligence (AI) may be used for handling an inventory by creating one using spectral clustering (SC) and a stock network. The portfolio created utilizing AI approaches in this case outperformed its traditional equivalents. Abdelazim, H. Y., & Wahba, K. (2006) addressed a crucial problem in the monetary industry by concentrating on the difficulty of choosing and controlling investment portfolios. The foundation of both current portfolio theory and Markowitz's efficient frontier theory starts with assets range, such as securities, to create an ideal combination for a portfolio that sits on the efficient frontier. This strategy takes a minor detour in two directions: first, determining which assets should be included from the available pool first, and second, forecasting predicted returns for more operative use of the Markowitz efficient frontier. The utilization of AI methodologies in diverse financial sectors has stimulated the development of quantitative and methodical approaches to portfolio creation. The study found that regardless of down markets, investments carefully picked and upheld regularly using artificial

intelligence may provide extra income by exploiting efficient frontier concepts. The results emphasize how significant it is to use the suggested AI approaches, such as neural systems and evolution algorithms, in the active selection and portfolio management of investments.

1.1 Modern portfolio theory or Markowitz theory

Markowitz developed a formula empowering the investors to mathematically address both risk tolerance and reward expectations, thus deriving an optimal portfolio. This theory restored upon two key concepts:

- Each investor targets to maximize returns while managing risk effectively.
- Diversifying a portfolio with unrelated individual securities can mitigate risk. Markowitz identified two components of risk concerning individual stock returns:

1. Systematic Risk

This pertains to market risks that remain unaffected by diversification, such as the potential for overall market and economic downturns leading to investment losses. It's crucial to recognize that MPT does not assert the ability to mitigate this inherent risk

2. Unsystematic Risk

Also known as unsystematic risk, this type of risk is unique to individual securities and can be mitigated through diversification as the number of securities in the portfolio increases.

1.2 Type of evidence used for risk management

Artificial intelligence and machine learning have been successful in helping to manage portfolio risk. But most of their success depends on how much appropriate data is

available. If the correct data is at hand, AI and ML can use it to site shifts that can then be concluded to arrive at actionable risk mitigation policies.

- Historical prices:** Studying historical securities price patterns can provide perception into what could happen next.
- Market-related news:** The challenge here is to separate the related information.
- Real-time prices:** This category of data is distinct from the historical price. AI can use real-time data to provide investment managers with a crucial risk management tool.
- Social media data:** Is there any way to use this brine of data to manage portfolio risk? AI can provide an answer.
- Company-specific data:** Company's financials, executives & decision makers' profiles, and their track record, etc.
- Laws and regulations:** AI can sift through substantial amounts of government-issued rules to identify the relevant quantities.

1.3 Risk related to portfolio management

In portfolio management, certain risks are there that one may be encountered.

- Market Risk** - it arises because of the prevailing volatile situation in the market and is a systematic risk.
- Equity risk**- This risk originates from the fluctuation in stock prices. It results in the unsettling prospect of losing capital if there is a stock market decline. Investments that are heavily reliant on the stock market, rise and fall with it. There is a chance of potential financial dissolution in the event of huge losses.

- c. Interest rate risk-** This arises when there is a sudden change in the interest rate. It mainly occurs with debt instruments. Modifications in interest rates can result in heavy losses or it could also bring unpredicted gains.
- d. Currency risk-** it depicts the fear of loss due to variations in foreign exchange rates. A shift in the exchange rate can diminish returns when you convert them back to your currency.
- e. Liquidity risk-** This poses a threat to your finances, as it does not allow you to sell an investment rapidly without incurring a substantial loss in value. It arises only in emergencies when you promptly need cash. However, since the market value of your assets is low, selling them is not very valuable in this situation.
- f. Concentration risk-** It occurs when investors heavily invest in one type of asset. If investors diversified their assets they are less likely to face the situation of concentration risk.
- g. Credit risk-** This type of risk arises when your money's safety is in imperilment. It's a good idea to check the credit rating of the security before you invest in them.
- h. Reinvestment risk-** This concept of investment risk plays with the interest you receive on the invested amount. Imagine investing your money in a bond that pays you a nice amount of interest. But if interest rates in the market go down, you might not find another good investment that pays the same amount. Your future returns may not be as good as before.
- i. Horizon risk-** This risk is about unexpected events that might force you to sell your investments at the point of need. For example, you planned to hold your investment for many years, but something comes up, and you have to sell when the market is not doing well. This can lead to losses.

