9 Artificial Intelligence and Machine Learning: Applications

Learning Objectives

After reading this chapter, you should be able to:

LO 9.1 Explain the development and adoption of ChatGPT.
LO 9.2 Discuss the use of AI for personal financial advice.
LO 9.3 Evaluate the responses of different AI platforms to financial queries.
LO 9.4 Analyze the factors that AI platforms consider when providing financial advice.
LO 9.5 Describe how AI is used in fraud detection, including by the U.S. Treasury.
LO 9.6 Discuss the use of AI in the financial industry for various applications.
LO 9.7 Discuss how JPMorgan Chase uses AI within its various business lines.

After discussing AI and ML technology in the previous chapter, this chapter shifts the focus to the business and finance applications of AI and ML. Students will understand the significant implications of AI and ML technologies for business and finance operations and for consumers. Organizations leverage these technologies to drive innovation, enhance efficiency, and augment decision-making processes. People can use AI for personal financial advice.

The chapter further explores the specific domain of AI in finance. By examining the intersection of AI and ML with the finance industry, students will gain insights into specialized applications tailored to this sector. Topics such as risk management, fraud detection, algorithmic trading, and customer service are covered. Also discussed are the unique opportunities and challenges associated with implementing AI and ML solutions within financial institutions, offering a nuanced discussion of this dynamic field.

9.1 ChatGPT Adoption

This section delves into the analysis of **ChatGPT,** a product developed by OpenAI, a San Francisco–based AI research and deployment company. GPT stands for Generative Pretrained Transformer, representing a concept in which responses are generated through pretraining by humans and subsequently transforming input into expressive output. OpenAI has periodically released upgraded versions of its AI product, most recently, ChatGPT-4. ChatGPT functions as an AI multimodal language, capable of generating natural language text from both image and text prompts. It emulates human conversation, providing responses based on user requests.

The development and funding of ChatGPT have seen several rounds and involvement from various groups. Elon Musk was a key cofounder of OpenAI, contributing an initial funding of $100 million. Musk resigned from the company's board in 2018, citing the time commitments required by his companies, Tesla and SpaceX,

to address existing challenges, as well as conflicts between some OpenAI services and Tesla, as reasons for his departure.

ChatGPT
An AI chatbot that uses machine learning to generate human-like responses to natural language prompts.

Apart from Musk, other notable funders include

- Sam Altman, CEO of OpenAI
- Ilya Sutskever, chief scientist at OpenAI
- Greg Brockman, CTO of OpenAI
- John Schulman, research scientist at OpenAI
- Wojciech Zaremba, research scientist at OpenAI
- Jessica Livingston, Reid Hoffman, and Peter Thiel, major financial backers and strategic supporters

OpenAI benefits from the support of two key partners for their ChatGPT product: Microsoft and Nvidia. Each partner contributes distinct forms of support to the product, with Nvidia providing the GPU and Microsoft supplying the supercomputer infrastructure, as shown in Figure 9.1.

Further, Microsoft made substantial investments of over $1 billion in both 2019 and 2021. In January 2023, they furthered their commitment with an additional $10 billion investment in OpenAI. This partnership ensures that Microsoft's Azure remains the exclusive cloud provider for OpenAI, with Microsoft integrating GPT models across its product suite.

Consider the following computing capabilities of ChatGPT.

- ChatGPT-3 boasts 175 billion parameters, whereas ChatGPT-4 scales up to 100 trillion parameters.
- ChatGPT-3 handles approximately 10 million queries daily.
- The accuracy (tolerance) of ChatGPT-3 stands at 76 percent, while ChatGPT-4 achieves 90 percent accuracy.
- ChatGPT leverages various technologies, including neural networking, supervised learning, and reinforcement learning.

The engineering behind ChatGPT involves a multilayered weighted algorithm, incorporating pattern recognition and a large language model. Pattern recognition aims to mimic human-like responses. For example, it uses (1) textual relationship analysis to construct coherent replies, (2) a word probability list guiding the selection of subsequent words, (3) the integration of a stop mechanism influenced by request length and format, and (4) a randomness in the ranking process to prevent solely choosing the highest probability option.

9.1.1 Speed of ChatGPT Adoption

As of May 2024, ChatGPT had over 200 million active users per week. ChatGPT experienced unprecedented exponential growth in users and traffic. For example, as shown in Figure 9.2, it took only five days for it to reach 1 million users after launching in

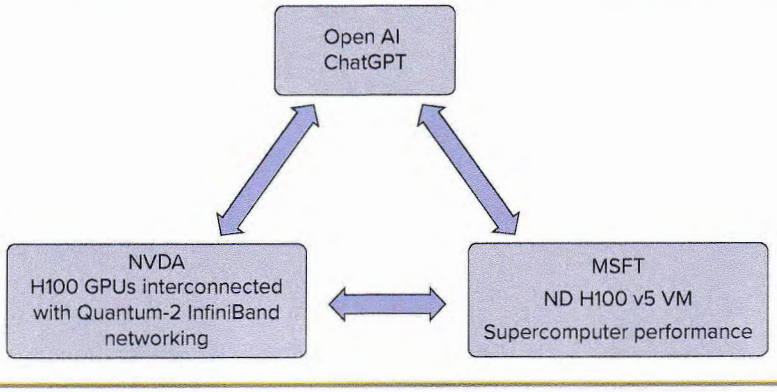


FIGURE 9.1
Cooperation among OpenAI, Nvidia, and Microsoft

November 2022. Comparatively, it took Instagram approximately 2.5 months to reach 1 million downloads. And Netflix had to wait around 3.5 years to reach 1 million users.

ChatGPT also achieved 100 million users very rapidly, as shown in Figure 9.3. It achieved that status in two months, while the next-fastest apps to reach this milestone were TikTok (9 months), Instagram (30 months), and Pinterest (30 months).

Interest in ChatGPT can be measured with Google Trends data. The web search interest for ChatGPT commenced in November 2022 and reached its pinnacle in April 2023, both in the United States and globally, as shown in Figure 9.4. Note that the figure shows an index in which 100 is the highest to date.

