



How do firms utilize artificial intelligence and machine learning in the wealth management process?

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This paper aims to explain the ways in which wealth management firms make use of artificial intelligence and machine learning in decision making of processes. To better analyze this situation JPMorgan is taken as a case study to observe applications of AI/ML and how the company has benefited from this. Along with this, the paper also aims to highlight the challenges faced with utilizing AI/ML in the wealth management process.

I: Introduction to wealth management

It is an investment advisory service that uses a consultative process to address the needs of affluent clients, that can help assist clients manage their money and provide them with advisory services. This combines other financial services to help tailor a personalized strategy that uses a range of financial products and services for the client's benefit.

II: Introduction to AI/ML

Stands for artificial intelligence and machine learning, AI enables computers to think/ behave like humans and perform tasks on its own. ML is how a computer system constantly develops its intelligence to perform tasks. Machine Learning is a part of artificial intelligence which uses data and algorithms to imitate the way humans learn and develop accuracy. Such tasks are widely used by individuals in the form of voice assistants like Apple's Siri, Amazon's Alexa whereas businesses make use of this technology to carry out extensive research, management tasks, decision making etc.

III: Introduction to Fintech

Fintech is short for financial technology which makes use of technology that can help improve and automate the use of financial services. These services include forecasts, record keeping, decision making etc. Using this technology, firms can better manage their financial operations. Fintech is a rapidly growing industry that serves the interests of both consumers and businesses in multiple ways, for example: Money banking, cryptocurrency and investment apps.

How is AI/ML used in the wealth management process:

In brief, AI/ML can improve data analysis. Modern algorithms of AI/ML help firms analyze large volumes of data from various sources. This is used by firms to carry out many operations such as finance in a more efficient way, where there is vast amounts of data. By using data, AI/ML can be used to identify and control risk in the investment portfolios of their clients, letting them take preventative measures to safeguard investments of their clients by using AI/ML to identify patterns and trends that may lead to problems in the future.

IV: The wealth management process

The wealth management consists of the following steps:

- Gathering financial data
- Establishing financial goals
- Analyzing the portfolio
- Recommending a financial plan
- Implementing the plan
- Monitoring and reporting the plan

Gathering financial data:

In order to analyze the client's current financial situation, there is gathering of financial data. This involves examining the clients income, assets, liabilities, account statements, credit reports and other important data. There is also thorough market research in terms of stocks, in order to advise clients of where and when to invest profitably. In order to do so, the advisory firm must analyze the market's trends and set realistic predictions. Wealth managers interview the client and send out forms and questionnaires as well to better understand the client's current financial circumstances, future financial goals, areas for improvement and risk tolerance which better helps coming up with an investment strategy in the future.

● Market analysis and prediction:

In the process of market analysis and prediction, artificial intelligence can analyze vast amounts of financial data at a significantly higher speed than a human analyst using its algorithms. Other AI algorithms help process historical stock prices, news articles, social media sentiment and financial reports in order to identify trends and correlations in the market. These patterns, when calculated accurately using AI, can help wealth management firms recommend investment based on real time information in order for clients to make more informed decisions.

● Natural Language Processing:

NLP, a subfield of AI, plays a crucial role in enabling computers to comprehend human language. Its primary application lies in assisting companies to decipher unstructured data. While we commonly encounter NLP in everyday phone autocorrect features, it serves more profound purposes in the realm of finance.

In the financial sector, NLP finds utility in various tasks, including classifying financial documents, extracting financial relationships, managing risks, handling asset management, and enriching content. Its versatile applications empower financial firms to process and analyze data more effectively, enhancing their decision-making processes and overall efficiency.

Among the many uses of NLP, a prominent application is in gathering and analyzing market information. Firms rely on this technology to swiftly extract valuable insights from vast volumes of textual data, enabling them to make well-informed decisions and bolster their market intelligence.