1.4 Strategies for risk and portfolio management

Multiple elements, such as economic fluctuations, geopolitical occurrences, and shifts in market sentiment, exert an impact on market stability. To confront these exceptional challenges successfully, investors must utilize an array of strategies:

1. **Traditional system:** Traditional system of portfolio management consists of following steps:
 - a) **Analysis of constraints:** This involves analysis of constraints of investor and includes the following;
 - Income Needs- relies upon the investors' requirement for steady income to cover living costs and counteract inflation.
 - Liquidity Needs- Investor's fondness for liquid assets.
 - Safety of capital- The safety of principal amount at the point of liquidation.
 - Time Horizon- It is the investor's life cycle stage at the time frame for planning investments.
 - Tax Consideration- It is the tax advantages of making an investment in a specific asset.
 - Risk tolerance- it is the risk taking capacity of the investor.
 - b) **Determination of objectives:** within the specified constraints, it incorporates goals. The investors' ability to bear risk

and income needs are reflected in the limitations. Some shared goals are;

- Current income,
- Growth in income,
- Capital increase and
- Preservation of capital.

These goals cannot be fully accomplished, so if capital appreciation is the investor's goal, they must be prepared to invest in securities that carry a high level of risk in order to receive high returns.

c) **Selection of Portfolio:** the most favourable asset mix for an investor depends upon his investment goals

- Current income and asset mix – sixty percent in debt and forty percent in equity.
- Progression in Income and asset mix- sixty percent in equity and forty percent in debt.
- Capital Appreciation and asset mix- ninety percent in equity and ten percent in debt.
- Safety of Principal and asset mix- focus on short term debt instruments and ten percent on equity.

d) **Analysis of Risk & Return:** It entails assessing risk and return while considering the investor's financial capacity to handle specific risks.

e) **Diversification:** It encompasses adjusting the portfolio in line with the investor's inclination towards income generation and their tolerance for risk. The following are the steps can be taken in this regard

- Selection of Industries
- Selection of companies in the industry
- Determining the size of security

2. Starring role of AI in portfolio management

AI is essential to many sort of portfolio management and offers unique benefits for each strategy:

- **Aggressive portfolio management-** Profit maximisation is the main goal of this approach. Portfolio managers frequently trade in order to profit from low-cost stocks that are bought and then sold when their values increases. The main emphasis is on capital appreciation and significant growth potential. AI supports aggressive portfolio management by quickly analysing vast volumes of financial data using strong algorithms. These algorithms assist portfolio managers in making investment decisions that maximise profits by identifying cheap stocks, predicting market trends, and completing transactions rapidly. The data analysis capabilities of AI help find opportunities to buy cheap stocks, and when their value increases, sell them.
- **Conservative portfolio management-** This approach relies on a predefined profile line up with prevailing market conditions. Portfolio managers allocate investments to properties such as index funds, offering relatively lower yet dependable returns. The goal is to ensure stability and a steady, lucrative perspective over the long term. By spotting low risk investment opportunities, AI investments aid in conservative portfolio management. AI systems are able to identify low-risk assets or index funds that fit the goal of steady, predictable returns. Through more robust portfolios, AI models can combat market volatility and create a stable image

that appeals to stability-seeking investors.

- **Discretionary portfolio management-** Portfolio executives are empowered to make choices about investments on the name of investors, adjusting plans according to their goals and risk bearing capability. Depending on the objectives of investors, managers can choose appropriate investment strategies. By providing personalised investment advice, artificial intelligence in investment management makes a substantial contribution to discretionary management. AI systems are able to create customised portfolios by utilising investors' risk tolerance, financial goals, and preferences. Additionally, they are capable of dynamically modifying portfolios to accommodate changing conditions and maximise their potential to satisfy investors.
- **Advisory portfolio management-** Although portfolio managers offer advice on potential investments, investors ultimately have the final say. Investors are free to choose whether or not to follow the advice provided. Before making decisions, final expert advice carefully weighing the merits of professional portfolio managers' recommendations. Consultative portfolio management are improved by AI technology in asset management, which provides data-driven recommendations by analysing a vast amount of market insights, and monetary data. These suggestions help investors decide if they should follow the advice of experienced portfolio managers. Furthermore, AI can help with tracking and evaluating the results of suggested investments.

