THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN INVESTMENT MANAGEMENT DECISIONS

Abstract

Artificial Intelligence (AI) stands as one of the most transformative and intriguing fields in human history. Its roots can be traced back to ancient times, when humans first pondered the concept of creating machines capable of mimicking human intelligence. The 21st Century has seen this vision come to fruition with AI no longer being a fictional concept but our present-day reality. The advent of AI in the business field leads to questions of how industry will be impacted and how continued adoption and growth of AI in business processes will take place. The presence of AI could dramatically impact cost structures, change production processes, create new products and change job requirements and qualifications.

This chapter aims to explore the fascinating history of AI, from its nascent beginnings to its present-day impact, highlighting its inroads into investment decision making. The application of AI in investment decision making will not only creates opportunities for businesses but will also require businesses to address certain challenges it will bring along with it.

Keywords: Artificial Intelligence, Investment Decisions, Investment Management, Risk Management.

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I. A BRIEF HISTORY OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) stands as one of the most transformative and intriguing fields in human history. Its roots can be traced back to ancient times, when humans first pondered the concept of creating machines capable of mimicking human intelligence. Throughout the centuries, AI has undergone significant advancements, driven by technological breakthroughs, scientific discoveries and visionary minds.

1. **Early Origins and Concepts (Antiquity - 1950s):** The quest for creating artificial beings can be observed in ancient myths and folklore, where tales of automatons and mechanical contraptions captured the imagination. The scientific exploration of Artificial Intelligence (AI) can be attributed to the works of early pioneers like Arabic mathematician Al-Jazari, who in the 12th century, designed automated humanoid musicians [2] and Leonardo da Vinci, whose sketches explored the principles of humanoid robotics.

   The modern era of AI began to take shape in the mid twentieth century with the advent of electronic computers. In 1950, Alan Turing proposed the concept of a machine capable of exhibiting intelligent behaviour through his seminal paper "Computing Machinery and Intelligence." This paper laid the foundation for the idea of a thinking machine, now known as the Turing Test, which assesses a machine's ability to exhibit human-like intelligence [15].

2. **The Birth of AI and Early Exploration (1950s - 1970s):** The 1950s witnessed significant breakthroughs in AI research. In 1956, the Dartmouth Conference [10], led by John McCarthy, Marvin Minsky, Nathaniel Rochester and Claude Shannon, marked the start of AI as a distinct field of study. In fact, it was Minsky who first coined the term, ‘Artificial Intelligence’. The conference brought together prominent scientists, paving the way for collaborative research and the development of AI as a discipline.

   During this period, scientists began to explore AI through different approaches, including symbolic AI, which involved using symbolic representations to mimic human cognitive processes. Researchers developed programs like Logic Theorist and General Problem Solver, highlighting the potential of AI in problem-solving and logical reasoning.

3. **The AI Winter and Resurgence (1980s - 1990s):** The 1980s and 1990s marked a challenging phase for AI, commonly known as the AI winter. Funding cuts, unmet expectations and technical limitations led to a decline in AI research. However, during this period, progress was made in subfields such as expert systems, natural language processing, and machine learning.

   The resurgence of AI in the late 1990s was fuelled by advances in computing power, the availability of large datasets, and breakthroughs in machine learning algorithms. Notably, the introduction of neural networks, inspired by the structure of the human brain, revolutionized AI. The development of back propagation, a technique to train neural networks, and the success of Deep Blue, IBM's chess-playing computer, generated renewed interest and optimism in the field [15].

4. **AI in the Digital Age (2000s - Present):** The 21st century witnessed remarkable progress in AI, driven by exponential growth in computational capabilities and the accumulation of vast amounts of data. Machine learning techniques, such as support vector machines and decision trees, became increasingly powerful and versatile. AI applications began to permeate various industries, including finance, healthcare, transportation and entertainment.

   One of the most significant milestones in recent years has been the rise of deep learning. Deep neural networks, with their ability to learn hierarchical representations from data, achieved ground breaking results in areas like computer vision, speech recognition and natural language processing. The development of virtual assistants, such as Apple's Siri, Amazon's Alexa and Google Assistant only goes to show how AI can be used to drastically improve user experience through better language and voice recognition, deep learning, platform integration and relevant search results.