FIGURE 9.2

Time to reach 1 million users
ChatGPT

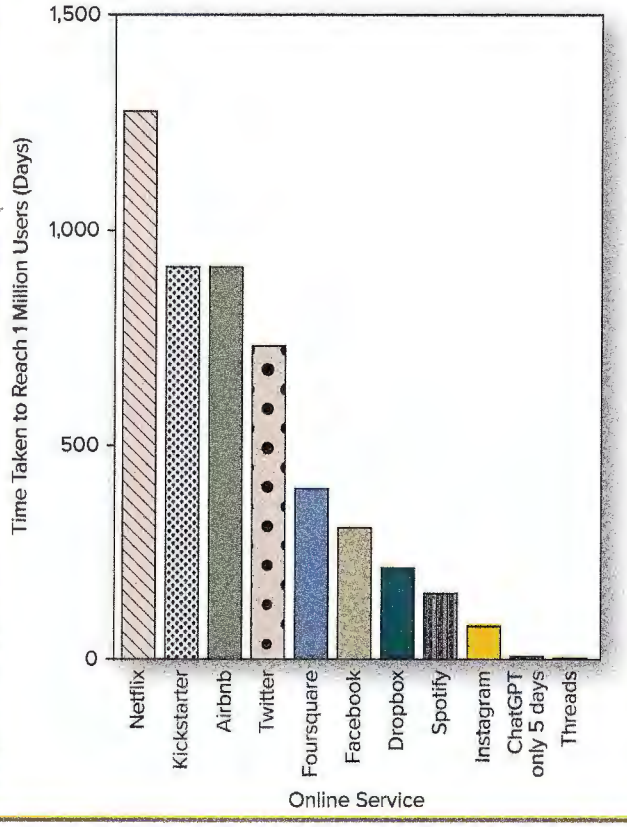


FIGURE 9.3

Months to reach 100 million users
ChatGPT 06/23/2025

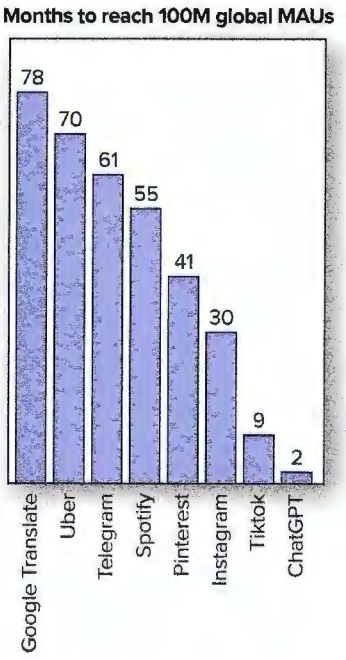
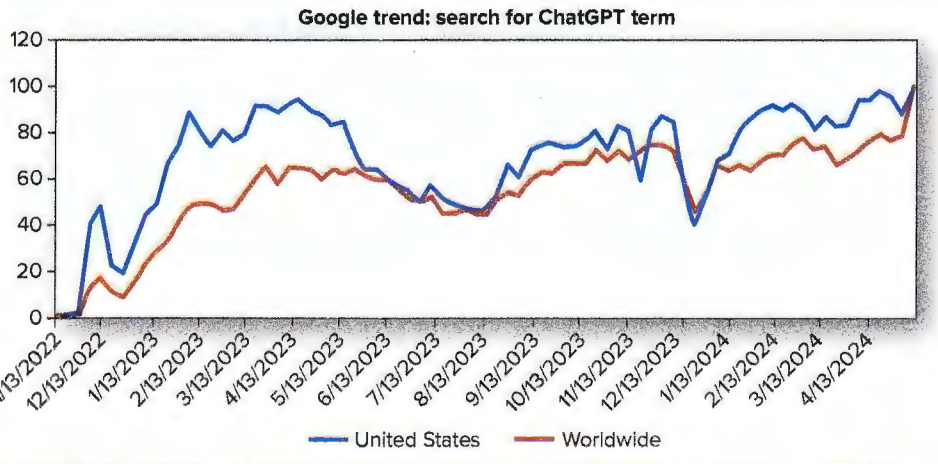


FIGURE 9.4

Google search trends for ChatGPT
McGraw Hill LLC



FINTECH IN THE NEWS

Meta Becomes AI Behemoth with Llama

Meta is known for Facebook, Instagram, WhatsApp, and the metaverse. Its Llama AI models have been integrated into its social media platforms, and now other businesses are using Llama to develop their own AI software. Meta AI has shared that a few large companies like AT&T, DoorDash, Goldman Sachs, Nomura Holdings, Shopify, and Zoom have adopted Llama models for a range of business functions that include customer service, document review, and computer code generation.

Llama (Large Language Model Meta AI) is a group of autoregressive large language model tools released by Meta AI. It was first released February 2023 and is now in version Llama 4, as of April 2025. Two of the models are small enough to run directly on smartphones and laptops for on-device inference, which speeds up processing and improves privacy because they do not need the cloud. Larger models add visual reasoning to text-generating capabilities so they can identify images, pull information from charts and graphs, read handwriting, and work with other visual data.

Meta has also developed three safety models, Llama Guard, Prompt Guard, and Llama Code Shield, designed to prevent Llama models from running harmful prompts or generating insecure computer code.

The Llama models are freely available for almost anyone to use for research and commercial purposes. If you want to try these models for yourself, go to Meta AI: https://www.meta.ai/.

9.2 AI in Consumer Finance

Three popular AI platforms used by consumers are Open AI's ChatGPT, Google's Gemini, and Microsoft's Copilot. To determine how these AI platforms respond to financial queries, each of these platforms was asked several finance questions. Some questions were very specific, and others were more about the big picture.

9.2.1 Specific Financial Questions

Consider the following question posed to the AI platforms:

> *What portfolio asset allocation do you recommend for a 65-year-old man who is retiring with $1.5 million in investment assets, no mortgage, and no pension?*

The responses from each platform are summarized in Table 9.1. First, notice that ChatGPT's recommendations are much narrower, with allocations of 35 to 40 percent in stocks, 50 to 55 percent in fixed income, and 5 to 10 percent in alternative investments. Gemini and Copilot recommendations have more broad ranges, like Gemini's 40 to 60 percent in stocks, 30 to 50 percent in fixed income, and 10 to 20 percent in cash equivalents.