Establishing financial goals:

After analyzing the data, wealth managers need to establish the financial goals they want to achieve with input from the client. Wealth managers need to distinguish short-term goals like building an emergency fund or saving for a house, and long-term goals such as retirement planning. To better ensure the effectiveness of the goals the SMART criteria needs to be applied which is, making goals specific, measurable, achievable, relevant, and time-specific. After this the objectives need to be prioritized based on their importance to the clients financial well being, timeline and alignment with the clients values. This lets resources be allocated more effectively. Then there are monetary values attached to these goals which quantifies them. This structured approach helps create a well defined financial plan which is essential to making sure these goals are achieved.

● Robo advisors*:

Robo advisors use AI/ML in order to analyze conditions and provide financial advice in order to establish goals. Automated algorithms send out surveys to clients in order to gather information about the investors predictions, goals and risks. Robo advisors examine financial transactions including investment and other bank transactions etc of the clients. Upon gathering vast data, robo advisors use algorithms to study the financial behavior of clients and accordingly suggest financial goals.

Analyzing the portfolio:

Portfolio analysis is the process of assessing an investment portfolio to determine its alignment with an investor's specific needs, preferences, and financial resources. The primary goal is to evaluate the likelihood of the portfolio meeting the investor's set objectives and mandates, while considering the associated risks. This evaluation involves examining historical performance of asset classes and factoring in elements like inflation. Regular portfolio analysis is crucial for investors as it enables them to make informed decisions

aimed at enhancing their portfolio's returns. If any disparities are identified, adjustments and rebalancing can be implemented to realign the portfolio and ensure progress towards achieving the investor's goals.

- Fundamental analysis:

Wealth management firms leverage AI to analyze unstructured data and text, enabling the generation of insightful reports and relevant information. Subsequently, they employ ML to identify correlations between various asset classes, empowering investors with knowledge about outperforming and underperforming assets within their portfolios.

- Risk Management:

AI/ML plays a crucial role in wealth management firms by analyzing historical trade patterns, identifying outperforming assets, and establishing correlations among different asset classes. This enables effective risk assessment and management of investors' actions. The superior forecasting accuracy of AI/ML models results from their capability to interpret nonlinear effects between scenario variables and risk factors. Consequently, firms can make informed decisions to mitigate a wide range of risks, including operational, technology, liquidity, and market risks, among others. The integration of AI/ML in wealth management brings valuable insights, enhances risk management, and improves investment outcomes.

- Trade management:

AI is implemented in finance by algorithmic trading, where algorithms perform programmed trading instructions that can help make relevant predictions of the market, using variables such as time, volume and price in order to determine the best trading options. This reduces the risk for investors of losing out on transactions. Such trading techniques assist in analyzing transaction costs and executing large trades for wealth managers.

- Recommending a financial plan:

Once goals are set, the next crucial step is to create a financial plan. Wealth managers begin by conducting a consultation to understand their clients' risk tolerance levels, which guides them in devising an appropriate investment strategy. After this, they thoroughly analyze the clients' goals, assessing their feasibility considering the clients' current financial profiles and positions. After analyzing and gathering all of this information, the wealth managers proceed to craft a personalized plan that aligns with the clients' specific needs while keeping their risk tolerance in mind.

- AI driven personalized financial planning:

In the high-stakes world of wealth management, the ultimate goal is to seize profitable opportunities while prudently mitigating financial risks. To achieve this delicate balance, AI is harnessed to analyze intricate data and cash flows, yielding invaluable insights that can swiftly flag suspicious activities and even detect potential fraud. By employing AI-driven analytics, wealth management firms add an extra layer of security and protection for their clients' assets, fostering trust and confidence among investors and enhancing the overall integrity of the financial system.

Beyond risk management, AI/ML's potential extends to improving predictions and market forecasts for assets. Armed with this data, wealth management firms can chart a strategic roadmap aligning clients' present circumstances with their future aspirations and goals. This comprehensive approach allows businesses to consider all conceivable factors that may impact the plan or budget, streamlining the planning process and yielding highly accurate results. As a result, investors can set specific, measurable, achievable, relevant, and time-bound (SMART) objectives, ensuring well-informed and successful investment.