2.1 Ways in which AI help in the mitigation of various risk in managing portfolio

AI got a major role in reducing a variety of risks in portfolio investment. It is hard to believe that AI algorithms and measures in the financial industry offer sophisticated risk assessment, mitigation, and decision making solutions. Let us examine how AI facilitates the management of the different risk categories:

- **Operational risk-** Operational risk signifies the potential for losses due to inadequate or flawed internal systems, processes, or human error. Examples include staff errors endangering a company's stability, fraud, and system failures. AI in asset management looks at the huge amount of data to identify operational errors, potential fraud, and asymmetry. Using these algorithms to identify employee behaviour or unusual transaction patterns that could indicate fraud can lower operational risk.
- **Market risk-** Market risk is the tentative loss resulting from market fluctuations, including recessions, unstable political environments, natural disasters, interest rate changes, or other external events that impact the financial markets. Highly sophisticated algorithms are used by AI portfolio to forecast market movements and identify trends that human research might overlook. By examining historical data, news, social media, and a variety of artificial intelligence models and market indicators, we can forecast future market shifts that could be brought on by natural disasters, political unrest, or economic fluctuations.
- **Technology risk-** Technology risk includes the scope for normal business operations to be disrupted by cyberattacks, data breaches, or technical

issues. AI is needed for improving cybersecurity protocols. By spotting patterns that are unique in network traffic, warning of possible dangers, and automatically thwarting limiting attacks, machine learning algorithms can lessen the effects of data and cyberattacks.

- **Liquidity risk-** An investment carries liquidity risk when it is difficult to sell or convert into cash equals their fair market value. This risk could lead to losses due to limited marketability or a notable decline in the selling price. AI techniques support the estimation of an asset's liquidity within a portfolio. AI can forecast potential liquidity issues by analysing historical data and market patterns, enabling investors to make informed choices regarding the liquidity of their holdings.
- **Credit risk-** Credit risk is the possibility of experiencing a monetary loss in case a borrower or other party defaults, fails to repay a loan, or fails to meet prearranged monetary obligations. It depicts the potential for late or non-payment, which could result in suffering for the investor or lender. Artificial Intelligence algorithms paves in examining the reliability of a potential borrower or investment. These systems have the ability to provide more accurate risk assessment by examining a large amount of financial data and credit histories. This would assist investors in making well informed decisions regarding risks and return calculations.

2.2 Risk of AI in managing portfolio

AI solutions are all about data. The different decision-making algorithms like genetic algorithms, neural networks, etc. are dependent upon data to analyze the data and make predictions. Some of the data related challenges include:

- **Incomplete Data Set:** The quality of response to an algorithm determines the feature of the output- 'Garbage In Garbage Out'. Any gaps in the data set quality can turn profits into losses, thereby reversing the impact of technology. An improper or incomplete data set can lead to incorrect predictions or assessments.
 - **A huge Data Set to Train:** For a machine to cognitively learn, it needs a large-sized data set. The bigger the data set, the better it would be for an ML model to understand the trends and patterns to make predictions. A relevant data set is the key to the most suitable output.
 - **Bias:** The quality and availability of the dataset have a direct effect on the algorithm's bias. You can read about examples of Biased AI in this article about Ethical AI.
 - **Black Swan:** An incorrect data set can lead to unexpected events called Black Swan. However, for an ML model to learn from its experiences and deal with unexpected scenarios in the future, it is important to encounter such scenarios. However, they can lead to some severe consequences that can lead to loss. Technology breaches are unavoidable. However, with the right set of precautions and measures to enhance the quality of output (especially with the data set), AI technology can be best utilized for managing financial assets and portfolios.
- ### 3. Use cases of AI in managing a portfolio
- **Factor investing analysis**
Creating portfolios with particular elements like size, value, quality, momentum, or volatility is known as factor investing. By analysing



correlations, market trends, and historical data, AI can assist in recognising and assessing these factors. It paves in improving investment programs by searching out the elements that have consistently increased returns or decreased risk, enabling a more suitable and precise in constructing portfolio. AI qualifies investors by estimating the past consequences of each factor in managing risk or generating returns. AI is capable of processing intricate relationships between a wide range of factors and their performance with respect to various market conditions through the use of calculations. With the help of this analysis, investors can choose and balance their portfolio components more sensibly.

