



**BERLIN SCHOOL OF
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**Dissertation Title: Using Smart Computers To Make Better
Investment Choices: How Artificial Intelligence Can Improve Your
Investment**

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ABSTRACT

This dissertation explores the role of artificial intelligence (AI) and smart computer systems in revolutionizing investment decision-making. In today's dynamic and complex financial landscape, traditional investment strategies often fall short in providing optimal returns and managing risks. This research investigates how AI technologies can enhance investment practices, empowering investors to make more informed and profitable choices.

The study begins by delving into the foundational principles of AI and machine learning, providing a comprehensive overview of the technology's capabilities and limitations.

The dissertation also delves into the various AI-driven investment tools and platforms currently available in the market and their practical utility. It highlights case studies and real-world examples of AI implementation within the investment industry, showcasing how it has revolutionized traditional strategies.

This research employs a mixed-methods approach that combines a quantitative survey with a qualitative examination of existing research papers, reports, and articles, the study reveals the increasing adoption of AI and ML technologies in financial institutions. The quantitative findings showcase prevalent applications like algorithmic trading, risk management, fraud detection, credit scoring, and customer service. The qualitative analysis uncovers crucial themes, including trends in AI and ML adoption, obstacles to adoption, the impact of regulation, workforce transformation, and ethical and social considerations. The study underscores the necessity for financial professionals to evolve their skills and for organizations to address challenges such as data privacy, regulatory compliance, and ethical considerations. This research contributes valuable insights into the realm of AI and ML in finance, aiding policymakers, regulators, and professionals in comprehending both the advantages and challenges associated with these technologies.

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DISSERTATION THESIS



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INTRODUCTION

AI is computer software that acts like humans. It helps create solutions and improve applications in areas like healthcare, finance, and environmental protection (Bipach,2023). Making smart investment choices in today's finance world is crucial for success (Cuthbert, 2023). With technology advancing rapidly, the use of artificial intelligence (AI) and smart computers has become a game-changer in the investment landscape. This dissertation explores how incorporating AI can improve the way we make investment decisions.

Traditional methods of analyzing investments are facing challenges in today's complex markets. Smart computers, powered by AI, offer a promising solution. These machines can process massive amounts of data, identify patterns, and adapt to changing market conditions, making them valuable tools for making informed investment choices. (Barry, 2023)

This research aims to provide a clear understanding of how AI can enhance investment decision-making. By using machine learning, predictive analytics, and advanced data processing, smart computers can uncover hidden insights, identify investment opportunities, and manage risks more effectively than traditional methods.

The dissertation will explore the basic concepts behind AI in investment, examining relevant academic literature and frameworks that support the integration of smart computers into investment decisions. Real-world applications and case studies will also be explored to showcase the practical benefits of using AI in investment management.

Additionally, the study will discuss some ethical concerns, regulatory challenges, and potential limitations associated with AI in investment practices. By considering these aspects, the research aims to present a balanced perspective on the impact of smart computers on investment decision-making and also seeks to contribute valuable insights into how AI can revolutionize investment strategies.

Motivations:

This research is driven by the need for better tools to handle the complexity of today's financial markets. Traditional methods are struggling, so we're exploring how smart computers can help us make smarter investment choice.

Aims and Objectives:

This thesis aims to understand how AI can change the way we make investment decisions. We will explore how investment decision came about and how introduction of technology such as AI and machine learning is influencing it. We want to explore the good and challenging parts of using smart computers in finance. The goal is to figure out how to use AI to make better, informed, and strategic investment decisions.

Research Question:

We're asking a simple but important question: How can artificial intelligence and smart computers make our investment choices better in today's financial world?

CHAPTER ONE – LITERATURE REVIEW I

Investing has come a long way, from old-school methods to today's high-tech solutions. This review takes you on a journey through the history of investment choices. We'll start with the basics—how people used to decide where to put their money. Then, we'll zoom into the present, where artificial intelligence (AI) is changing the game. Imagine computers making investment decisions! We'll explore how this shift impacts everything, from the way we analyze data to how we manage risks. Join us in unraveling the story of how AI is making investing smarter and what challenges come with it. Let's dive into the past and present to understand where investing might be headed in the future!

This part is also like a quick guide through a big library of information. We'll explore how people used to decide where to invest money and how it's changed over time. We'll look at the old-school ways, newer methods using numbers, and how technology has shaped things since the late 1900s. Plus, we'll dig into the big role of Artificial Intelligence and talk about the issues and criticisms that come with it. It's like a journey through the past and present of making investment choices, with a focus on what AI brings to the table.

First, we'll look at how people used to invest, then we'll see how things shifted with new technologies like Artificial Intelligence (AI). We'll talk about the old-school methods and how feelings in the market influenced decisions. We'll also touch on the shift to using math and algorithms in the later part of the 20th century. This change included the rise of online trading platforms. As we get closer to today, we'll focus on AI, which uses smart technology like machine learning and neural networks to make investment decisions better. We'll see real examples, like using AI to predict stock prices. But, we'll also talk about the challenges and criticisms that come with using AI. Moving forward, we'll dig even deeper, looking at how AI makes decisions more accurate, helps manage risks, and improves overall investment strategies. We'll focus on key areas like AI in financial markets, how it boosts investment strategies, risk management, and predictive modeling. This journey helps us understand how investing has changed, with AI playing a big role today. The next part will give you even more insights, going deeper into real-world examples to show how AI actually works in practice. We'll use references from important works and current sources to back up what we're saying.

Evolution of Investment Decision-Making: Traditional to Modern Perspectives

Investment strategies have evolved, influenced by economic changes and technology. Traditional methods, rooted in fundamental and technical analyses (Graham & Dodd, 1934; Fama, 1965), set the foundation. Now, artificial intelligence (AI) plays a crucial role in decision-making.

The investment setting including stocks, bonds, real estate, mutual fund, Exchange-Traded Funds (ETF), cryptocurrency, commodities, private equity, venture capital, foreign exchange (Forex), derivatives etc. and their respective decision-making such as whether to sell, buy or hold these financial instruments has undergone significant transformations throughout history. This literature review explores the evolution of investment strategies, tracing the development from traditional approaches to the incorporation of modern technologies, with a particular focus on the role of artificial intelligence (AI).

1.1 The Traditional Methods:

Historically, investment decisions were primarily based on fundamental analysis, technical analysis, and market sentiment. Scholars such as Benjamin Graham and David Dodd laid the groundwork for fundamental analysis, emphasizing the importance of financial statement analysis and intrinsic value. Technical analysis, on the other hand, relied on historical price and volume patterns, while market sentiment reflected the collective psychology of investors.

In the early 2000s, during the dot-com bubble, fundamental analysis became crucial for investors assessing the value of technology companies. Companies with high earnings but questionable business models were often overvalued. For instance, the rise and fall of companies like Pets.com highlighted the importance of scrutinizing financial statements and evaluating the sustainability of earnings.

The principles of fundamental analysis were laid out by Benjamin Graham and David Dodd in their seminal work "Security Analysis" (1934). The enduring significance of fundamental analysis is evident in studies that show long-term investors relying on financial metrics like earnings per share (EPS) and price-to-earnings (P/E) ratios to make investment decisions.

During the 2008 financial crisis, technical analysis played a crucial role for traders navigating volatile markets. Recognizing key technical patterns and trend reversals helped traders manage risks and identify potential entry or exit points. The use of moving averages and trendlines became particularly relevant during this period.

Technical analysis principles, emphasizing historical price and volume patterns, have been influential since the early 20th century. Notable technical analysts like Charles Dow and Ralph Nelson Elliott laid the foundation for these methods. While specific statistics may vary, surveys have shown that a significant number of short-term traders incorporate technical analysis into their decision-making processes.

The Game-stop saga in early 2021 is a compelling example of market sentiment impacting investment decisions. Retail investors, fueled by social media platforms like Reddit, collectively influenced the price of Game-stop stock. The event underscored the power of mass sentiment in shaping market dynamics.

Market sentiment, reflecting the collective psychology of investors, is a dynamic force. Surveys, such as the American Association of Individual Investors (AAII) Investor Sentiment Survey, provide insights into investor sentiment trends. The index measures the percentage of individual investors who are bullish, bearish, or neutral about the stock market over the short term.

However, ethical concerns persist with traditional investment methods, encompassing issues like insider trading advantages, potential market manipulation, and an emphasis on short-term gains, emphasizing the need for a reevaluation of investment practices

1.2 The New Ways of Using Numbers:

The latter half of the 20th century witnessed the rise of Quantitative methods in investment, with the development of mathematical models and algorithms. This shift aimed to introduce more systematic and data-driven approaches to decision-making. The Capital Asset Pricing Model (CAPM) and the Efficient Market Hypothesis (EMH) were influential theories during this period.