At first glance, ChatGPT's recommendation appears more conservative than the others because of the lower allocation to stocks. However, ChatGPT includes a recommendation for a 10 percent allocation to international stocks and 5 to 10 percent allocation to alternative investments.

Copilot is the only platform that recommends index funds and bond funds, while ChatGPT and Gemini recommend owning the stock and bond securities directly. Owning low-cost funds is likely better advice to the average person who has little interest in picking individual stocks and bonds and who is not knowledgeable about portfolio construction and diversification.

TABLE 9.1 | Asset Allocation Recommendations

	ChatGPT	Gemini	Copilot
Stocks	35%–40% A mix of U.S. large-cap dividend-paying stocks 10% international	40%–60% Focus on large-cap and dividend-paying stocks	30%–50% Dividend-paying stocks or low-cost index funds for growth and income
Fixed income	50%–55% High-quality government and corporate bonds, along with some inflation-protected securities (like TIPS)	30%–50% High-quality government and corporate bonds, and some short-to-intermediate-term bonds	40%–60% High-quality bonds or bond funds
Cash equivalents		10%–20%	5%–10%
Alternatives	5%–10% Real estate investment trusts, preferred stocks, or other		

Results generated by ChatGPT took place on March 26, 2025. Results generated by Gemini took place on March 26, 2025. Results generated by Copilot took place on March 26, 2025. AI companies might have changed or improved their outputs since this content was generated.

The AI platforms also provided additional explanations and recommendations. Common mentions include the following:

- Consider individual circumstances such as risk tolerance, health considerations, income needs, and overall financial goals.
- Review and rebalance your portfolio.
- Consult a financial advisor.

Now consider the following question posed to the AI platforms:

> *A person got a 30-year mortgage of $500,000 at a 6.5 percent interest rate. Four years later, interest rates dropped to 5.3 percent. If it costs 1.5 points to refinance and they plan to keep the house for many years, should the mortgage be refinanced? What are the savings?*

Table 9.2 summarizes the responses from each platform. Note that the three platforms computed different monthly payments for the current mortgage. Using a time value of money calculator with n = 360 months, I = 6.5/12, PV = 500,000, FV = 0 produces the monthly payments of $3,160.34. Copilot was the closest and simply rounded to the nearest dollar. ChatGPT was next closest at $3,157, and Gemini was the furthest at $3,187.09. Interestingly, Gemini might seem to be the most accurate because it reports the answer to the penny while the others round to the dollar. Yet, Gemini was the least accurate. These errors carry through to the rest of the calculations.

After four years, the remaining balance of the mortgage is $475,297.86. Interestingly, Copilot was the most accurate for the monthly payment, which should have allowed it to compute a more accurate balance, yet its balance estimate was the least correct. For the new mortgage, both ChatGPT and Copilot assumed it would be the standard 30-year

TABLE 9.2 | Mortgage Refinance

	ChatGPT	Gemini	Copilot
Monthly payment	$3,157	$3,187.09	$3,160
Remaining balance	$475,400	$474,904	$478,000
Assumed term of new mortgage	30 years	26 years	30 years
New monthly payment	$2,633	$2,872.48	$2,650
Refinance cost	$7,130	$7,123.56	$7,170
Payback period	–	22.64 months	14 months
Monthly savings	$524	$314.61	$510
Total cost savings	≈ $30,000	$90,943.56	–
Refinance?	Yes	Yes	Yes

Results generated by ChatGPT took place on March 26, 2025. Results generated by Gemini took place on March 26, 2025. Results generated by Copilot took place on March 26, 2025. AI companies might have changed or improved their outputs since this content was generated.

period. Gemini assumed it would be for the remaining 26 years of the current mortgage. Of course, that assumption impacts the rest of the estimations.

At an interest rate of 5.3 percent, a refinanced 30-year mortgage will have monthly payments of $2,639.35. Also, with a balance of $475,297.86, the 1.5 percent refinancing cost (called points) is $7,129.47. All platforms were close on the refinancing costs estimates. Even though there were errors in the estimates for this situation, all platforms made a good recommendation that the homeowner should refinance the mortgage.

Consider the following question posed to the AI platforms:

> *I am a 26-year-old woman earning $75,000 per year. I currently have little savings. I have $20,000 left on a student loan and $25,000 in car debt. My employer offers a traditional 401(k) plan. I can contribute up to 10 percent of my pay and my employer will match up to 5 percent of pay. How much should I contribute?*

In this case, the recommendations from the three platforms were very consistent. They all recommended the following:

- Contribute at least 5 percent of the salary to the 401(k) plan to maximize the employer match.
- Prioritize paying off high-interest rate debt first.
- Build an emergency fund of 3 to 6 months' worth of living expenses.
- Gradually increase the 401(k) contribution to 10 percent.

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Gemini went further than the other two platforms to illustrate how the 5 percent contribution would impact her monthly income.

Annual income:	$75,000
Monthly income (before taxes):	$6,250
401(k) contribution (5%):	$312.50/month
Employer match:	$312.50/month
Remaining income:	$5,625

Results generated by Gemini took place on March 26, 2025. AI companies might have changed or improved their outputs since this content was generated.

Unfortunately, the Remaining Income computation is not correct. Gemini seems to have subtracted both the employee's and employer's contributions from the monthly paycheck. The woman's remaining income is $5,937.50 (= $6,250 – $312.50). In addition, since the 401(k) plan contribution is done pre-tax, she does not pay income taxes on it as she does on the rest of her income. Thus, there will be a small tax savings as well.

9.2.2 Big Picture Financial Questions

Consider the following question posed to the AI platforms:

> *What factors should be considered when choosing between active and passive investing in today's market?*

This question describes a common argument in the investment community: Should an investor actively buy and sell stocks and mutual funds, or should they invest in index funds and passively hold those investments? Proponents of the active approach argue that it allows investors to capture extra returns from undervalued stocks and play defense in down markets. Advocates of the buy and hold philosophy argue that it costs less in fees and trading costs, allows for fewer behavioral biases, and ultimately enjoys a higher return. Table 9.3 reports the factors to consider when making the active versus passive investing decision by AI platform. The factors are shown in the order presented in the platform responses.