II. ARTIFICIAL INTELLEGENCE AND THE BUSINESS WORLD

Today we live in a world of 'big data' and companies now have access to more data than they ever had before. This coupled with the rapid expansion, adoption and all-pervasiveness of the Internet has created the right environment for integrating AI into business functions.

The McKinsey Global Survey on AI [11] shows that AI adoption in at least one business area has more than doubled since 2017. The report goes on to indicate that the top cases of use of AI can be seen in services operations optimization, creation of new AI-based products, customer service analytics, customer segmentation, new AI-based enhancements of products, customer acquisition and lead generation, contact-center automation, product feature optimization, risk modeling and analytics and predictive service.

Given below are some key areas where AI has been and is likely to continue making a significant impact on businesses:

1. **Automation and Efficiency**: AI technologies enable businesses to automate repetitive tasks, streamline processes, and improve overall efficiency. From customer support chatbots to robotic process automation (RPA) for data entry and analysis, AI-driven automation helps companies save time and resources, allowing employees to focus on more strategic and creative tasks.

2. **Data Analysis and Insights**: AI excels at processing and analysing vast amounts of data quickly and accurately. Businesses leverage AI-powered analytics tools to gain valuable insights from structured and unstructured data, enabling data-driven decision-making and improved forecasting.

3. **Personalization and Customer Experience**: AI enables businesses to offer personalized experiences to customers, tailoring products, services, and marketing messages to individual preferences and behaviours. This level of personalization enhances customer satisfaction and increases customer loyalty.

4. **Predictive Analytics**: AI algorithms can analyse historical data to predict future trends, behaviours, and outcomes. This capability is valuable in areas like sales forecasting, demand prediction, and risk assessment, helping businesses make better-informed decisions.

5. **Natural Language Processing (NLP)**: NLP technology empowers businesses to interact with customers more naturally through voice assistants, chatbots, and sentiment analysis. This enhances communication and provides valuable customer feedback.

6. **Supply Chain Optimization**: AI can optimize supply chain management by predicting demand, identifying potential disruptions, and optimizing inventory levels. This leads to cost savings, faster delivery times, and improved overall efficiency.

7. **Fraud Detection and Security**: AI-powered algorithms can detect patterns indicative of fraud, helping businesses protect themselves and their customers from financial losses and security breaches.

8. **Healthcare and Biotechnology**: AI is revolutionizing the healthcare and biotech industries, from drug discovery and medical imaging analysis to personalized treatment plans and remote patient monitoring.

9. **Financial Services**: AI is being used extensively in the financial sector for credit risk assessment, algorithmic trading, fraud detection, and customer service [8, 9].

10. **Human Resources**: AI is being integrated into HR processes for candidate screening, employee performance analysis, and employee engagement measurement [6].

11. **Marketing and Advertising**: AI-driven marketing tools help businesses target specific audiences more effectively, optimize ad campaigns, and measure their effectiveness.

It's important to note that the adoption and impact of AI in different industries and businesses may vary based on factors such as the complexity of the tasks involved, the readiness of the organization to embrace AI, and regulatory considerations. While AI has the potential to bring about significant benefits, it also raises ethical and privacy concerns, which businesses need to address responsibly.

III. THE ROLE ARTIFICIAL INTELLIGENCE IN INVESTMENT MANAGEMENT

The field of investment management has seen rapid changes due to the introduction of technology and AI. Vast amounts of data can be tackled with the help of AI to improve predictions, aid pattern identification and automate investment decisions. The advantages associated with integrating AI into the investment management function can be summarized into the following [12, 17]:

- Ability to analyse big data and make meaningful inferences from the same.
- Portfolio Optimisation
- Risk mitigation
- Improved forecasts
- Consistent, unbiased forecasts

AI in investment management has been gradually gaining traction due to its applicability in key investing decision making areas.

IV. APPLICATION OF ARTIFICIAL INTELLIGENCE IN INVESTMENT DECISIONS

1. **Data Processing and Analysis:** AI can analyse vast amounts of data in real-time, including financial reports, market trends and macroeconomic indicators. This ability enables AI to identify patterns and trends that humans might overlook thus leading to better-informed investment decisions. Studies have shown that forecasts made using AI and machine learning tend to outperform the traditional linear regression-based models in terms of accuracy and robustness [4].