- **Real-time market monitoring**

AI continuously examines number of sources, including, social media, news, and market data, as part of its real time market watch. AI can quickly spot, news, events or new trends that could have a significant influence on investment decision by utilising natural language processing and machine learning. This skill allows portfolio leaders to make prudent decisions based on up-to-date information and respond swiftly to market changes. AI, for example, can find out changes in consumer sentiments, breaking news, or geopolitical events that could affect particular businesses or industries. By quickly identifying these key elements, AI helps investors get timely access to information so they can modify their investment plans or portfolio allocations appropriately.

- **Alternative data analysis**

Additional insights are offered by AI's capacity to process data from other sources, such as social media sentiment regarding a specific brand. These

unconventional data sources, artificial intelligence (AI), can uncover trends or connections that traditional financial analysis might miss through data analysis. This helps with making better-informed investment choices by using a wider variety of data. By giving a wider viewpoint, incorporating such alternative data sources improves investment strategies. Investors can react to market fluctuations more adaptably and identify risks and opportunities with this improvement that outmoded financial analysis might suppress. Traditional approaches are complemented by AI's capacity to analyze and interpret unusual data, which improves the comprehensiveness and precision of investment decisions.

- **Scenario analysis and stress testing**

AI is very good at stress-testing portfolios under diverse economic conditions and simulating a variety of market scenarios. This potent feature enables investors to predict the performance of their portfolios under various circumstances, especially unfavourable market conditions. Thorough examinations of these tried-and-true situations provide investors with insightful information that helps them improve their strategies and make their portfolios more resilient to future market swings. Investors are empowered to modify their investment strategies with the gained knowledge from these simulated scenarios. This could entail asset allocations rebalancing, diversifying holdings, or putting hedging strategies into practice to better position their portfolios for resilience in the face of market uncertainties.

- **Dynamic hedging strategies**

AI is essential for creating and putting into practice dynamic hedging plans. It

responds to shifting market conditions to help manage the associated risk with various positions in a portfolio these tactics protect the portfolio from possible losses by using a variety of financial instruments to counteract or minimise the impact of unfavourable price fluctuations in asset. AI continuously modify these tactics in light of current market data, enabling more efficient risk management. AI assists in mitigating possible vulnerability in the portfolio by quickly modifying the hedging strategy in response to changing market dynamics. The flexibility of hedging techniques is essential for quickly reacting to changes in the market and preserving the stability and performance of the portfolio as the whole. Because AI can analyse and make decisions in real time, investors can quickly modify their hedging strategies in response to shifting market conditions, which improves risk management and may lessen the impact of unfavourable price movements on the portfolio.

- **Portfolio optimization**

AI is vital for portfolio optimisation because it uses difficult algorithms to efficiently balance risk and return. By analysing large datasets, AI models are able to determine the best mix of low and high risk investments based on the risk tolerance of investors. With the use of quantitative analysis and machine learning, AI aims to create the most advantageous portfolio by optimising the Sharpe ratio to increase profitability in relation to risk. AI assesses different investment scenarios by utilising historical data and predictive analytics revealing trends and correlations that might be missed by human analysis. Considering market conditions and individual risk profiles, it provides

insights into diversification strategies and the best asset allocations. As a result, risk-adjusted returns and overall portfolio performance are improved, and investors and portfolio managers are able to make better, data-driven decisions. AI makes it possible to optimise portfolios dynamically and responsively because of its processing capability of enormous volumes of data and its ongoing adaptation to changing market conditions. This ultimately helps investors achieve the best possible balance between risk and return.