Quantitative investment strategies use math and computer algorithms to pick where to invest money in a systematic way, taking emotions out of the decision. They include various methods like statistical arbitrage, factor investing, risk parity, machine learning, and artificial intelligence (AI). Looking back, key ideas from people like Harry Markowitz and William Sharpe set the stage for quantitative investing after World War II. As computers got better in the 1960s and '70s, experts, known as "quants," could create more complex ways of managing risk and finding investment opportunities. But, there were problems, especially after the 1987 stock market crash and the 2008 financial crisis.

After 2008, there was a push to make better models and include "tail risk" (uncommon but big events) in the strategies. Recently, machine learning and AI have added a new layer to quantitative investing, promising better ways to analyze data but also bringing up ethical concerns and possible big risks

One illustrative example of the integration of quantitative methods in investment is the development and application of algorithmic trading strategies. In the late 20th century and continuing into the 21st century, financial institutions increasingly adopted algorithmic trading systems to execute large and complex trades with speed and precision. High-frequency trading (HFT) is a prime example, where algorithms analyze market data and execute trades at extremely high speeds, often within milliseconds. This approach aims to capitalize on inefficiencies in the market and exploit price differentials.

The use of quantitative methods and mathematical models in finance has been extensively studied and documented in academic literature and financial publications. A seminal work that discusses the influence of quantitative methods is "A Random Walk Down Wall Street" by Burton Malkiel.

While specific statistics regarding the rise of quantitative methods may vary, a report by Aite Group estimated that by 2010, high-frequency trading accounted for over 60% of U.S. equity market trading volume. This statistic underscores the substantial impact of quantitative approaches in shaping the landscape of modern financial markets.

The use of quantitative methods in investment decision though is accompanied by various challenges. These include reliance on assumptions that may not hold in dynamic markets, issues related to the quality and availability of historical data, difficulties in adapting to changing market conditions, and the risk of over fitting models to historical data. Human behavioral factors, regulatory compliance challenges, and the impact of transaction costs and liquidity constraints are also significant concerns. Additionally, the inability to incorporate qualitative factors, the occurrence of black swan events, and ethical considerations pose further complexities. Achieving successful quantitative investment strategies requires a nuanced and adaptive approach that considers both quantitative and qualitative aspects.

1.3 Technological Advancements in the Late 20th Century:

Technological Advancements in the Late 20th Century: The late 20th century saw the integration of computers into investment processes. The advent of online trading platforms and the use of software for analysis marked a crucial turning point. Investors began to leverage technology for faster information processing and trade execution.

One significant real-life example of this technological transformation is the rise of online trading platforms. The emergence of platforms like E*TRADE in the late 1990s democratized access to financial markets. Investors were no longer reliant on traditional brokerage houses and could execute trades with a few clicks from the convenience of their homes. This accessibility revolutionized the landscape of retail investing, empowering individual investors with unprecedented control over their portfolios.

Electronic Communication Networks (ECNs): In addition to online trading platforms, the late 20th century saw the rise of Electronic Communication Networks (ECNs). These systems allowed for direct access to financial markets, enabling investors to interact with each other without the need for intermediaries. This contributed to increased transparency and efficiency in stock trading.

Algorithmic Trading: The late 20th century witnessed the development and adoption of algorithmic trading strategies. With the use of advanced algorithms, traders could automate the execution of large orders, optimize trading strategies, and react to market conditions in real-time. This marked a shift towards more sophisticated and data-driven trading practices.

Risk Management Software: The integration of technology in investment processes also brought about advancements in risk management. Software tools were developed to assess and manage financial risks, helping investors make more informed decisions. This was particularly crucial in the context of a globalized and interconnected financial system.

Data Analytics and Big Data: The late 20th century paved the way for the increased use of data analytics and big data in financial decision-making. Investors and financial institutions began harnessing large datasets to identify trends, patterns, and correlations, providing valuable insights for making investment decisions.

Globalization of Financial Markets: Advancements in communication technology, such as the internet and faster data transmission, facilitated the globalization of financial markets. Investors gained access to information and opportunities from around the world, leading to increased cross-border investments and a more interconnected global financial system.

Securities Regulation and Compliance Software: As financial markets evolved, regulatory requirements became more complex. The late 20th century witnessed the development of software tools to assist financial institutions in adhering to regulatory compliance. This was crucial for ensuring transparency, preventing fraud, and maintaining the integrity of the financial system.

Mobile Trading Apps: Towards the end of the 20th century and into the 21st century, the development of mobile technology further transformed the investment landscape. Mobile trading apps allowed investors to monitor markets, execute trades, and manage their portfolios from the convenience of their smartphones, increasing accessibility and flexibility.

1.4 The Role of Artificial Intelligence:

The evolution aims for more effective practices. Traditional methods faced challenges in modern markets (Lo, 2004). Quantitative methods brought systematic and data-driven approaches (Malkiel, 2003), addressing market dynamics.

In recent years, as computational power continues to rise, data volumes experience exponential growth, and approaches consistently enhance, Artificial Intelligence has emerged as a game-changer in the investment landscape. Machine learning algorithms, neural networks, and natural language processing have opened new avenues for data analysis and decision-making. AI's ability to process vast amounts of data in real-time offers the potential for more accurate predictions and improved investment outcomes.

An exemplary application of AI in investment is the utilization of machine learning algorithms for stock price prediction. Hedge funds and asset management firms have increasingly employed sophisticated machine learning models to analyze historical market data, identify patterns, and predict future price movements. For instance, firms like Renaissance Technologies, known for its Medallion Fund, leverage AI-driven strategies to achieve remarkable returns. These strategies involve complex mathematical models that adapt to changing market conditions, demonstrating the potential of AI to enhance decision-making in investment management.

AI methods are increasingly used in finance, like managing assets, algorithmic trading, credit evaluations, or blockchain-based finance, thanks to lots of data and affordable computing. Machine learning models use big data to automatically learn and improve predictions without human programming. Using AI in finance is expected to help financial companies by making things more efficient and improving services for consumers. This can benefit consumers by offering better and personalized products, using data for investment insights, and possibly helping with financial inclusion for clients with limited credit history. But, using AI in finance also brings risks, like biased or unfair results, and concerns about handling data. The complexity of AI techniques could amplify these risks, creating challenges for existing financial supervision and governance frameworks. The lack of clarity in how AI models work could lead to potential market risks and conflicts with the technology-neutral approach to policymaking. While many risks are not unique to AI, using these techniques could make them more significant due to their complexity and autonomy.

While artificial intelligence (AI) holds significant promise in revolutionizing investment practices, it is imperative to proactively address various challenges and criticisms associated with its implementation.

These concerns encompass issues related to fairness, transparency, accountability, potential algorithmic biases, ensuring appropriate data quality, adhering to rigorous model testing and validation standards, and navigating regulatory risks. Acknowledging and actively addressing these challenges is crucial for the responsible and ethical integration of AI into investment practices.

CHAPTER TWO – LITERATURE REVIEW II

The Impact of Artificial Intelligence on Investment Decision-Making

Artificial Intelligence (AI) started in the mid-20th century with the idea of creating machines that think like humans. As time passed, AI became more advanced, moving from basic programs to complex models. Now, AI can do things that not only mimic but also outperform humans in specific tasks. The present-day landscape of investment decisions is marked by a profound integration of artificial intelligence (AI) technologies, specifically machine learning algorithms and neural networks. These advanced techniques have evolved to become pivotal components, shaping the way financial decisions are made in contemporary markets.

Building on the general evolution discussed in Chapter 1, this chapter delves deeper into the specific role of artificial intelligence in investment decision-making. The focus is on understanding how AI technologies contribute to enhanced decision accuracy, risk management, and overall portfolio performance.

2.1 AI in Financial Markets:

AI has played a crucial role in addressing complex challenges in the financial sector, particularly in areas like fraud detection and risk assessment. The sheer volume of daily financial transactions makes manual fraud detection nearly impractical, and financial institutions are in a constant battle against ever-evolving fraud techniques. Traditional systems often react to fraud after it occurs, but AI predictive analytics enable financial entities to proactively identify and prevent suspicious activities.

In real-time payment systems, where instant fraud detection is essential, traditional methods often struggle to keep up with the speed and transaction volume. AI methods, such as deep learning, trained on millions of transactions, can quickly detect patterns and anomalies, surpassing human capabilities. Financial institutions integrating AI-based real-time fraud detection have observed a significant reduction in fraudulent transactions, up to 40%, along with a decrease in false positives.

Credit card companies utilize AI to predict the probability of user defaults, aiding in credit limit decisions and loss reduction. By training on historical data, including transactions, payment histories, and even social factors, AI models offer more accurate predictions. Some advanced models even consider non-traditional data, such as social media activity. Credit card companies employing AI-based risk assessment tools report a decrease in bad loans compared to traditional methods.

In the stock market, known for its unpredictability, manual trading strategies may struggle with rapid fluctuations. AI algorithms, trained on extensive datasets of market data, can make real-time trading decisions by analyzing patterns and predicting short-term price changes more accurately. Additionally, AI aids portfolio managers in assessing risks by forecasting potential market downturns based on global news and events. Trading companies adopting AI-based strategies consistently outperform traditional methods, with some reporting an increase in annual returns of up to 15%.