TABLE 9.3 | Factors to Consider When Choosing Between Active and Passive Investing

ChatGPT	Gemini	Copilot
Market efficiency	Market efficiency	Market conditions
Cost	Fees	Cost
Investment goals and risk tolerance	Investment goals and time horizon	Time and effort
Investment horizon	Risk tolerance	Risk tolerance
Tax considerations and portfolio turnover	Market volatility	Investment goals
Expertise of fund managers	Tax implications	Tax implications
	Personal involvement	
	Current market considerations	

Results generated by ChatGPT took place on March 26, 2025. Results generated by Gemini tat took place on March 26, 2025. Results generated by Copilot took place on March 26, 2025. AI companies might have changed or improved their outputs since this content was generated.

All platforms mention that cost, investment goals, risk tolerance, and tax implications are important factors. ChatGPT is the only one to mention the expertise of fund managers as an important factor but also fails to mention current market conditions. Gemini's Personal Involvement factor likely is referring to the same factor as Copilot's Time and Effort. Copilot fails to mention **market efficiency,** which concerns the extent to which stock prices incorporate available information. If market prices do not fully incorporate information, then opportunities may exist to make a profit from finding under- or over-valued stocks. If markets are very efficient, then active strategies will be less effective. Gemini provides the only mention of market volatility as a factor.

market efficiency

The extent to which stock prices incorporate available information.

Now consider the following question posed to the AI platforms:

> *What are three things that investors should be aware of before seeking financial advice from an AI?*

A condensed form of ChatGPT's response is as follows:

- *Personalized advice.* AI-generated advice typically provides general information and is not tailored to individual financial circumstances. It lacks the ability to fully understand personal factors like risk tolerance, financial goals, or specific tax situations that a licensed financial advisor would consider.
- *Limitations and data accuracy.* AI tools rely on historical data, programmed algorithms, and available information, which might not capture the most up-to-date market conditions or unexpected economic changes.
- *Regulatory and professional considerations.* AI is not a substitute for a licensed financial advisor, and its advice may not meet the fiduciary standards that come with personalized, professional guidance.

Results generated by ChatGPT took place on March 26, 2025. AI companies might have changed or improved their outputs since this content was generated.

ChatGPT is focusing on limitation on personal information, current market data, and regulatory concerns. These are results generated by ChatGPT that took place on March 26, 2025. AI companies might have changed or improved their outputs since this content was generated.

Now, compare that to a condensed form of Gemini's response. Although the query asked for three things investors should be aware of, Gemini was able to squeeze in more concerns by grouping them into three categories.

1. Limitations in understanding nuance and context
   - *Emotional intelligence.* AI lacks the emotional intelligence and empathy that human financial advisors possess.
   - *Contextual understanding.* AI might struggle to interpret complex, real-world scenarios that require contextual understanding and subjective judgment.
   - *The "Black Box" problem.* It can be difficult to understand precisely how AI arrived at a particular recommendation.

2. Data bias and accuracy
   - *Data dependence.* AI's performance is heavily reliant on the quality and completeness of the data it is trained on.
   - *"Hallucinations."* AI will give information that is completely false but present it as if it is fact.
   - *Market volatility.* AI models trained on historical data may struggle to adapt to sudden shifts in market conditions or unprecedented economic events.
3. Regulatory and liability concerns
   - *Evolving regulations.* The regulatory framework for AI in financial services is still developing, which creates uncertainty about liability and accountability in cases of AI-generated financial advice that leads to losses.
   - *Lack of personal liability.* AI systems do not have personal liability.
   - *Data security and privacy.* Investors must be aware of the potential risks to data security and privacy.

Results generated by Gemini took place on March 26, 2025. AI companies might have changed or improved their outputs since this content was generated.

Gemini provided an expanded and more sophisticated response to the query than did ChatGPT. For example, it expanded ChatGPT's concern about the limitations in not knowing personal factors to issues of empathy, contextual understanding, and trust. For concerns about data accuracy, Gemini included the possibility of false information and unprecedented economic events. These are results generated by Gemini that took place on March 26, 2025. AI companies might have changed or improved their outputs since this content was generated.

Now, compare that to a condensed form of Copilot's response.

- *General guidance, not personalized advice.* AI can analyze trends, explain concepts, and suggest potential strategies, but it doesn't fully account for an individual's unique financial situation, risk tolerance, or long-term goals.
- *Data quality matters.* AI relies on the information it is trained on or has access to. If the underlying data is outdated, incomplete, or biased, it could impact the accuracy of its advice.
- *Limitations in handling complex scenarios.* AI might struggle with nuanced or highly specialized financial cases, such as tax optimization, estate planning, or integrating emotional aspects of decision-making.

Results generated by Copilot took place on March 26, 2025. AI companies might have changed or improved their outputs since this content was generated.

Copilot's response is structured similarly to that of ChatGPT. The first two issues on generalized device and data quality are equivalent between the two platforms. However, Copilot does not mention regulatory issues but does add limitation in handling complex scenarios. These are results generated by Copilot that took place on March 26, 2025. AI companies might have changed or improved their outputs since this content was generated.

In general, all three platforms provide important considerations for investors using AI platforms for financial advice. Gemini seems to have provided the most comprehensive response.

venture capital

Investment funding for early-stage, innovative businesses that also provides finance and operational expertise for start-up companies.

9.3 AI in the Financial Industry

Artificial intelligence has transformed various sectors, introduced new possibilities, and changed the way industries operate. From predicting market trends to improving operational efficiencies, AI's applications are impacting the finance industry. As AI continues to advance, its influence on specific sectors such as cryptocurrency, **venture capital,** financial stability, and **corporate social responsibility** becomes more pronounced. AI is being used to support traditional finance and disrupt traditional finance processes.

corporate social responsibility

A business model in which companies integrate social and environmental concerns in their business operations instead of considering only economic profits.

Employing machine learning (ML) decision-making processes can enhance how financial institutions analyze data, manage risk, and make investments. Notable effects include

- Revolutionizing the industry by modernizing traditional manual banking practices.
- Unveiling deeper insights from amassed data.
- Facilitating swift, contactless interactions with real-time credit approvals.
- Augmenting fraud protection and cybersecurity measures.

9.3.1 Financial Data

fundamental data
Information about a company's financial health and stability.

market data
Information about price, volume, and other data that comes from the trading process.