- **Fundamental analysis**

AI methods are instrumental in effectively organizing textual analyses extracted from annual reports, economic reports, and other relevant documents. This frees portfolio management professionals from the laborious task of conducting extensive research, allowing them to allocate sufficient time to executing data-driven decisions. Moreover, AI has the capability to unveil concealed correlations and pinpoint stocks positioned for either outperformance or underperformance based on these associations. However, it is essential to recognize that trading decisions aren't solely reliant on data. AI is deprived of the intuitive judgment inherent in humans, particularly concerning emotional intelligence in trading scenarios. This emotional dimension grants human intellects an edge over AI in certain transaction contexts.

- **Risk management**

AI plays a pivot role in overcoming portfolio risk by harnessing data driven insights and advanced analytics. AI-driven risk assessment simulations evaluate an investor's risk tolerance using various factors such as age, financial objectives, income stability, and

expenses, thereby providing a more accurate risk profile. AI facilitates modification by employing refined algorithms to analyse and recommend varied asset allocations. Through machine learning, AI suggests optimal diversification tactics, dispersing investments across various asset classes and risk levels, consequently mitigating overall portfolio risk. For instance, AI may suggest higher-risk investments for younger investors that line up with their risk tolerance and long-term investment goals. It enthusiastically adjusts the portfolio based on investors' age, proposing a more conventional approach as risk tolerance decreases and the need for capital protection grows. Moreover, AI-driven systems offer personalized investment solutions by presenting a range of fund selections and portfolio strategies, empowering investors to modify their portfolios to their risk inclinations. AI algorithms continually monitor market conditions, facilitating timely fund adjustments to exploit returns while aligning with investors' evolving risk appetite and market dynamics.

- **Trade management**

In financial trading, AI entails automating trade performance according to predefined trading procedures or guidelines. These rules are crafted using cultured algorithms that scrutinize market data, detect patterns, and predict market shifts. Machine learning models examine chronological data to anticipate future trade results, aiding portfolio executives in making well-informed decisions and mitigating trading risks.

- **Asset allocation**

AI plays an important role in dynamically adjusting strategic asset allocation, considering individual factors like age,

risk appetite, and evolving market dynamics. Leveraging machine learning and projecting analytics, AI sifts through extensive datasets to suggest and fine-tune the optimal mix of asset classes for each investor's portfolio. This AI-driven method ensures that the portfolio maintains its intended equilibrium of asset classes over time, thereby improving risk-adjusted returns and residing in line with the investor's changing financial objectives. AI's ability to adapt to shifting parameters and market conditions facilitates a more customized and efficient asset allocation strategy, providing investors with a customized investment journey that evolves alongside their life stages.

- **Tax optimization**

AI improves investment tax optimisation by employing algorithms to deliberately allocate assets for optimal after-tax returns. Utilizing predictive analytics, AI evaluates investment options, taking into account tax implications, expected returns, and individual tax brackets. This approach recommends placing high-yield assets in tax-deferred accounts to maximize tax efficiency. In terms of stock investments, AI models advise holding stocks for the long term, particularly for high-income earners, to maximize potential savings. Additionally, AI helps in timing sales during low-income years to optimize tax savings and mitigate the impact of the net investment income tax, resulting in perpetual tax savings and enhanced after-tax returns. AI algorithms also propose tax-efficient investment strategies, such as tax-loss harvesting, to help investors minimize tax liabilities and maximize after-tax returns. Furthermore, AI considers each investor's unique tax circumstances, including income, capital

gains, and tax brackets, and suggests personalized strategies that comply with tax regulations while reducing the overall tax burden. This leads to improved investment performance. By leveraging AI for tax-efficient investment strategies, investors can navigate the intricate tax landscape with precision and confidence, ensuring that their investment decisions are in alignment with their financial goals while minimizing tax-related expenses. This approach ultimately improves the overall returns on their investments.

- **Liquidity analysis and management**

AI is crucial in the analysis and management of liquidity within portfolio management. By utilizing historical data, up-to-date market statistics, and predictive modelling, AI evaluates liquidity requirements and proposes modifications to guarantee ideal cash utilization and maintain adequate liquidity levels in portfolios. AI algorithms examine various factors, including cash flow trends, market conditions, and investor preferences, to suggest reallocating assets or modifying investment strategies, ensuring portfolios retain sufficient liquidity while maximizing returns. This AI-driven methodology aids portfolio managers in making well-informed decisions, responding to evolving market conditions, and keenly managing liquidity requirements for enhanced portfolio performance and risk mitigation.