The financial industry has witnessed a surge in the use of AI for analyzing market trends, predicting price movements, and identifying investment opportunities. This section explores the various AI techniques employed in financial markets, including machine learning algorithms, predictive analytic, and algorithmic trading strategies.

Especially the environment for investment management firms is changing due to technology and evolving investor preferences. While traditional ways of standing out in investment management are becoming common, Artificial Intelligence (AI) is creating new chances that go beyond just saving costs.

Machine Learning Algorithms: Transformative Decision-Making Tools: The advent of machine learning algorithms has revolutionized investment practices, allowing for data-driven decision-making processes. Notably, these algorithms have demonstrated unparalleled capabilities in pattern recognition, risk assessment, and predictive modeling (Lopez de Prado, 2018). For instance, the utilization of machine learning in stock price prediction has gained prominence among hedge funds and asset management firms (Zhang & Wu, 2019). Such algorithms analyze vast datasets, identifying intricate patterns that traditional methods may overlook. The dynamic nature of machine learning ensures adaptive strategies that evolve with changing market conditions, presenting a significant advantage in navigating the complexities of the financial landscape.

Neural Networks: Mimicking Human Decision-Making Neural networks, inspired by the human brain's structure and functioning, play a crucial role in enhancing the cognitive capabilities of AI in investment decision-making. These networks excel in tasks such as sentiment analysis, natural language processing, and complex pattern recognition (Lopez de Prado, 2018). Their ability to analyze unstructured data, such as news articles, social media sentiment, and macroeconomic indicators, provides investors with a comprehensive understanding of market dynamics.

Additionally, natural language processing (NLP) has evolved to decipher and interpret vast amounts of textual data, offering valuable insights from news articles, financial reports, and social media sources. The ability of NLP algorithms to extract sentiment and relevant information in real-time contributes to a more holistic and timely decision-making process.

Academic literature, as highlighted by Zhang and Wu (2019), underscores the practical application of machine learning in asset pricing, emphasizing its significance in the financial domain. The real-world success stories, such as Renaissance Technologies' Medallion Fund, further validate the transformative impact of AI-driven strategies on investment outcomes (Lopez de Prado, 2018).

Deloitte Global's recent report, "Artificial Intelligence—The Next Frontier for Investment Management Firms," focuses on four main areas for change that can help firms create new ideas and provide new types of value within the investment space:

Generating alpha: For firms aiming for growth through better performance, using alternative data sets and AI sets them apart for more success.

Enhancing operational efficiency: Firms will keep using AI and advanced automation to keep getting better at what they do. They can also turn these usual cost centers into AI-powered services.

Improving product and content distribution: Customer experience is crucial, and AI is aiding advisors in getting more insights, making content more tailored, and delivering it to clients faster.

Managing risk: AI is changing the game for risk management, giving firms tools to strengthen compliance and risk functions, automate data analysis, and handle uncertain situations.

The report suggests that when these four areas combine with AI, investment management firms can quickly change their business models, operations, and capabilities. But to get the most out of AI, firms need to carefully handle the mix of technology and talent.

McKinsey & Company (2018) notes AI's practical integration in finance. Deloitte Global (2023) emphasizes AI's role in generating alpha, enhancing efficiency, and managing risks.

2.2 Enhancing Investment Strategies with AI:

AI's impact on traditional investment strategies is a key area of exploration. From optimizing asset allocation to dynamically adjusting portfolios based on market conditions, AI is reshaping how investors approach strategy development and implementation.

AI's transformative influence on traditional investment strategies extends across various dimensions, presenting opportunities for profound improvements. Beyond its labor-saving and predictive capabilities, AI becomes a strategic ally in optimizing asset allocation and dynamically adjusting portfolios based on real-time market conditions.

Traditionally, asset allocation has relied on historical data and predefined risk parameters. AI, however, introduces a dynamic paradigm by assimilating vast datasets in real-time. This allows for a nuanced understanding of market trends, enabling investors to adapt asset allocations swiftly and proactively respond to emerging opportunities or risks.

The essence of AI's impact lies in its ability to go beyond static strategies. It empowers investors to create adaptive portfolios that evolve in tandem with market dynamics. Machine learning algorithms, a subset of AI, analyze intricate patterns and correlations, facilitating the identification of previously unseen opportunities or potential pitfalls. This dynamic responsiveness enhances the resilience of investment portfolios against unexpected market shifts.

Moreover, AI augments strategic decision-making by incorporating diverse data sources, including non-conventional indicators, sentiment analysis, and global economic factors. This comprehensive approach goes beyond the confines of traditional quantitative models, providing a more holistic view of the investment landscape.

The concept of 'smart portfolios' emerges as AI-driven algorithms continuously learn from market behaviors, adapting strategies for optimal performance. This continuous learning loop ensures that investment strategies remain agile and responsive in an ever-changing financial environment.

As we explore the impact of AI on investment strategies, it becomes evident that the integration of these technologies goes beyond mere automation. It signifies a fundamental shift in how investors conceptualize and implement their strategies. The chapters that follow will delve deeper into real-world examples and case studies, illustrating the tangible outcomes of employing AI in investment decision-making.

2.3 Risk Management and Predictive Modeling:

One of the significant advantages of AI lies in its ability to assess and manage risks. This section examines how AI-powered models contribute to more accurate risk assessments, stress testing, and scenario analysis, providing investors with valuable insights for making informed decisions in dynamic market environments.

AI's prowess in risk management and predictive modeling marks a transformative leap for investors. Referencing a study by Zhang and Wu (2019) and insights from McKinsey & Company (2018), AI-powered models outshine traditional methods in gauging and handling risks.

Traditionally, risk assessments relied on historical data and static models, making them less adept at capturing the complexities of dynamic markets. AI, however, excels at processing vast datasets in real-time, learning from evolving market patterns. This adaptive capability enables AI models to provide investors with a nuanced understanding of potential risks, going beyond the limitations of conventional approaches.

Furthermore, AI facilitates sophisticated stress testing and scenario analysis. It can simulate a myriad of market conditions, helping investors prepare for various contingencies. The ability to foresee potential challenges and opportunities in dynamic environments empowers investors to make more informed and strategic decisions.

Drawing from the insights of Zhang and Wu (2019), who highlight the impact of machine learning in asset pricing, and McKinsey & Company's report on the role of AI in finance, we see that AI-driven risk assessments offer a 360-degree view of the market landscape. This comprehensive understanding equips investors with valuable insights, enhancing their ability to navigate the intricacies of modern financial markets. As we delve into practical examples in the following chapters, we'll see how AI's risk management capabilities translate into tangible benefits for investors seeking to thrive in a dynamic and unpredictable financial landscape.

2.4 Challenges and Ethical Considerations:

As AI continues to play a pivotal role in investment decision-making, it is essential to address challenges and ethical considerations associated with its use. This section critically examines issues such as algorithmic biases, model clarity and the potential for excessive dependence on automated systems.

In navigating the expanding landscape of artificial intelligence (AI) within investment decision-making, it becomes imperative to delve into the multifaceted realm of challenges and ethical considerations that accompany its pervasive use. This section conducts a meticulous exploration, scrutinizing issues that demand careful consideration for the responsible integration of AI in the investment domain.

Algorithmic Biases: One of the paramount challenges involves the inherent biases embedded within algorithms. As AI systems process vast datasets, there is an inherent risk of perpetuating and even exacerbating existing biases present in the data. This section thoroughly examines how algorithmic biases may inadvertently lead to skewed decision outcomes, potentially reinforcing societal inequities and prejudicial patterns. It prompts a critical evaluation of methods to mitigate biases, ensuring that AI-driven investment decisions align with principles of fairness and inclusivity.

Model Interpretability: The opacity of complex AI models poses a distinctive challenge in investment contexts. Understanding how these models arrive at specific decisions is crucial for fostering trust and transparency. This segment scrutinizes the issue of model interpretability, delving into the necessity of comprehensible AI systems. It explores methods to enhance transparency, allowing stakeholders, including investors and regulators, to grasp the rationale behind AI-generated decisions, thus fostering accountability and informed decision-making.

Over reliance on Automated Systems: In the era of AI-driven investment, the potential pitfall of over reliance on automated systems is a pivotal concern. This section critically assesses the risks associated with an excessive dependence on AI, emphasizing the importance of maintaining a balance between technological augmentation and human expertise. It discusses strategies to mitigate the risk of blindly trusting automated systems, advocating for human oversight and intervention in critical decision junctures to prevent unintended consequences.

By meticulously addressing these challenges and ethical considerations, this section contributes to the development of a framework that ensures the responsible and ethical integration of AI into investment decision-making processes. It advocates for a paradigm where the transformative power of AI aligns with societal values, regulatory standards, and the overarching goal of fostering a resilient and equitable investment landscape.