Implementing the plan:

After the financial plan is approved, wealth managers assist their clients in implementing the recommended strategies. This involves various tasks such as opening investment accounts, selecting specific investments, setting up automated contributions, and collaborating with other professionals like tax advisors or estate planning lawyers, if required, to ensure a comprehensive approach to their financial endeavors.

Monitoring and reporting:

Wealth managers play an active role in regularly reviewing and adjusting their clients' investment portfolios and financial plans. They closely monitor the progress of the financial plan and make necessary adjustments to ensure it remains on track and aligned with the clients' changing circumstances, market conditions, and financial objectives. By working closely with clients, wealth managers adapt the plans to accommodate shifts in market dynamics, life events, and evolving goals. This proactive approach ensures that the financial plan stays current, flexible, and tailored to meet the specific goals and needs of each client. Constant communication is a key aspect of wealth managers' service. They keep clients informed with regular updates on the status of their portfolios, market trends, and any modifications made to their financial plans. In addition to this, wealth managers provide financial education, empowering clients to make well-informed decisions and confidently navigate their financial journey. Through this collaborative and informative approach, wealth managers help clients achieve their financial aspirations and build a secure future.

V: How does JPMorgan Chase & Co. Utilize AI/ML

About JPMorgan Chase & Co.:

JP Morgan is a renowned and prestigious banking institution known worldwide. It has a huge amount of assets, \$2.6 trillion, making it one of the largest in the world. While established on 31st December 2000, the New York-based banking giant has a long history that goes back over 200 years. JP Morgan excels in various areas in wealth management, including, investment banking, financial services for consumers and small businesses, commercial banking, financial transactions processing, and asset management. Its success and reputation in the financial industry highlight its ability to adapt and thrive over time. This large firm's influence spans across different sectors, making it a versatile and reliable choice for clients seeking various financial services. With a strong commitment to excellence and a focus on customers, JP Morgan continues to be a significant player in the financial world, shaping the industry's future for generations to come.

The company operates in more than 100 countries worldwide and manages over \$2.6 trillion worth of client assets. JP Morgan does not only rank first in terms of market share of total assets but also the largest market capitalization and value of total domestic deposits in the United States. Its market share and total assets amount to 8.27% and the value of their total assets exceeded \$3.3 trillion in 2022 making them the 5th largest bank worldwide by assets in 2022. JP Morgan has also acquired various other companies and their assets such as Bear Stearns (2008), Climate care (2008), Cazenove group (2010), and WePay (2017) which is Silicon valley based fintech company, etc.

Usage of AI/ML:

NLP:

JP Morgan is actively leveraging AI to gain a competitive edge in the market by enhancing services and reducing costs. Their ambitious research goals involve using AI to predict and influence economic systems, combat financial crime, and empower their workforce.

In their day-to-day operations and decision-making processes, JP Morgan has embraced AI initiatives, particularly in the realm of equity investing. NLP plays a key role in this context, as it enables the analysis and prediction of market conditions based on historical trends. By utilizing NLP technology, the firm can identify investments with the highest potential for profitability.

The integration of NLP in the financial industry began gradually in the late 2000s to the early 2010s. Initially, it was utilized primarily for gauging market sentiment and analyzing various reports, but its applications have since expanded significantly. JP Morgan's forward-looking approach in adopting AI and NLP reflects their commitment to staying at the forefront of technological advancements and achieving their strategic objectives in the financial landscape.

Time series analysis:

Time series analysis is a method utilizing machine learning and statistics to predict future data points within a chronological sequence and probabilities. The goal of time series prediction is to use historical data to develop educated approximations or predictions for upcoming data points. Time series data consists of observations recorded at successive time intervals.

JP Morgan can carry out time series analysis to help with various functions such as risk management, Investment and asset management, Algorithmic trading and more as time series management helps in forecasting future market conditions, asset prices and other economic forecasts. These predictions are important for optimizing investment strategies and real time informed decision-making, recommending a financial plan, reducing risk while establishing financial goals giving JP morgan a competitive advantage in the industry.