4. AI techniques used in portfolio management

AI technologies have meaningfully transformed portfolio management, offering a series of tools and methodologies that enhance decision-making, risk valuation, and portfolio optimization. Some crucial AI

technologies used in portfolio management include:

- **Machine Learning (ML)**

In portfolio management, controlled learning algorithms, skilled in historical data with labelled datasets, leverage predictive or classification capabilities. These algorithms excel in forecasting asset prices, scrutinizing market trends, and refining investment portfolios. Unsupervised learning algorithms, on the other hand, analyze unlabelled data to unveil concealed patterns and structures. Methods such as K-means clustering are utilized to segment assets or classify clusters sharing similar traits, thereby enhancing comprehension of asset behaviours and relationships.

- **Natural Language Processing (NLP)**

NLP (Natural Language Processing) entails the processing and analysis of human language to comprehend thoughts, extract crucial information, and identify events within unstructured data. Its role is to decipher textual data, extracting insights that influence investment decision.

- **Deep learning**

A branch of machine learning employing neural nexus to examine intricate patterns. Within portfolio management, deep learning models like recurrent neural networks (RNNs) or convolutional neural networks (CNNs) can be utilized for predictive analytics, sentiment analysis, or pattern acknowledgement in financial data.

- **Predictive analytics**

The integration of statistical techniques and AI enables the prediction of future outcomes using historical data. These models play a pivotal role in forecasting asset prices, recognizing market movements, and evaluating risks, thereby facilitating positive portfolio management strategies.

- **Reinforcement learning**

Reinforcement learning is a machine learning approach where algorithms learn by trial and error to maximize cumulative rewards. In portfolio management, this method can be applied to optimize transaction strategies or asset allocations.

- **Robo-advisors**

These platforms are powered by AI and offer automated, algorithm-based guidance on portfolio management. AI techniques are used by robo-advisors to build and manage diversified portfolios according to the objectives and risk tolerance of investors. In today's dynamic and quickly evolving financial landscape, these AI technologies enable investors and portfolio managers to make data-driven decisions, optimise portfolios, and effectively manage risks. Their application keeps changing, transforming conventional portfolio management techniques.

5. Benefits of AI for portfolio management

Let's focus on the aid AI brings to portfolio management, highlighting how it enhances various aspects of this financial practice.

- **Advanced data analysis:** AI in portfolio management make use of strong

algorithms to examine enormous datasets and spot correlations, patterns, and trends that human analysts might miss at first glance. Artificial intelligence can process large amounts of financial data, news, economic indicators, and alternative sources to make better investment decisions.

- **Dynamic asset allocation:** AI has the capacity to consistently evaluate both market conditions and an investor's preferences, enabling dynamic asset allocation within a portfolio. This elasticity allows for quick adjustments in line with changing market dynamics, ensuring alignment with the investor's objectives and risk tolerance. AI's real-time analysis and adaptability greatly improve the portfolio's congruence with the investor's evolving needs and the dynamic financial environment.

- **Risk management and diversification:** AI expands portfolios by detecting correlations between asset classes, mitigating overall risk exposure. Its analysis of interrelationships among assets allows for strategic allocation, reducing the portfolio's susceptibility to market fluctuations and enhancing its flexibility.

- **Automation and efficiency:** AI simplifies routine tasks in portfolio management, such as restructuring portfolios, executing trades, and observing investments. This mechanization can free managers to focus on higher-level strategies and decision-making.

- **Behavioural analysis and predictive modelling:** AI can integrate behavioural analysis and predictive modelling,

comprehending patterns in investor behaviour and forecasting possible market arrangements. This capability aids in making investment choices that are more tailored and managing portfolios in a more customised manner.