CHAPTER THREE – METHODOLOGY

The methodology employed in this research aims to explore and analyze the role of artificial intelligence (AI) in improving investment choices. This methodology section outlines the research design, data collection methods, analysis techniques, and ethical considerations for investigating the impact of AI on investment choices. It ensures a robust and comprehensive approach to addressing the research objectives. The research design involves a combination of qualitative and quantitative methods to provide a comprehensive understanding of the subject.

1. Research Design

This study utilizes a mixed-methods research design. It combines quantitative data analysis, including historical financial data and AI-driven investment strategies' performance, with qualitative analysis through interviews and surveys to gather insights into investors' perceptions and experiences.

2. Data Collection

Quantitative Data:

The quantitative component of this research relies on historical financial data, including stock prices, economic indicators, and asset returns. This data will be obtained from reputable financial databases, such as Bloomberg, Yahoo Finance, and academic sources, to assess the impact of AI-driven investment strategies on investment outcomes.

Qualitative Data:

To gain insights into investors' perceptions and experiences with AI-driven investment, qualitative data will be collected through semi-structured interviews and surveys. A sample of investors, including retail investors, asset managers, students and financial advisors, will be selected to participate in interviews. Surveys will be distributed to a broader audience of potential investors and other AI enthusiasts to gather a wider range of perspectives.

3. Data Analysis

Quantitative Data Analysis:

Quantitative data will be analyzed using statistical methods and software tools, including correlation analysis, and performance metrics. The goal is to assess the historical performance of AI-driven investment strategies compared to traditional approaches and their impact on investment choices.

Qualitative Data Analysis:

Qualitative data from interviews and surveys will be subjected to statistical analysis. Responses will be coded and categorized to identify recurring themes, opinions, and experiences related to AI in investment choices. This analysis will provide a deeper understanding of investors' attitudes and preferences.

4. Case Studies

A subset of the research will involve the analysis of specific AI-driven investment case studies. These case studies will involve examining real-world applications of AI in investment decisions. BlackRock, Inc. which is a publicly owned investment manager will be looked at how it has adopted AI over the years in its investment decision and its relative impact. It will provide insights into how AI is being practically utilized to make investment choices and its impact on investment outcomes.

5. Ethical Considerations

This research adheres to ethical guidelines in conducting interviews and surveys. Informed consent will be obtained from all participants, and data will be anonymize to protect privacy and confidentiality. The research will also consider and discuss ethical aspects related to AI in investment throughout the analysis.

6. Limitations

It is essential to acknowledge some limitations of this study. The historical data used may not account for all potential variables affecting investment choices. Additionally, the sample size for interviews and surveys may be limited, which could impact the generalization of the findings. All limitations possible will be identified for further academic to be centered on.

7. Significance of the Study

The research aims to provide valuable insights into the role of AI in investment choices and to contribute to the understanding of how AI can improve investment outcomes. The study will offer practical recommendations for investors and financial professionals looking to incorporate AI into their investment strategies.

CHAPTER FOUR – FINDINGS / ANALYSIS / DISCUSSION

This chapter extensively explores how artificial intelligence (AI) plays a role in shaping investment decisions, gathering insights from a variety of sources. We examine the outcomes of a survey that captures the current thoughts and worries about AI in investment. Furthermore, we present a thorough case study on how BlackRock has embraced AI, providing a real-world example of a major financial player adapting to technological advancements.

To enhance our comprehension, this chapter also includes an examination of existing literature on the adoption of AI in investment choices. By combining insights from the survey, a significant industry case, and pertinent scholarly works, our goal is to create a complete view of the opportunities, challenges, and changing dynamics associated with integrating AI into the formulation of investment strategies. As we navigate through the survey findings, the BlackRock case, and insights from existing literature, we acquire valuable perspectives that contribute to the broader discussion about the transformative influence of AI in the financial sector.

4.1 ANALYSIS / DISCUSSION

Transformative Investing: BlackRock's AI-Powered Journey

This case study explores the transformative impact of artificial intelligence (AI) on investment decisions through the lens of BlackRock, a global leader in investment management. Focused on the intersection of AI and finance, BlackRock's AI Lab, comprising researchers, data scientists, and engineers, employs state-of-the-art technologies such as generative AI platforms, specifically ChatGPT, to enhance investment strategies. This study delves into how BlackRock leverages transformer technology to maximize the accuracy and precision of natural language processing (NLP), ultimately improving investment insights and outcomes.

The company primarily offers its services to a diverse range of investors, including institutional, intermediary, and individual clients such as corporate entities, public organizations, union pension plans, industry pension plans, insurance companies, third-party mutual funds, endowments, public institutions, governments, foundations, charities, sovereign wealth funds, corporations, official institutions, and banks. Additionally, the company provides global risk management and advisory services. It actively manages separate client-focused portfolios in equity, fixed income, and balanced investments. The company also initiates and oversees a variety of investment funds, including open-end and closed-end mutual funds, offshore funds, unit trusts, and alternative investment vehicles like structured funds. The range of funds encompasses equity, fixed income, balanced, and real estate mutual funds, as well as exchange-traded funds (ETFs) covering equity, fixed income, balanced, currency, commodity, and multi-asset categories. Furthermore, the company is involved in the launch and management of hedge funds. Its investment scope spans public equity, fixed income, real estate, currency, commodity, and alternative markets worldwide. The company primarily focuses on growth and value stocks, spanning small-cap, mid-cap, SMID-cap, large-cap, and multi-cap companies. It also invests in dividend-paying equity securities. The company's investment portfolio includes investment grade municipal securities, government securities, corporate bonds, and asset-backed and mortgage-backed securities. Utilizing both fundamental and quantitative analysis, the company employs a comprehensive approach, combining bottom-up and top-down strategies in its investment decisions. Various investment strategies, including liquidity, asset allocation, balanced, real estate, and alternative approaches, are employed by the company. In the real estate sector, it targets investments in Poland and Germany. The company evaluates the performance of its portfolios by benchmarking against a range of indices, including those from S&P, Russell, Barclays, MSCI, Citigroup, and Merrill Lynch. (BlackRock, Inc. (BLK) Company Profile & Facts - Yahoo Finance, 12/31/2023)

The Rise of AI in Investment

The rise of AI in investment, often referred to as algorithmic trading or quantitative investing, has been a significant trend in the financial industry. AI technologies are increasingly being employed to analyze vast amounts of financial data, identify patterns, and execute trades with speed and precision.

Increasingly, finance and investment is witnessing the widespread adoption of Artificial Intelligence (AI) techniques across various domains like asset management, algorithmic trading, credit underwriting, and blockchain-based finance. This surge is facilitated by the abundance of available data and the affordability of computing capacity. AI systems excel at processing and analyzing large datasets. They can quickly identify patterns, trends, and correlations in financial data that may be challenging for human analysts to discern.

One of the remarkable capabilities of AI is its potential to automate trading, eliminating the need for human intervention in many cases. This can be achieved through the development of advanced algorithms that can execute trades automatically based on preset conditions and real-time market data.

1. Algorithmic Trading

Algorithmic trading relies on AI-powered algorithms to execute trades automatically. This approach allows investors to take advantage of market trends and make trades in real-time, without the need for human intervention. Some examples of financial institutions that use algorithmic trading include Goldman Sachs, JP Morgan Chase, and Citadel Securities. Approximately 60-73% of the total US equity trading is attributed to algorithmic trading, according to estimates.

These institutions use algorithmic trading in a variety of ways as follows:

Automated order execution: Algorithmic trading systems can automatically execute large trades at the best available prices and minimize transaction costs.

Market making: This strategy involves constantly providing liquidity to the market by simultaneously buying and selling a particular security or asset.

Statistical arbitrage: This strategy involves exploiting market inefficiencies by buying undervalued assets and selling overvalued assets. Overall, algorithmic trading has become an integral part of the financial industry, with many institutions using these systems to automate and streamline their trading operations.

2. Quantitative Investing

Quantitative investing uses AI algorithms to identify undervalued stocks and other investment opportunities. It relies on complex statistical models and machine learning algorithms to analyze vast amounts of financial data and make investment decisions. This approach has become increasingly popular in recent years, as investors seek to gain a competitive advantage in the market by using cutting-edge technology to identify undervalued stocks and other investment opportunities. Despite its advantages, quantitative investing also presents certain challenges, such as the need for robust data sets and the risk of over-reliance on algorithmic models.

Here are some real-life applications of quantitative investing:

Renaissance Technologies: This hedge fund, founded by mathematician James Simons, is one of the pioneers of quantitative investing. Renaissance Technologies Medallion Fund uses ML algorithms to analyze market trends and make investment decisions. Over the past three decades, the fund has generated returns of over 70% per annum.

Goldman Sachs: Goldman Sachs uses quantitative techniques, including machine learning and data analytics, to manage its portfolios. The firm's flagship fund, the Goldman Sachs Quantitative Equity Fund, uses a variety of quantitative strategies to generate returns.