   Alternative data can also be incorporated into analysis. Alternative data sources go beyond traditional financial data and include social media trends, satellite imagery, and consumer behaviour. These non-traditional datasets could provide unique insights into investment opportunities and market trends.

2. **Predictive Analytics:** Predictive analysis is a statistical and data mining technique used to make predictions about future events based on historical data and trends. The accuracy of predictive analysis depends on the quality and relevance of the data used, as well as the algorithms and methodologies applied.

   AI-powered algorithms can utilize historical data to make predictions about future market movements and identify potential investment opportunities or risks. By assessing historical patterns and correlations, AI can assist investors in making more accurate predictions about market behaviour.

3. **Algorithmic Trading:** Algorithmic trading, or "quantitative trading," uses AI algorithms to execute trades based on predefined criteria, without human intervention. These algorithms can process data faster and execute trades more efficiently than human traders, leading to improved trading strategies and reduced transaction costs.

4. **Risk Management:** AI can help investors access and manage risk by analysing various risk factors and simulating potential outcomes under different scenarios. This risk modelling can enable investors to make more informed decisions, mitigate potential losses, and optimize portfolio diversification [13].

5. **Sentiment Analysis:** AI-powered sentiment analysis can gauge public opinions and emotions from various sources such as social media, news articles, and online forums. This information can provide additional insights into market sentiment and investor behaviour, influencing investment strategies.

6. **Personalized Investment Solutions:** AI can offer personalized investment recommendations based on an individual's risk tolerance, financial goals, and investment preferences. This level of customization can lead to more satisfactory outcomes for investors.

The use of robo-advisors, AI-powered platforms that automatically manage investment portfolios based on users' preferences and risk tolerance, was expected to grow [1]. These platforms offer low-cost, automated investment services, making it easier for retail investors to access professional investment advice.

7. **Market Surveillance:** AI can help regulatory bodies monitor and detect unusual market activities, ensuring market integrity and reducing fraudulent activities. Capabilities of financial market anomaly detection can be further enhanced by AI [7].

V. CHALLENGES IN INTEGRATING ARTIFICIAL INTELLEGENCE INTO INVESTMENT DECISION MAKING

Despite the applications and benefits of AI in investment decision making, there are challenges to consider as AI continues to shape investment decisions [5,14]:

1. **Ethical Concerns:** AI systems may inadvertently perpetuate biases present in historical data, leading to unfair or discriminatory outcomes. Efforts to address these biases and ensure ethical AI usage are crucial. Issues relating to customer consent, privacy and data protection are also associated with AI.

2. **Black Box Problem:** The "black box problem" in AI refers to the challenge of understanding and interpreting the decisions made by complex machine learning models, particularly deep learning models like neural networks. These models are often called black boxes because their internal workings can be extremely intricate and difficult for humans to comprehend.

   In traditional programming, if there's a bug or error, developers can trace the code and identify the problem area, but with AI models, it's not as straightforward. When such models are used to make important decisions in areas like healthcare, finance, autonomous vehicles, or criminal justice, the lack of transparency can be concerning.AI algorithms can be complex, making it challenging to understand the reasoning behind specific investment decisions. The lack of transparency can create trust issues among investors.

3. **Regulatory Hurdles:** The integration of AI in finance rises regulatory and legal concerns, including transparency, accountability, and potential regulatory changes to accommodate AI-driven processes.

4. **Overreliance on AI:** While AI can enhance decision-making, complete reliance on AI models without human oversight may lead to unforeseen risks during extreme market conditions or unexpected events.

VI. CONCLUSION

The advent of AI in the realm of finance has completely transformed domain of Investment Management. In the future, we may see more advanced AI models with improved interpretability and explainability. Additionally, advancements in machine learning, natural language processing, and reinforcement learning may lead to even more sophisticated AI-driven investment strategies.

However, it's essential to keep in mind that AI in investment decisions should be seen as a tool to support human decision-makers rather than a replacement for human judgment. Successful integration of AI in finance will likely involve a combination of AI's analytical power with human expertise and domain knowledge to achieve optimal results.

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