- **Enhanced transparency and reporting:** Top-tier AI-based systems produce clear and comprehensive reports that offer valuable insights into portfolio performance, enable benchmark comparisons, and elucidate the reasoning behind investment decisions. This transparency builds trust and empowers investors to gain a deeper understanding of and monitor their investments more effectively.
- **Continuous learning and improvement:** AI systems have the capacity to grow over time by learning from their mistakes. Their investment strategies can be continuously improved by adapting and developing in response to new data inputs, market conditions, and performance feedback. In order to maximise investment choices, risk management, and portfolio performance, artificial intelligence is developing breakthroughs in data analysis, machine learning, and automation. Its ability to handle sizable datasets and carry out complex analyses provides a major edge in making knowledgeable, flexible, and successful investment decisions.

6. Key considerations in selecting the right AI portfolio system

Selecting the right AI-powered portfolio involves several crucial considerations:

- **Clarity and justification:** Artificial intelligence (AI) systems with transparent processes for making choices should be

prioritized when being evaluated. Look for models that offer clear justifications for the investments they make. To gain confidence in the system, investors must comprehend the logic underlying the computer's decisions.

- **Historical performance and outcomes:** Analyze the AI portfolio system's prior performance. Examine its long-term performance, taking into account both growing and cutting patterns, in a range of marketplace environments.
- **Risk-taking tactics:** Examine the methods the AI uses for handling risks. A trustworthy AI portfolio solution should have robust risk mitigation features in place to reduce possible losses during market downturns. Investors must comprehend the AI's attitude to risk.
- **Tools for tailoring:** Verify whether the AI portfolio system allows for customization to meet different risk tolerances and investing goals. Investors should seek algorithms that can customize a portfolio to match unique requirements.
- **Fees and charges:** Recognize the fee schedule related to managing an AI portfolio. Even while AI solutions usually offer lower management fees than conventional choices, it's crucial to understand how these expenses may affect total returns.
- **Diversity strategy:** Make sure that the AI selection system prioritizes diversity by including a wide variety of assets, like stocks, bonds, exchange-traded funds, and other securities. Portfolios that are more diversified are better able to manage challenging market conditions.
- **Plan for a departure and flexibility:** Learn how to make adjustments or remove your investment from the AI portfolio. A clear and effective exit plan must be offered by the system, allowing

stakeholders to swiftly access cash or modify their plans as necessary.

When choosing the best AI-powered portfolio system, you must carefully consider these elements to ensure that it corresponds with your investing objectives, tolerance for risk, and overall financial strategy

7. AI vs traditional portfolio managers

Sr. No	Points of differences	AI	Traditional fund manager
1.	Data-Driven Decisions	AI portfolios base their decisions on advanced algorithms and data analysis. They can process vast amounts of data from various sources, ascertaining patterns and correlations that might elude human fund managers. This data-centric approach ensures that investment choices remain grounded in objective analysis.	Human fund managers, on the other hand, rely on their experience and expertise to make investment decisions. While their knowledge can be valuable, it's subject to human emotions and biases, which can influence their choices. They may make decisions based on intuition and judgment developed over their career.

2.	Consistency	AI portfolios are highly consistent in their approach. They strictly adhere to predefined rules and algorithms, confirming that investment strategies remain unchanged regardless of market conditions. This consistency can be reassuring for investors seeking a disciplined approach.	The consistency of traditional fund managers can fluctuate. Their strategies may adapt to evolving market sentiments or personal judgments, resulting in variability over time. While adaptability can be an asset, it can also introduce inconsistency.
3.	Speed of Execution	AI portfolios can execute trades rapidly, often within milliseconds. This swift execution is particularly advantageous in fast-paced markets, where timely decisions can make a significant difference in returns.	Human fund managers typically require more time for research, analysis, and execution. This slower response can lead to missed opportunities or delayed reactions to rapidly evolving market conditions.