BlackRock: BlackRock is one of the world's largest asset managers, with over \$8.6 trillion in assets under management. The company uses machine learning and other quantitative techniques to analyze market trends and manage its portfolios.

3. High-Frequency Trading(HFT)

High-frequency trading (HFT) refers to the use of advanced algorithms to execute large volumes of trades at incredibly high speeds, often within microseconds. High-frequency trading takes the Algorithm trading approach to the extreme, using AI algorithms with the goal of profiting from small market fluctuations. However, the use of HFT has also been subject to controversy, with concerns about its impact on market stability and fairness.

Here are some real-life applications of HFT:

Market-making: Firms use HFT algorithms to provide liquidity to the market by buying and selling assets at the best available prices. For example, a market-making firm using HFT algorithms may place buy and sell orders for a particular stock at a rapid pace, responding quickly to changes in market conditions to maintain a stable bid-ask spread. This allows the firm to profit from the difference between the buying and selling price while also facilitating trading for other investors.

Arbitrage Trading: HFT algorithms can identify price discrepancies between different markets or instruments and execute trades to profit from those differences. For instance, an HFT firm may identify a price difference between a futures contract and the underlying asset, and execute trades to profit from the discrepancy.

AI-powered Investment Products in Real Life

AI-powered investment products have been on the rise in recent years. Among these, the popular ones are AI-powered Exchange Traded Funds (ETFs) and AI stock pickers, which use advanced algorithms to make investment decisions.

I. AI-powered Exchange Traded Funds (ETFs)

AI-powered ETFs are designed to track a specific index or sector while using machine learning algorithms to optimize portfolios. For instance, AI-powered ETFs can analyze market data to identify undervalued companies or assess market sentiment to make more informed investment decisions. One example of an AI-powered ETF is the AI-Powered Equity ETF (AIEQ), which uses IBM's Watson AI technology to select stocks based on several factors, including news sentiment analysis, financial statements, and market trends.

II. AI stock pickers

AI stock pickers use deep learning algorithms to identify stocks with the potential for high returns. These algorithms are trained using historical data to identify patterns and make predictions about future market trends. One example of an AI stock picker is the Qraft AI-Enhanced US Large Cap Momentum ETF (AMOM). This ETF uses machine learning algorithms to identify high-performing stocks based on their momentum, and it rebalances its portfolio monthly based on its algorithm's predictions.

4. Fraud detection

Fraud detection is one of the critical areas where AI is making a significant impact in the finance industry. Fraudulent activities like money laundering, identity theft, credit card fraud, and many more can cause severe financial damage to individuals and companies. To detect such activities and prevent them, financial institutions are using advanced AI-powered fraud detection tools. These tools can analyze massive

amounts of data, including transaction histories, customer profiles, and external data sources, to identify suspicious activities and patterns. Many organizations like PayPal, JP Morgan Chase, MasterCard, and many more use fraud detection tools powered by AI.

5. Natural Language Processing (NLP):

NLP is used to analyze and understand news articles, social media, and other textual data. Sentiment analysis helps gauge market sentiment, and AI systems can react to breaking news or changing sentiment in real-time. The evolution of advanced models like GPT-4, LLaMA, and PaLM has transformed the manner in which traders assess text data from news and social media for sentiment analysis. Utilizing LLM-powered sentiment analysis allows for real-time and precise insights, empowering traders to make informed decisions. For example, a trading team can assess diverse online content to gauge public sentiment regarding a company, influencing their decisions to buy or sell. This instantaneous analysis provides a significant advantage in the dynamic and fast-paced realm of trading.

6. Portfolio Management:

AI is utilized in portfolio construction and optimization. It helps investors build diversified portfolios based on risk preferences, market conditions, and other relevant factors.

7. Risk Management:

AI models contribute to risk assessment and management by identifying potential risks and providing recommendations to mitigate them. This helps in creating more resilient investment strategies.

8. Robo-Advisors:

Robo-advisors, powered by AI, provide automated, algorithm-driven financial planning services with minimal human intervention. These platforms offer cost-effective and efficient investment solutions for individuals.

9. Regulatory Compliance:

AI is also used for regulatory compliance by automating the monitoring of transactions and ensuring adherence to financial regulations.

Overview of BlackRock as a global investment and risk management solutions provider.

BlackRock which was founded in New York in 1988 stands out as a prominent global investment and risk management solutions provider, commanding a significant presence in the financial industry. Renowned for its vast scale and influence, BlackRock serves as a leading asset management company with a comprehensive range of investment offerings. (About BlackRock - What We Do, Who We Are & Our Purpose, 2023)

BlackRock's mission is to create a better financial future for our clients, by building the most respected investment and risk manager in the world

The firm is recognized for its diverse portfolio of investment products, including exchange-traded funds

(ETFs), mutual funds, and other investment vehicles. BlackRock's extensive reach spans across various asset classes, providing clients with opportunities for diversification and tailored investment strategies.

Beyond investment management, BlackRock has positioned itself as a leader in risk management solutions. The company leverages sophisticated analytics and technology to assess and mitigate risks effectively, contributing to the overall stability of investment portfolios. With a global footprint, BlackRock serves a broad client base that includes institutional investors, corporations, governments, and individual investors. The firm's commitment to innovation and adaptability has enabled it to navigate dynamic market conditions and deliver value to its clients. BlackRock's influence extends beyond traditional asset management, encompassing initiatives related to sustainable investing and responsible corporate governance. The firm actively engages in promoting environmental, social, and governance (ESG) principles, reflecting a commitment to long-term sustainability and responsible investing practices.

Introduction to the AI Lab, emphasizing its composition and role in driving innovation.

AI Lab serves as a dynamic ecosystem where brilliant minds converge to push the boundaries of technology, paving the way for transformative advancements in various fields.

The AI Lab is a multidisciplinary environment, bringing together experts from diverse backgrounds such as computer science, mathematics, neuroscience, data science, and engineering. This amalgamation of skills fosters a collaborative atmosphere where researchers, scientists, and engineers work synergistically to tackle complex challenges and create groundbreaking solutions.

The lab is equipped with state-of-the-art infrastructure, including high-performance computing clusters, advanced robotics, and cutting-edge hardware accelerators. Additionally, it houses extensive datasets that serve as the fuel for machine learning algorithms, enabling researchers to train and optimize models for a wide range of applications.

The composition of the AI Lab is not only limited to human talent. Advanced AI systems and autonomous agents are integral components, working in tandem with human researchers to explore novel approaches, analyze vast datasets, and generate insights that may be beyond human capacity alone.

Role in Driving Innovation:

The AI Lab plays a pivotal role in driving innovation across various domains. Here are key aspects of its contribution:

Algorithmic Advancements: Researchers at the AI Lab are constantly refining and innovating algorithms, pushing the boundaries of what AI systems can achieve. This includes advancements in machine learning, deep learning, natural language processing, and computer vision.

Application Development: The lab actively engages in developing practical applications of AI across industries such as healthcare, finance, transportation, and more. These applications may range from predictive analytics and personalized medicine to intelligent decision support systems.

Ethical AI: As AI technologies become more pervasive, the AI Lab is committed to addressing ethical considerations. Researchers work on developing responsible AI frameworks, ensuring fairness, transparency, and accountability in AI systems.

Human-AI Collaboration: The lab explores ways in which AI can enhance human capabilities through collaborative efforts. This involves the development of systems that seamlessly integrate with human workflows, augmenting decision-making processes and problem-solving.

Educational Initiatives: The AI Lab contributes to the broader academic community by providing educational resources, hosting workshops, and collaborating with educational institutions. This fosters the growth of the next generation of AI researchers and practitioners.

The Role of Generative AI in Investment Insights

Applications of generative AI like ChatGPT, GitHub Copilot, Stable Diffusion, and similar technologies plays a significant role in generating investment insights by leveraging its ability to analyze data, identify patterns, and simulate various scenarios through Data Analysis and Pattern Recognition, Predictive Modeling, Natural Language Processing (NLP) for Sentiment Analysis, Fraud Detection and Risk Management Analysis, Portfolio Optimization, Algorithmic Trading, Market Forecasting, Customized Insights and Recommendations and Enhancing Fundamental Analysis on AI platforms like AWS, Harvey AI, Alphabet, Azure, Databricks, Mosaic ML, and others

As per a recent market analysis, the generative AI sector within the asset management market is poised for remarkable growth. The market size is projected to surge from a modest USD 312 million in 2022 to an impressive USD 1,701 million by the year 2032. This substantial expansion is expected to occur at an extraordinary Compound Annual Growth Rate of 19% over the forecast period spanning from 2022 to 2032, underscoring the industry's recognition of its disruptive potential. While traditional methods of asset management have been effective to a certain extent, they often grapple with the intricate complexity and volatility of today's markets. The finance industry has traditionally relied on historical data and human expertise for guiding investments, yet this approach has inherent limitations. In this context, generative AI emerges as a transformative ally, seamlessly integrating human insight with the computational capabilities of machine learning. (Takyar, 2023)

Deloitte anticipates that leveraging generative AI could enhance front-office productivity for the top 14 global investment banks by a substantial margin, ranging from 27% to 35%. This improvement is projected to translate into an additional revenue of US\$3.5 million per front-office employee by the year 2026. (AI in investment banking | Deloitte Insights, 2023)

Recent studies on the impact of generative AI on productivity yield promising results. According to research by Stanford, the implementation of generative AI in a call center led to a notable 14% increase in productivity. Another study from the Massachusetts Institute of Technology concluded that generative AI contributed to time reduction and enhanced work quality for professionals such as marketers, consultants, and data analysts. A common observation is that this technology has the potential to level the playing field and, notably, aid lower-skilled workers in enhancing their outputs and productivity. However, initial efforts may be required from lower-skilled workers to validate the technology effectively.