AI is particularly helpful for analyzing data, which supports the effects listed above. There is an enormous amount of data in finance. Table 9.4 delineates the various types of data. There is data about the firm and the economy (**fundamental data**). **Market data** derives from the stock trading process. There is also much data from the analysis of others, like analyst recommendations and credit ratings. Lastly, nontraditional data are being used that involve images, sentiment of popular songs, sentiment of Google Trend searches, sentiment of social media posts, and the like. Using this data, AI can conduct fast real-time calculations, forecast performance metrics, and identify anomalous patterns in spending, sentiment, Google trends, and more.

9.3.2 Banks

The advantage of AI in finance is growing, propelled by the surge in online banking, which fosters contactless transactions and thereby minimizes the necessity for in-person interactions. However, the transition to virtual platforms may engender heightened endpoint vulnerabilities, encompassing smartphones, desktops, and mobile devices.

Thus, the banking industry is using AI in many capacities, including improving efficiency, operations, and customer satisfaction. Evident is an intelligence platform that monitors AI advances in the financial services industry by benchmarking and tracking AI adoption. They created the Evident AI Index to provide a benchmark of AI adoption throughout the banking sector. The Index evaluates 50 of the largest banks in the world against 90 individual indicators. The benchmark uses four aspects of AI capability: Talent, Innovation, Leadership, and Transparency. Talent represents their capability and development. For example, in May 2023, Capital One hired Milind Naphade, a former program director and chief scientist at IBM Research, from Nvidia to head the bank's AI Foundations organization. Innovations measures research, patents, ventures, and their general AI ecosystem. Leadership represents their AI strategy and communications. Transparency is how responsible their AI activities are. Table 9.5 shows the Index and subcategories for the 15 highest-ranked banks.

JPMorgan Chase and Capital One have been getting use cases into production quickly. JPMorgan Chase is using AI in the fields of customer personalization, trading, operational

TABLE 9.4 | **Financial Data Categories**

Fundamental Data	Market Data	Analytics	Alternative Data
Balance sheet	Price/yield/implied	Analyst recommendation	Images
Income statement	Volatility and volume	Credit ratings	Metadata
Cash flows	Earnings	Forecast and projections	Google trends and searches
Macro variables	Dividend/coupon	Sentiment index	X/chats

TABLE 9.5 | **Evident AI Index, 2024**

Bank	Total Score	Talent Rank	Innovation Rank	Leadership Rank	Transparency Rank
JPMorgan Chase	70.0	2	1	3	1
Capital One	68.5	1	3	14	14
Royal Bank of Canada	54.5	6	2	8	10
Wells Fargo	48.4	4	5	36	8
CommBank	46.7	7	12	2	5
UBS	44.6	3	18	15	15
HSBC	44.6	15	9	5	3
Citigroup	41.7	5	7	13	43
TD Bank	40.8	10	8	20	16
Morgan Stanley	40.0	18	4	17	42
Goldman Sachs	39.8	13	6	27	37
BNP Paribas	39.3	12	14	6	21
BBVA	39.1	8	20	7	26
BNY	38.8	20	13	10	11
Bank of America	38.5	11	11	18	20

efficiencies, fraud manager, and credit decisioning. More generally, the finance industry is using AI for

- Process automation and knowledge access.
- Improving customer experience.
- Fraud detection.
- Trading.
- Regulatory compliance.
- **Risk management,**
- Prevention of customer scam losses.

risk management

The process of identifying, assessing, and managing financial risks to reduce an organization's exposure.

9.3.3 U.S. Treasury

The federal government is using AI to fight financial crime. Specifically, the U.S. Treasury Department sifts through massive amounts of data for fraud detection and prevention. In fiscal year 2024, they recovered $4 billion worth of fraud overall and $1 billion worth of check fraud. Rather than rely on generative AI, the fraud detection efforts relied on machine learning to analyze vast amounts of data and make decisions and predictions based on what it has learned.

U.S. officials quietly started using AI to detect financial crime in late 2022, taking a page out of what many banks and credit card companies already do to stop criminals. The goal is to protect taxpayer money against fraud, which spiked during the COVID-19 pandemic as the federal government scrambled to disburse emergency aid to consumers and businesses.

The process combines sifting through endless streams of data and detecting subtle patterns—all in a fraction of the time it would take a human to do it. Experts say that once sophisticated AI models are trained, they can sniff out suspicious transactions in mere milliseconds. The AI systems flag suspicious transactions for a human to examine so that the federal agencies make the final determination of whether something constitutes fraud.

More fraud detection is coming. The Treasury is exploring how to adopt the fraud detection methods that leading banks and credit card companies are deploying. The

department is working with federal- and state-administered programs to enhance their fraud detection tools. Lastly, they are teaming up with state agencies to fight unemployment insurance fraud.

9.3.4 Credit Risk Scoring

credit reporting agency
A private company that collects and sells information about a person's credit history and financial situation, also known as a credit bureau or consumer reporting agency.

credit risk
The potential that a borrower will not repay a debt obligation.

Experian is one of the main consumer **credit reporting agencies.** In addition to that, it offers AI-powered **credit risk** management solutions to financial institutions and companies that include advanced data modeling, alternative data integration, and customizable risk assessment tools. Advances in machine learning and modeling are making credit risk decisions more efficient and precise.

The new techniques can overcome some of the limitations of traditional credit risk models. The following are some examples:

- *Slow analysis.* Building traditional credit risk models takes many months. They may start to underperform if there's a sudden shift in consumer behavior or a world event that impacts people's finances. However, ML adapts much quicker.
- *Less data.* New ML models can analyze vast amounts of information and uncover data points that are more highly predictive of risk.
- *Lower performance.* Applying machine learning models can increase accuracy and effectiveness, allowing lenders to make better decisions.

ML models quickly incorporate all types of data available to them, like internal data, alternative data, credit bureau data, credit attributes, and more. Thus, they provide a more accurate view of a consumer's creditworthiness. Note that there are two types of errors prediction models can make: (1) accepting applicants that should be turned down and (2) turning down applicants that should be accepted. The goal is to reduce these errors. In addition, the process is efficient. Models that can more accurately segment and score populations will result in fewer applications going to manual review, thereby saving money.