4.	Risk Management	AI portfolios incorporate advanced risk management techniques, automatically adjusting portfolio allocations based on predefined risk thresholds or market volatility indicators. This dynamic approach can help protect investments during market downturn.	Risk management by traditional fund managers is often manual and may not be as responsive to rapidly changing market conditions. It can be influenced by the manager's individual judgment.
5.	Management Fees	AI portfolios typically come with lower management fees compared to traditional fund managers. These cost savings can result in higher net returns for investors over the long term.	Traditional fund managers usually charge higher management fees, which can impact overall returns. These fees cover the costs of human expertise and personalized service.
6.	Learning and Adaptation	AI algorithms can continuously learn and adapt from new market data. They engage in extensive back testing to identify optimal strategies. This capacity for self-improvement means that AI portfolios can potentially become more effective over time.	The performance of traditional fund managers can vary, and their ability to adapt to changing market conditions may be influenced by their individual experiences and expertise.
7.	Availability	AI portfolios operate 24/7, monitoring global markets and reacting to news and events in real-time, even outside of human working hours.	Traditional fund managers are typically limited to working hours and may not be available to respond to market developments that occur outside of those hours.

Conclusion

Intelligent technology (AI) has disrupted several sectors, including the financial industry, in recent years. AI approaches can help with portfolio management in a variety of ways, addressing the drawbacks of



traditional portfolio design methods and expanding the potential for alpha generation. Machine learning (ML) may be used to anticipate asset prices, for example, and create systems that can learn from the past. One particularly useful technique for developing a step-by-step and dynamic strategy for portfolio optimization is reinforcement learning (RL). Text mining and sentiment analysis can improve portfolio management by giving current market news. Scale approaches can reveal hidden aspects impacting different asset values, assisting in the development of an equitable portfolio. Artificial intelligence may optimize an investment portfolio or generate a portfolio that mimics an index with only a couple of assets.

AI may provide better estimates of asset returns and risks and solve complex restrictions on portfolio optimization, which can result in better out-of-sample performance for AI-driven portfolios than traditional approaches. From a technological aspect, leading financial sector firms are implementing AI to automate operations and increase operational efficiency, manage enormous amounts of data, improve evaluations of risks, and present solutions that are better aligned with investor needs and risk tolerances. In contrast, AI-driven portfolio management frequently depends on outputs from a black-box model rather than precise mathematical formulae based on a specific dataset. This makes it more difficult to comprehend and explain AI's judgments, which is crucial for winning over various groups like financiers, investment advisors, and creditors.

Suggestions and Recommendations

The integration of AI into portfolio management has revolutionized the process of making investment decisions. AI has accelerated the analysis of extensive and varied datasets, greatly enhancing decision-making by providing valued insights into market trends and potential investment prospects. Its adaptability to quickly changing market conditions has established AI as an essential tool for trading companies, enabling them to mitigate unpredictability, improve risk management, and ultimately enhance profitability and enactment. As we approach a new age in portfolio management, the utilization of AI is not just a trend but a crucial strategy for those aiming to stay forward in the competitive finance landscape. The future promises significant AI advancements and innovations, presenting unparalleled opportunities for those embracing AI in portfolio management.

References:

1. Zhang, X., & Chen, Y. (2017, September). An artificial intelligence application in portfolio management. In *International Conference on Transformations and Innovations in Management (ICTIM 2017)* (pp. 775-793). Atlantis Press.
2. Abdelazim, H. Y., & Wahba, K. (2006). An artificial intelligence approach to portfolio selection and management. *International Journal of Financial Services Management*, 1(2-3), 243-254.
3. <https://insights.daffodilsw.com/blog/the-role-of-ai-in-intelligent-portfolio-management>
4. <https://www.frontiersin.org/articles/>
5. <https://insights.daffodilsw.com/blog/the-role-of-ai-in-intelligent-portfolio-management>



BODHIVRUKSHA JOURNAL OF DIVERSE DISCIPLINE (BJDD)

E-ISSN :

An Open Access, Peer-Reviewed, Multidisciplinary Scholarly Journal
Bi-monthly | Multilingual | Academic Research

Email: editor@bjddjournal.org

Website: www.bjddjournal.org

6. <https://pirimidtech.com/managing-portfolio-risk-with-ai-ml/>
7. <https://www.solulab.com/ai-in-portfolio-management>
8. <https://guidedchoice.com/modern-portfolio-theory>
9. <https://www.studocu.com/ph/document>
10. <https://emeritus.org/blog/finance-what-is-portfolio-management/>
11. <https://www.sciencedirect.com/science/article/>
12. (<https://papers.ssrn.com/sol3/papers.>)