Given the encouraging potential, the industry is witnessing a surge in proofs-of-concept (POCs) and experiments. JPMorgan Chase, for instance, has sought trademark approval for a product named "IndexGPT," designed to provide investment advice to customers. Wells Fargo is utilizing large language models (LLMs) to assist in determining the information clients need to report to regulators and how they can optimize their business processes.

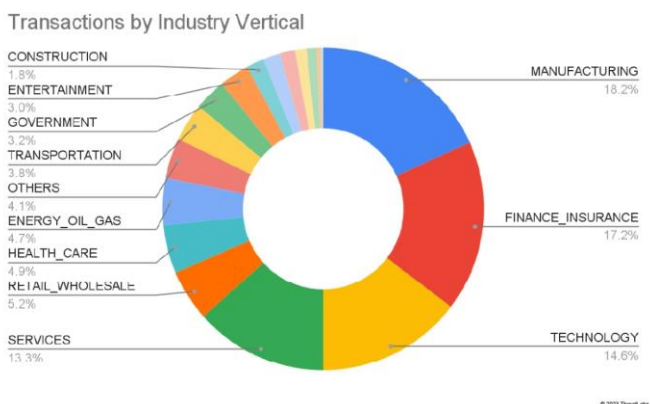
Federal Reserve researchers evaluating GPT models' ability to interpret "Fedspeak" (i.e., categorizing Federal Open Market Committee announcements as dovish or hawkish) discovered that these algorithms not only outperformed other methods but also exhibited reasoning abilities comparable to humans. Numerous institutions are already employing similar GPT models to analyze official statements and speeches released by central banks.

Moreover, vendors catering to investment banks are significantly investing in this emerging technology. Bloomberg, for example, recently introduced "Bloomberg GPT," a large language model with 50 billion parameters specifically tailored for finance. Similarly, Pitchbook has unveiled a new tool called "VC Exit Predictor," utilizing a machine learning algorithm to forecast a startup's potential growth prospects.

Exploration of generative AI, with a focus on ChatGPT and its rapid adoption in various industries.

AI is a comprehensive umbrella term that covers a diverse range of techniques and technologies created to imitate human intelligence and problem-solving. This encompasses machine learning, generative artificial intelligence models, natural language processing, computer vision, robotics, deep learning, and various other approaches.

People including industries have been really interested in how ChatGPT and other similar AI systems like GPT-3 and GPT-4 work in AI applications recently.



(Analysis of Generative AI Trends and ChatGPT Usage,2023)

As seen in the presented data, a significant number of transactions come from the manufacturing sector, with notable use of applications like ChatGPT, Drift, and Pypestream. At the same time, the finance sector has a substantial share, making up 17.2% of transactions, mainly due to the adoption of ChatGPT and Drift. Regardless of the industry, ChatGPT, Drift, and LivePerson consistently stand out as the most popular

generative AI-powered applications. Drift is an AI-powered conversational tool that integrates with email and chat, while LivePerson provides AI-powered services for customer interaction.

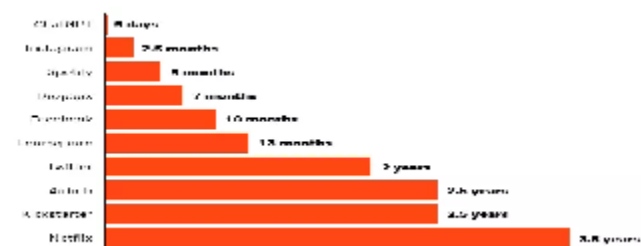
Discussion on the underlying technology of ChatGPT and its release by OpenAI.

In November 2022, ChatGPT was launched, and just four months later, OpenAI introduced a more advanced large language model (LLM) named GPT-4, showcasing notable improvements in capabilities. Similarly, by May 2023, Anthropic's generative AI, Claude, demonstrated the ability to process 100,000 tokens of text, equivalent to approximately 75,000 words per minute—an achievement compared to the initial capability of around 9,000 tokens when introduced in March 2023. ChatGPT is a counterpart model to InstructGPT, designed to adhere to instructions given in a prompt and furnish a comprehensive response.

As per OpenAI's explanation, they trained this model using Reinforcement Learning from Human Feedback (RLHF), employing similar methods to InstructGPT with slight variations in the data collection setup. The initial training involved supervised fine-tuning, where human AI trainers engaged in conversations playing both the user and an AI assistant role. Trainers had access to model-generated suggestions to assist in composing their responses. This new dialogue dataset was combined with the InstructGPT dataset, which underwent transformation into a dialogue format.

To establish a reward model for reinforcement learning, comparison data was necessary, comprising two or more model responses ranked by quality. This data was collected from conversations between AI trainers and the chatbot. A model-written message was randomly selected, various alternative completions were sampled, and AI trainers ranked them. Utilizing these reward models, the model underwent fine-tuning using Proximal Policy Optimization, and this process was iterated multiple times. (Introducing ChatGPT, 2023)

Figure 1 illustrates that ChatGPT achieved the milestone of one million users at a faster pace compared to any other online application. The chart depicts the time taken by various online applications to reach one million users.



Information obtained from Statista, based on data derived from company announcements through Business Insider/LinkedIn as of January 24, 2023. Kickstarter is quantified by one million backers, Airbnb by one million nights booked, and Instagram by one million downloads (systematic-investing, Jun 15, 2023)

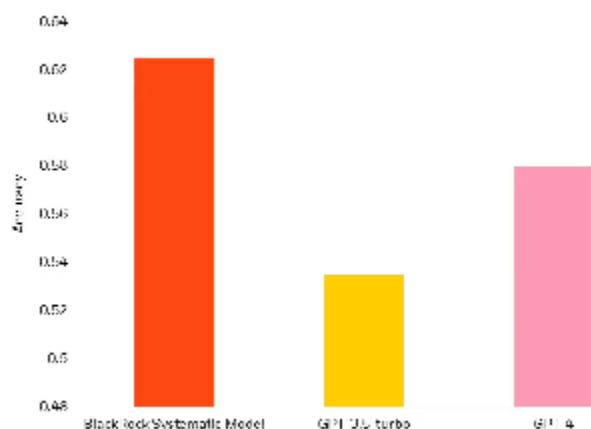
Integration of Transformer Technology at BlackRock

The AI Labs engage in research that intersects artificial intelligence and finance, combining concepts to foster innovation in both domains. They apply expertise in statistics, machine learning, optimization, stochastic control, and decision theory to address diverse challenges within the organization, spanning areas such as retirement, trading, alternatives, and ETFs.

As indicated in a publication from BlackRock (systematic-investing, Jun 15, 2023), the emergence of generative artificial intelligence (AI) platforms like ChatGPT has garnered increased attention in the realm of AI, particularly regarding advancements in natural language technology. These AI platforms, utilizing transformer technology to generate extensive human-like text outputs, have the potential to contribute to informed investment decision-making.

Within BlackRock Systematic, transformers are employed to enhance the accuracy and precision of natural language processing ("NLP") across diverse data sources, aiming to unveil potentially valuable investment insights. (systematic-investing, Jun 15, 2023)

Figure 2 illustrates that the BlackRock Systematic earnings call model has undergone fine-tuning to accurately predict market reactions following earnings announcements. The chart pertains to the precision of models in forecasting post-earnings market responses.



As of May 2023, BlackRock Systematic conducted an analysis, utilizing a dataset comprising 200 earnings calls. In this evaluation, predictions were generated for each model and subsequently compared with actual return outcomes (either positive or negative) observed in the subsequent 3-day stock returns. The accuracy is determined by calculating the proportion of correct predictions for each model.

The provided analysis suggests that BlackRock Systematic has made efforts to refine its earnings call model, as depicted in Figure 2. The focus of this refinement is on enhancing the model's capability to

accurately predict market reactions that follow earnings announcements. The chart specifically addresses the precision of these models in forecasting how the market responds post-earnings.