9.3.5 Cryptocurrency

AI is playing a pivotal role in the cryptocurrency space, particularly in optimizing trading strategies. AI algorithms can analyze historical price movements and trading volumes to make predictions, identify arbitrage opportunities, and manage risks in volatile markets. With the rise of AI-based trading bots, cryptocurrency investors can automate their trades, benefiting from real-time market analysis. Further, AI enhances the security of cryptocurrency platforms by detecting fraudulent activities and ensuring the integrity of blockchain networks.

9.3.6 Start-Ups and Venture Capital

start-ups
New businesses that are in the early stages of their operations and have the potential for high growth.

Start-ups are leveraging AI to streamline operations, improve customer experience, and scale quickly. AI tools help start-ups analyze data to make informed decisions, automate routine tasks, and gain insights into market trends. ML algorithms can optimize marketing campaigns, enhance customer engagement, and streamline product development processes. AI serves as a force multiplier for start-ups, enabling them to compete with larger, more established companies despite limited resources.

Venture capital firms increasingly use AI to identify promising investment opportunities. AI-driven platforms can sift through vast amounts of data, such as market trends, company performance metrics, and founder profiles, to flag high-potential start-ups. Predictive analytics can also help venture capitalists forecast a company's growth trajectory, assess risks, and make more data-driven investment decisions. AI thus transforms

the venture capital industry by introducing greater precision and insight into the investment process.

9.3.7 Economic Forecasting

Accurate economic forecasts are critical for companies to plan their capital budget investments. Depending on the firm, they require predictions about consumer spending, interest rates, foreign exchange rates, among other information. AI is revolutionizing economic forecasting by analyzing vast data sets in real time, providing accurate predictions about economic indicators like inflation, GDP growth, and unemployment rates. ML models improve the precision of economic forecasts by identifying complex relationships between variables that traditional econometric models may overlook. AI's predictive capabilities enable governments and businesses to make better-informed policy decisions and financial plans.

9.3.8 Fraud Detection

As illustrated in section 9.3.3 on the U.S. Treasury, fraud detection is one of the most impactful applications of AI in the financial services. ML algorithms can detect anomalies in transaction patterns, flagging potential fraud before it occurs. AI continually learns from new data, improving its ability to identify suspicious activities such as identity theft, payment fraud, and insider trading. This application is particularly valuable for banks, credit card companies, and insurance firms, as it reduces the incidence of fraud and minimizes financial losses.

9.3.9 Corporate Misconduct

Corporate misconduct can represent a major cost to shareholder value. Depending on the misconduct, it can also impact society and the environment. Nevertheless, a common type of corporate misconduct is accounting fraud, including earnings manipulation. ML can provide superior misconduct prediction accuracy compared to traditional approaches. For example, ML-based predictions outperform simpler existing fraud models of accounting fraud. In addition to accounting fraud, textual analysis and ML can be used to predict general violations of regulatory rules in the areas of consumer protection, environment, competition, employee safety, and more.

9.3.10 Financial Inclusion for Underserved Populations

AI is helping to bridge the gap in **financial inclusion** by providing access to financial services for underserved populations. AI-driven tools analyze alternative data sources—like mobile phone usage or social media activity—to assess the creditworthiness of individuals who lack formal financial histories. These tools enable people in remote or low-income regions to obtain loans, insurance, and other financial services. AI is playing a critical role in expanding access to financial systems, thereby reducing global financial inequality.

financial inclusion
The policy of providing access to financial services for underserved populations.

9.3.11 Sustainability

AI assists investors and corporations in managing **Environmental, Social, and Governance (ESG)** issues by providing in-depth analysis of sustainability performance. AI tools can aggregate and analyze large volumes of data from company reports, social media, and third-party databases to assess an organization's ESG practices. Investors use AI to make informed decisions about which companies align with their ethical standards, while companies can leverage AI to improve their ESG performance.

Environmental, Social, and Governance (ESG)
A framework that measures a company's performance on sustainability and ethical issues.

In the realm of Corporate Social Responsibility (CSR), AI helps companies monitor and improve their social and environmental initiatives. AI tools can track the impact of CSR programs, analyze feedback from stakeholders, and measure how these initiatives affect a company's reputation. By providing actionable insights, AI allows companies to optimize their CSR efforts, ensuring that they make a positive impact on society while also meeting business goals.

9.3.12 Financial Stability

AI strengthens financial stability by monitoring systemic risks in global markets. Central banks and financial institutions use AI to predict market crashes, liquidity crises, and other financial disruptions by analyzing vast data sets. AI's ability to detect early-warning signs allows policymakers and regulators to take preemptive actions to stabilize markets, enhancing the overall resilience of the financial system.

9.3.13 Disruption: Payment Systems, Crowdfunding, Robo-Investing

Technology is not just making regular financial processes more efficient and effective—it is also completely disrupting some financial segments. Examples include payment systems; **crowdfunding;** and automated trading, investing, and advising.

crowdfunding
A method of funding a project or venture by collecting small amounts of money from many people, usually online.

Electronic payment services allow users to make and receive payments without directly using traditional financial institutions. They can be used by individuals, businesses, and organizations to transfer money or funds electronically. Payments are made through

- Mobile payment apps,
- Digital wallets, and
- Cryptocurrency.

Electronic payments are faster and easier to process than traditional paper checks. They can usually be completed within one to two business days, or even instantly. Some systems are highly effective in rural areas and underdeveloped countries. These payment systems are discussed in detail in Chapter 11.

Crowdfunding is a way to raise money for a project or business by collecting small amounts of money from many people online. It is different from traditional financing methods, which involve raising equity funds from investors through investment banks or loans from banks. Crowdfunding websites connect investors and entrepreneurs, which increases entrepreneurship by expanding the pool of investors beyond the traditional circle of owners, relatives, and venture capitalists. Crowdfunding is discussed in detail in Chapter 10.

robo-advisors
Digital platforms that use algorithms to provide automated financial advice and investment management services using a strategy built around client goals and preferences.