To delve into the details of this analysis, as of May 2023, BlackRock Systematic engaged in a comprehensive evaluation. This assessment involved a dataset that included information from 200 earnings calls. During the evaluation, the models generated predictions for each earnings call, and these predictions were subsequently compared with the actual return outcomes observed in the following 3-day stock returns.

The metric used to gauge the effectiveness of the predictions is accuracy, which is calculated by determining the proportion of correct predictions for each individual model. This accuracy measure provides insight into how well the models align with the actual market reactions, offering a valuable indicator of the predictive capabilities of the BlackRock Systematic earnings call model in the context of post-earnings market responses.

Identifying Investment Opportunities in the AI Era

AI is revolutionizing the investment management sector in various ways, providing firms with a competitive edge and delivering value to clients through algorithmic trading, personalized investment advice, and robo-advisors. An essential role of AI in investing lies in identifying investment opportunities capable of generating alpha, improving efficiency, and effectively managing risk.

Alpha Generation: The primary goal for any investor is to achieve alpha, indicating the ability to outperform a benchmark, typically the market, and attain superior returns. AI facilitates this by analyzing extensive and intricate datasets or indicators, unveiling concealed patterns and insights. Employing machine learning techniques such as regression, classification, and time series analysis, AI builds predictive models to forecast future trends and behaviors of various securities like stocks and ETFs.

For instance, the StockPicking Lab model scrutinizes over 3000 indicators to predict and outperform the market while minimizing drawdowns. An advantageous aspect of AI in alpha generation is its capability to process unstructured and unconventional data sources, including news articles, offering valuable signals about market sentiment and movements. The SFA (Summary of Financial Articles) tool is specifically designed for this purpose. Artificial intelligence utilizes natural language processing (NLP) and natural language understanding (NLU) methods to extract meaning and context from written data, such as earnings reports, financial statements, and analyst reports, which can significantly impact market performance.

Emphasis on the transformative impact of AI, positioning BlackRock at the cutting edge of innovation in the investment landscape.

By examining BlackRock's journey into AI-powered investing, this case study contributes to the broader understanding of how AI technologies can revolutionize traditional investment strategies, providing valuable insights for the thesis on using smart computers for improved investment choices.

Limited Detail on AI Models:

The case study provides an overview of BlackRock's use of AI, including ChatGPT and other generative AI platforms. However, it lacks detailed information about the specific AI models, algorithms, or architectures used, limiting a comprehensive understanding of the technological aspects.

Data Privacy and Security Concerns:

The case study does not delve deeply into data privacy and security considerations associated with the use of AI in handling vast amounts of financial data. Understanding how BlackRock addresses these concerns is crucial, especially given the sensitive nature of financial information.

Lack of Performance Metrics:

While the study mentions the fine-tuning of BlackRock Systematic's earnings call model, it does not provide specific performance metrics or detailed results of the analysis. Information on the model's accuracy, precision, and any challenges faced during the fine-tuning process would enhance the depth of the case study.

External Factors Impacting Market Predictions:

The case study emphasizes the precision of models in forecasting post-earnings market responses. However, it does not extensively discuss external factors, such as geopolitical events or economic changes, which could significantly impact market dynamics and challenge the accuracy of predictions.

Potential Bias in AI Models:

The case study lacks an in-depth exploration of how BlackRock addresses potential biases in AI models, particularly in the context of quantitative investing. Understanding the steps taken to ensure fairness and prevent unintended biases is crucial, especially given the societal implications of investment decisions.

Overemphasis on Positive Impact:

The case study primarily focuses on the positive impacts of AI in investment, such as alpha generation, fraud detection, and risk management. A more balanced view that also considers challenges, limitations, and ethical considerations would provide a comprehensive understanding.

Lack of Longitudinal Analysis:

The case study does not provide a longitudinal analysis of the performance and evolution of BlackRock's AI-powered strategies over an extended period. Long-term insights would be valuable to assess the sustainability and adaptability of AI models to changing market conditions.

Limited External Validation:

External validation or independent assessments of BlackRock's AI models are not discussed in the case study. Including insights from third-party evaluations or external experts could enhance the credibility of the presented information.

Generalization to Other Industries:

While the case study highlights the impact of generative AI in asset management, the generalization of findings to other industries may be limited. Each industry has unique challenges and requirements, and the case study does not explicitly discuss the transferability of BlackRock's AI strategies.

Rapid Technological Advancements:

Given the rapid pace of technological advancements in the field of AI, the case study's information may become outdated quickly. Continuous updates on BlackRock's AI initiatives and adaptations to emerging technologies are not addressed.

To address these limitations, future research and case studies could provide more granular details on technology, performance metrics, and ongoing challenges, ensuring a comprehensive and up-to-date understanding of BlackRock's AI-powered investment strategies.

Survey Analysis



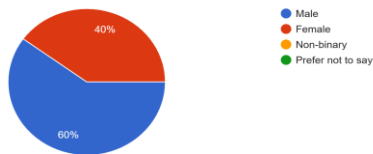
Questionnaire_ Impact of Artificial

The Role of AI in Investment Decisions

This survey dives into the use of AI in investment decisions, a topic central to the dissertation. The goal is to understand how people see and use AI in finance, exploring the changing landscape of investment choices.

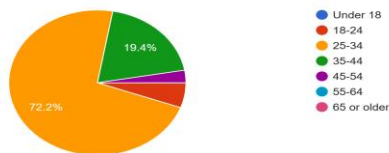
Section 1: Demographics

Section 1: Demographics 1.1. Gender:
35 responses



Gender: The respondents are evenly split between male and female.

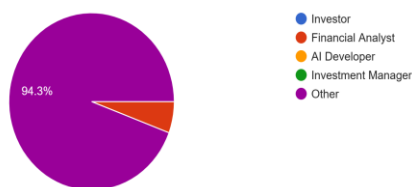
1.2. Age:
36 responses



Age: The majority of respondents fall within the 25-34 age range, with a few in the 35-44 range and one in the 18-24 range

Occupation: The respondents include students, a student, a banking professional, a graduate mining engineer, a support worker, an IT consultant, a teacher, a couple counselor, an engineer, an auditor, a civil engineer/researcher, a researcher, and a farmer.

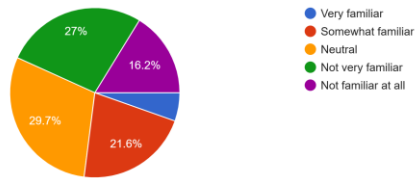
1.3. Occupation:
35 responses



Section 2: Knowledge and Use of AI in Investments

About half of the respondents are somewhat familiar with AI in investment decisions, while a few are very familiar or not familiar at all.

Section 2: Knowledge and Use of AI in Investments 2.1. How familiar are you with the use of artificial intelligence in investment decisions?
37 responses

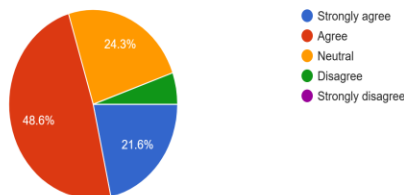


Only a small percentage have personally used AI in investment decisions, with experiences ranging from using facial recognition AI for digital transfers to implementing budget tools.

Section 3: Attitudes and Perceptions

The majority agree that AI can improve the accuracy of investment decisions, citing advantages such as speed, accuracy, and the ability to analyze vast amounts of data.

Section 3: Attitudes and Perceptions 3.1. To what extent do you believe that AI can improve the accuracy of investment decisions?
37 responses

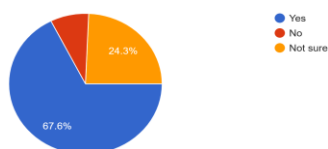


Concerns include the potential for incorrect predictions, susceptibility to manipulation, and ethical considerations when relying solely on AI. Some respondents believe AI can revolutionize traditional investment strategies, while others express reservations.

Section 4: Impact on Investment Strategies

Respondents believe AI has the potential to influence traditional investment strategies and improve risk management by identifying and analyzing risks in real-time.

Section 4: Impact on Investment Strategies 4.1. Do you think AI has the potential to revolutionize traditional investment strategies?
37 responses



There is a consensus that AI will play an increasingly important role in investment decisions, with expectations of more advanced models and algorithms.

Section 5: Future Outlook

Respondents envision the role of AI in investment decisions expanding over the next five years, with expectations of improvement and increased reliance on AI.

Section 6: Additional Comments

Some respondents highlight the need for user-friendly AI, emphasizing the importance of human oversight in investment decisions. Others express concerns about job displacement and ethical considerations associated with AI in investments.

Overall Findings:

Respondents generally have a positive attitude towards the use of AI in investment decisions, citing advantages such as speed, efficiency, and improved accuracy. Concerns include potential biases, ethical considerations, and the need for human oversight. The majority believe that AI will play a significant role in shaping the future of investment decisions.

Limitations of the Survey:

Small Sample Size: The survey sample size is relatively small, which may limit the generalizability of findings. It might not capture the diverse perspectives and experiences that a larger sample could provide.