Several forms of automated, or robo, platforms are in the investment arena. For example, **robo-advisors** provide low-cost advice for investors on how to invest their money. Robo-advising is a digital service that uses algorithms to automatically manage and invest money. Unlike human advisors, the best robo-advisors keep a watch on client investments 24/7 and make adjustments as necessary. Some robo-advisors began as start-ups, like Acorns, which later linked with Nobel Laureates in Economics and behavioral finance experts. Traditional financial firms like Vanguard are also implementing a robo-advisor service called Vanguard Digital Advisor.

algorithmic trading
A method of using computer programs to execute trades based on a set of conditions.

Another application is **algorithmic trading,** a method of using a computer program to automatically buy and sell securities based on predetermined rules. The trader sets parameters for the desired trades and positions, such as entry and exit conditions, and the program executes trades based on those parameters. The algorithm can use any typical trading rules from technical indicators, statistical and mathematical computations, to input from other nonstandard datasets. Robo-advising and algorithmic trading are discussed in detail in Chapter 12.

9.4 JPMorgan Chase and AI

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JPMorgan Chase operates as a comprehensive global financial services firm with many business lines. The *Consumer and Community Banking* division caters to individual consumers and small businesses, providing essential services such as retail banking, mortgages, credit cards, auto loans, and small business banking. The *Corporate and Investment Bank* division serves corporations, institutions, and governments, offering investment banking, sales and trading, and treasury services. *Commercial Banking* extends its services to middle-market companies, large corporations, and commercial real estate clients, focusing on lending, treasury services, and investment banking. Lastly, the *Asset and Wealth Management* division provides investment management and wealth management services to individuals, institutions, and endowments. Within these divisions, JPMorgan is using AI to improve efficiency, enhance quality, and provide new services.

9.4.1 Legal Document Review Operating Efficiency

Reviewing legal documents is a labor-intensive process that consumes significant time and resources for a large firm like JPMorgan. Throughout its divisions, it has documents for loan agreements, compliance documents, and various types of contracts. Review of legal documents requires highly skilled professionals to manually sift through thousands of documents. The sheer volume of paperwork and the risk of human error often leads to inefficiencies, missed opportunities, and increased operational costs. To increase efficiency and effectiveness, JPMorgan has implemented its Contract Intelligence (COiN) platform. COiN leverages ML to analyze and extract critical data from legal documents, addressing a long-standing challenge in financial and legal operations. COiN can process and extract data on 12,000 commercial credit agreements in seconds, saving thousands of hours of manual work. Key features of its ability include pinpointing specific critical contract clauses (such as default terms, renewal conditions, and regulatory requirements), risk assessment, and regulatory compliance.

The implementation of COiN has significantly enhanced operational efficiency at JPMorgan Chase, saving over 360,000 work hours annually, translating to millions of dollars in cost savings. The platform also reduces the likelihood of errors, enhancing accuracy in contract reviews and compliance reporting.

9.4.2 Productivity

Like many companies, JPMorgan is improving employee productivity through integrating generative AI tools into its internal operations. Advanced natural language processing and machine learning models assist employees in various tasks like locating information, generating reports, writing emails, and brainstorming innovative ideas. Specifically, an AI-driven chatbot provides employees with quick access to internal resources, which is especially challenging with its large global workforce. The AI models help draft documents and presentations. Reducing time spent on manual tasks allows employees to focus on complex tasks.

9.4.3 AI-Driven Investment Strategies

In its Asset and Wealth Management division, JPMorgan Chase uses IndexGPT, a generative AI tool that combines advanced data analytics with ML to design customized investment strategies for its clients. IndexGPT uses sophisticated algorithms to analyze market data, predict trends, and suggest optimal portfolio allocations for clients. Its capabilities offer real-time updates and adaptive strategies that align with clients' evolving financial goals. IndexGPT supports traditional asset classes like equities and fixed income as well as emerging classes like cryptocurrencies and ESG-focused investments.

IndexGPT enhances JPMorgan Chase's investment advisory services through impacts on client experience, operational efficiency, versatility, and industry leadership. Specifically, its personalized and adaptive investment strategies raise the level of service provided to customers, fostering stronger relationships. The AI-driven platform improves operational efficiency because it automates the analysis and strategy generation process, significantly reducing the time and resources required for portfolio management. In addition, IndexGPT is very versatile as it can cater to a diverse set of clients, from retail investors to high-net-worth individuals. Lastly, leveraging generative AI for investment strategy design positions JPMorgan Chase as a wealth management leader.

9.4.4 AI-Driven Trade Executions

AI algorithms designed for trade execution are transforming how global equity markets operate. By leveraging deep learning and real-time data analysis, these systems can adapt to market fluctuations instantaneously. This capability results in better execution prices and reduced transaction costs, addressing inefficiencies inherent in manual and traditional algorithmic trading methods. JPMorgan introduced LOXM, a sophisticated AI-driven trade execution platform. LOXM predicts price movements and market trends, enabling proactive trade execution and dynamic strategy adjustments to align with real-time market conditions. By analyzing liquidity and market depth, it minimizes the impact of large trades on market prices and customizes execution strategies to meet clients' specific goals and preferences. The introduction of LOXM represents a significant leap forward in trading technology, optimizing transactions and scalability to handle vast volumes typical in the global equity markets.

Consider the benefits that LOXM provides JPMorgan's trading operations.

- *Efficiency.* Trades are processed faster and with more accuracy, increasing overall operational efficiency.
- *Savings.* Minimizing transaction costs and market impact generates significant savings for the bank and its clients.
- *Client outcomes.* Clients experience better execution prices and more personalized trading.
- *Scalability.* LOXM operates seamlessly across JPMorgan Chase's global trading operations, some with diverse markets and high trade volumes.

9.4.5 AI-Powered Fraud Detection

Financial institutions are increasingly targeted by sophisticated cyberattacks and fraudulent activities. The growth in digital banking and e-commerce increases the volume and complexity of transactions, making it more difficult to safeguard client assets and maintain trust in operations. JPMorgan uses advanced AI-driven fraud detection and risk management tools that use machine learning algorithms and predictive analytics to monitor real-time transactions, identify anomalies, and flag suspicious activities. These systems continue to evolve by processing vast datasets and learning from historical fraud patterns to counter new threats.