Demographic Bias: The survey respondents are predominantly from the 25-34 age group, with a few from the 35-44 age group and only one from the 18-24 age group. This age bias may impact the representation of views across different age demographics.

Occupational Bias: The survey is skewed towards specific occupations, including students, researchers, therapists, and engineers. This bias may influence the results, as different professions might have distinct perspectives on AI and investment decisions.

Self-Reported Data: The survey relies on self-reported data, which may be subject to biases and inaccuracies. Respondents might provide answers that they perceive as socially desirable or in line with current trends.

Limited Geographic Diversity: The survey does not specify the geographic location of respondents. Regional variations in awareness, acceptance, and use of AI in investment decisions may not be adequately captured.

No Control Group: The survey lacks a control group, making it challenging to isolate the effects of AI on investment decisions compared to traditional methods. A control group could provide a baseline for comparison.

Limited Exploration of Negative Experiences: While some respondents shared positive experiences with AI, there is a lack of exploration into negative experiences or challenges faced by those who have used AI in investment decisions. This limitation might skew the overall perception of AI.

No Qualitative Data Analysis: The survey primarily collects quantitative data, and there is limited exploration of qualitative aspects. In-depth interviews or open-ended questions could provide richer insights into respondents' attitudes and experiences.

Time Sensitivity: The survey captures a snapshot of opinions at a specific point in time. Given the rapidly evolving nature of technology and finance, opinions may change over time as AI continues to advance.

Limited Diversity in AI Experiences: Respondents who have personally used AI in investment decisions provide limited details about their experiences. A more in-depth exploration of the specific AI tools, platforms, or algorithms used would offer a more nuanced understanding.

Potential Response Bias: Respondents who are more familiar or comfortable with AI might be more likely to participate in the survey. This could introduce a response bias, with the sample not fully representing individuals with less knowledge or skepticism about AI.

Acknowledging these limitations is crucial for interpreting the survey results and recognizing the need for further research to provide a more comprehensive understanding of attitudes toward AI in investment decisions.

4.2 FINDINGS

Summary of key findings and insights from BlackRock's use of AI in investment decisions.

This comprehensive exploration of BlackRock's use of artificial intelligence (AI) in investment decisions reveals several key findings and insights:

BlackRock's AI Lab and Transformer Technology:

BlackRock's AI Lab, comprising researchers, data scientists, and engineers, employs state-of-the-art technologies like generative AI platforms, specifically ChatGPT, to enhance investment strategies.

Transformer technology is used to maximize the accuracy and precision of natural language processing (NLP), contributing to improved investment insights and outcomes.

AI Trends in Investment:

The rise of AI in investment, known as algorithmic trading or quantitative investing, is a significant trend in the financial industry. AI technologies are increasingly utilized for analyzing vast financial data, identifying patterns, and executing trades with speed and precision.

Algorithmic Trading:

Algorithmic trading, relying on AI-powered algorithms, allows real-time trades without human intervention, with approximately 60-73% of total US equity trading attributed to this method. Applications include automated order execution, market making, and statistical arbitrage.

Quantitative Investing:

Quantitative investing leverages AI algorithms to identify undervalued stocks and investment opportunities using statistical models and machine learning. Examples include Renaissance Technologies, Goldman Sachs, and BlackRock employing quantitative strategies for portfolio management.

High-Frequency Trading (HFT):

HFT involves using advanced algorithms to execute large volumes of trades at extremely high speeds, profiting from small market fluctuations. Applications include market-making and arbitrage trading.

AI-Powered Investment Products:

AI-powered Exchange Traded Funds (ETFs) optimize portfolios using machine learning algorithms, while AI stock pickers identify stocks with high returns. Examples include the AI-Powered Equity ETF (AIEQ) and the Qraft AI-Enhanced US Large Cap Momentum ETF (AMOM).

Fraud Detection and Risk Management:

AI plays a crucial role in fraud detection, analyzing data to identify suspicious activities and patterns. Natural Language Processing (NLP) is used for sentiment analysis to gauge market sentiment and react to real-time news.

Portfolio Management and Robo-Advisors:

AI is employed in portfolio construction and optimization, helping investors build diversified portfolios. Robo-advisors, powered by AI, provide automated financial planning services with minimal human intervention.

Regulatory Compliance:

AI is used for regulatory compliance by automating transaction monitoring and ensuring adherence to financial regulations.

BlackRock's Global Presence and Commitment to Sustainability:

BlackRock, founded in 1988, is a leading global investment and risk management solutions provider with over \$8.6 trillion in assets under management. The company is recognized for its diverse portfolio of investment products and is committed to sustainability and responsible investing practices.

AI Lab's Role in Driving Innovation:

BlackRock's AI Lab, a multidisciplinary environment, contributes to algorithmic advancements, application development, ethical AI, human-AI collaboration, and educational initiatives.

Generative AI and ChatGPT's Impact:

Generative AI, including ChatGPT, plays a significant role in investment insights by analyzing data, predicting market trends, and enhancing fundamental analysis. The industry is witnessing a surge in proofs-of-concept (POCs) and experiments utilizing generative AI.

AI-Powered Growth Projections:

Market analysis indicates exponential growth in the generative AI sector within the asset management market, with a projected increase from \$312 million in 2022 to \$1,701 million by 2032.

BlackRock Systematic's Earnings Call Model:

BlackRock Systematic's fine-tuned earnings call model accurately predicts market reactions following earnings announcements, as demonstrated in an analysis of 200 earnings calls.

ChatGPT's User Adoption Milestone:

Figure 1 highlights ChatGPT's rapid adoption, reaching one million users faster than any other online application, as of data obtained from Statista and company announcements.

Integration of Transformer Technology:

BlackRock Systematic integrates transformer technology to enhance NLP accuracy, contributing to valuable investment insights.

In conclusion, BlackRock's strategic use of AI technologies, such as generative AI and transformer models, positions the company at the forefront of innovative and data-driven investment strategies. The integration of these technologies across various domains reflects the industry's recognition of AI's transformative potential in reshaping traditional financial practices.

Summary of key findings and insights from the Survey on the use of AI in investment decisions.

Knowing About AI: Some people know more about AI in finance than others. Many are starting to notice AI tools being used in finance, showing a growing awareness of their potential benefits.

Why AI is Good: People agree that AI has its perks in investing. Faster decisions, better analysis of data, and the ability to spot complex patterns are seen as big advantages.

Worries and Problems: Despite the good things, people worry about using AI in investments. Privacy concerns, biases in algorithms, and the challenge of understanding how AI makes decisions are common worries.

Trusting AI: Trust is a big deal. People trust AI more when it's clear how it works, when it's been reliable in the past, and when it's easy to understand.

Humans and AI Working Together: Many people like the idea of humans and AI working together. They think a mix of human experience and AI skills can lead to better investment decisions.

CONCLUDING REMARKS

In the journey through this thesis, we've navigated the evolving landscape of investment decisions with a lens focused on the transformative potential of artificial intelligence (AI). The exploration, titled "Using Smart Computers To Make Better Investment Choices: How Artificial Intelligence Can Improve Your Investment," has been a voyage into the future of finance, where the synergy of human intellect and machine precision promises to reshape the way we navigate the complex world of investments.

Our survey journeyed into the minds of individuals, capturing their perceptions, concerns, and hopes regarding the integration of AI in financial decision-making. The case study on BlackRock added a real-world dimension, showcasing how a major industry player has harnessed the power of smart computing to optimize investment strategies.

Using AI in investment is seen to make things better by cutting costs and doing tasks more efficiently, leading to more profits. This involves making better decisions, automating tasks, and improving how risks and rules are handled. AI is expected to make financial services and products better for people. This means introducing new products, offering more personalized choices, and improving overall services. Because of this, investors can enjoy better-quality products, more choices, personalized services, and maybe even lower costs.

The analysis of existing literature served as a guiding beacon, offering insights from academic and industry experts, enriching our understanding of the opportunities and challenges inherent in adopting AI for investment decisions.

It has been established that when it comes to employing AI in investment management, ethical considerations revolve around the trustworthiness of data, the precision and validity of models, the openness and clarity of algorithms, and the structures in place for accountability.

As we conclude, it is evident that the marriage of human intuition with AI capabilities holds immense promise. Transparency, reliability, and a collaborative approach are key elements that emerged from our exploration. Trust, a cornerstone in the successful integration of AI, remains paramount, and efforts towards building a robust foundation are vital for the widespread adoption of smart computing in investments.

This thesis is not just a reflection on the present but a glimpse into a future where the marriage of human ingenuity with AI sophistication can truly enhance our ability to make informed, strategic, and ultimately better investment choices. As we stand at the intersection of human insight and technological prowess, the possibilities for a more intelligent and resilient financial landscape beckon. The journey continues, and the future of investments appears ever more promising with the integration of smart computers into our decision-making arsenal.

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APPENDIX