Summary

This chapter explores the application of AI and ML in business and finance. It discusses the use of such AI platforms as ChatGPT, Gemini, and Copilot for consumer finance, analyzing their responses to specific and broad financial queries. The chapter also delves into AI's transformative role in the financial industry, covering areas such as fraud detection, risk management, algorithmic trading, and customer service. Finally, this chapter examines how financial institutions like JPMorgan Chase are implementing AI to enhance operational efficiency, productivity, investment strategies, trade executions, and fraud detection.

Keywords

algorithmic trading - A method of using computer programs to execute trades based on a set of conditions. *p. 168*

ChatGPT - An AI chatbot that uses machine learning to generate human-like responses to natural language prompts. *p. 156*

corporate social responsibility - A business model in which companies integrate social and environmental concerns in their business operations instead of considering only economic profits. *p. 163*

credit reporting agency - A private company that collects and sells information about a person's credit history and financial situation, also known as a credit bureau or consumer reporting agency. *p. 166*

credit risk - The potential that a borrower will not repay a debt obligation. *p. 166*

crowdfunding - A method of funding a project or venture by collecting small amounts of money from many people, usually online. *p. 168*

Environmental, Social, and Governance (ESG) - A framework that measures a company's performance on sustainability and ethical issues. *p. 167*

financial inclusion - The policy of providing access to financial services for underserved populations. *p. 167*

fundamental data - Information about a company's financial health and stability. *p. 164*

market data - Information about price, volume, and other data that comes from the trading process. *p. 164*

market efficiency - The extent to which stock prices incorporate available information. *p. 162*

risk management - The process of identifying, assessing, and managing financial risks to reduce an organization's exposure. *p. 165*

robo-advisors - Digital platforms that use algorithms to provide automated financial advice and investment management services using a strategy built around client goals and preferences. *p. 168*

start-ups - New businesses that are in the early stages of their operations and have the potential for high growth. *p. 166*

venture capital - Investment funding for early-stage, innovative businesses that also provides finance and operational expertise for start-up companies. *p. 163*

Questions and Activities

1. Discuss the ways in which AI is changing the financial industry.
2. Compare and contrast the asset allocation recommendations provided by ChatGPT, Gemini, and Copilot.
3. Explain the factors that AI platforms consider when advising on active versus passive investing.
4. What are the limitations and potential drawbacks of using AI for financial advice?
5. How is AI being used to enhance fraud detection in the financial industry and by the U.S. Treasury?
6. Explain how AI is changing credit risk scoring.
7. Discuss the role of AI in cryptocurrency trading and security.
8. How are start-ups and venture capital firms utilizing AI?
9. Describe how AI is used in economic forecasting.
10. How does AI contribute to sustainability and corporate social responsibility?
11. Discuss how JPMorgan Chase is using AI to improve its operations and services.

Academic Analysis

Nat Daley and Katherine Hunt, "Technology Will Save Financial Advice," *Financial Planning Research Journal* (2021): https://sciendo.com/pdf/10.2478/fprj-2021-0003

The article explores key aspects of financial and professional responsibility, emphasizing ethical decision-making in financial practices. It discusses the role of corporate governance, transparency, and regulatory compliance in fostering trust among stakeholders. The piece highlights case studies where lapses in responsibility led to financial crises, underscoring the importance of accountability in economic stability. The article also examines emerging trends in financial technology, including blockchain and AI, and their implications for ethical financial practices. Ultimately, it calls for enhanced education and training to equip professionals with the skills to navigate complex financial environments responsibly.

Questions

1. What are the key principles of financial and professional responsibility outlined in the article?
2. Discuss a case study mentioned in the article that illustrates a failure in financial responsibility. What were the consequences?
3. How do emerging financial technologies, such as blockchain and AI, challenge traditional notions of responsibility?

Maureen O'Hara and Artem Streltsov, "Keeping the Faith (and the Returns): An AI Approach to Values-based Investing," Cornell SC Johnson College of Business Research Paper (2024): https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4992209

This paper demonstrates a new approach for SRI investing that uses techniques from AI to enhance investor returns. Focusing on faith-based investing, the paper draws on large language models (LLMs) and deep reinforcement learning (DRL) to address the challenges posed by moral constraints on portfolio selection. Using the Global X S&P500 CATH ETF (the largest Catholic values fund) as an example, it uses textual analysis to identify companies consistent with the values mandate, allowing for the creation of "synthetic CATH" portfolios of different sizes and with longer time horizons. Each portfolio is optimized using DRL to arrive at an optimal set of portfolio weights that maximize out-of-sample Sharpe ratios.

Questions

1. What is value-based investing, and how does it differ from other investment objectives? Why would an investor want to follow this approach?
2. What is the historical performance of faith-based investing, and how could AI change this performance in the future?
3. How do LLMs and DRL techniques pick stocks and optimize the portfolios?

Alex Kim, Maximilian Muhn, and Valeri Nikolaev, *Financial Statement Analysis with Large Language Models,* University of Chicago, Becker Freidman Institute Working Paper No. 2024-65 (2024): https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4835311

This paper investigates whether an LLM can successfully perform financial statement analysis in a manner

similar to a professional human analyst. It provides standardized and anonymous financial statements to GPT4 and instructs the model to analyze them to determine the direction of future earnings. Even without any narrative or industry-specific information, the LLM outperforms financial analysts in its ability to predict earnings changes. The LLM exhibits a relative advantage over human analysts in situations when the analysts tend to struggle. Further, the paper finds that the prediction accuracy of the LLM is on par with the performance of a narrowly trained state-of-the-art ML model. LLM prediction does not stem from its training memory. Instead, the paper finds that the LLM generates useful narrative insights about a company's future performance. Lastly, the trading strategies based on GPT's predictions yield a higher Sharpe ratio and alphas than strategies based on other models. Taken together, the results suggest that LLMs may take a central role in decision-making.

Questions

1. What information is given to the LLM, and what is it trying to predict?
2. How are the results assessed?
3. What are the implications for using LLM for fundamental analysis?

Case Study

AI Financial Services Advice Consistency

Three popular AI platforms used by consumers are Open AI's ChatGPT, Google's Gemini, and Microsoft's Copilot. How do these AI platforms respond to financial queries? This activity explores the consistency and accuracy of financial advice between platform responses to consumer finance queries.

Connect provides

- Lease versus buy query
- Buy now or pay later query
- 401(k) retirement contribution query

Do you trust AI to make your financial decisions?