Reinforcement learning:

Reinforcement Learning is an area within the machine learning field that trains intelligent agents on learning about optimal behavior and how to make a series of decisions within a given environment with the objective of maximizing their overall rewards. Reinforcement learning employs algorithms that learn from their outcomes to make decisions about their next actions. Following each action, the algorithm receives feedback, indicating if the choice was right, neutral, or wrong. This can let the agents take decisions without any human guidance.

Companies such as JP Morgan can use reinforcement learning in order to do Automated trading, portfolio management, risk management, improving customer service etc. Ex: in Automated trading J.P. Morgan employs reinforcement learning to create trading algorithms which possess the ability to flexibly respond to shifts in the market by learning from past trading occurrences to execute more knowledgeable and strategic trading decisions. Reinforcement learning is especially valuable in steps of the wealth management process such as recommending a financial plan that is flexible and takes into account the dynamic environment.

The adaptability of reinforcement learning to changing circumstances and its capacity to learn from data make it a very valuable asset to JP Morgan

Recommender systems:

A Recommender System has the ability to forecast what an active user may prefer among a group of items. These systems utilize customer data, market insights, and past behavior to offer tailored recommendations, ultimately enhancing customer satisfaction and the effectiveness of their financial services.

These algorithms operate by identifying common patterns in the behavior of consumers or users with similar interests when it comes to a particular service or product after gathering financial data. J.P. Morgan utilizes recommendation systems extensively within its financial services. These systems analyze customer transaction records, preferences, and financial goals to propose customized product and service

recommendations, potentially boosting sales. Personalized financial insights and creditworthiness assessments improve client interactions. The systems leverage customers' financial histories for suggestions on additional services or upgrades. They also aid customer service representatives by proposing solutions.

J.P. Morgan employs recommendation systems for recommending a personalized financial plan, providing personalized services, financial goals specifically tailored towards the client, customer engagement, internal operations optimization, and better decision-making. This can be incredibly helpful for JP Morgan especially to improve customer service by meeting the needs of individual users.

Graph analytics:

Graph analytics involves depicting the connections among different entities through graph structures, and subsequently, exploiting these structures to gain predictive insights and valuable business information.

Though JP Morgan does not specifically state where they use AI/ML to help with graph analytics, here are some ways it's most likely integrated. AI and ML are instrumental in risk management, identifying potential financial risks by analyzing intricate networks of assets and liabilities which are incredibly important when analyzing portfolios. They are vital in fraud detection as they can be used to find any unusual patterns or anomalies in a graph. Credit risk assessment benefits from the evaluation of borrower creditworthiness based on data points and relationships. It can be used to predict optimal paths in graphs helping with strategic planning. It can also find various links and relationships between data. Artificial Intelligence (AI) and Machine Learning (ML) monitor shifts within the graph structure over time, enabling predictive analysis. Combining NLP with graph analytics uncovers valuable information from text data linked to the graph. All the information gathered can be used to establish financial goals and come up with a plan to achieve those goals. It can also be used to monitor how successful a plan is as it can be used to analyze its performance. This fusion delivers sophisticated, data-powered insights in the dynamic finance world.

Large Language models:

Large Language Models (LLMs) are advanced deep learning algorithms designed for diverse Natural Language Processing (NLP) tasks. They rely on transformer models and are trained on extensive datasets, which makes them highly capable in understanding, translating, predicting, and generating text and other content. LLMs are integral to various NLP applications, including translation, chatbots, AI assistants, and more.

Large Language Models (LLMs) are becoming indispensable in the finance sector, transforming the way financial professionals operate. LLMs excel at summarizing complex financial reports, helping experts extract vital insights swiftly. They also provide immediate responses to finance-related queries, from market trends to financial regulations, benefiting both professionals and clients. JPMorgan Chase is in fact one of the first financial intuitions that introduced an AI-powered virtual assistant to facilitate offering a dependable, multichannel customer service experience. This virtual assistant adapts to user behavior through

machine learning, making tailored recommendations to enhance cost-effectiveness. LLMs streamline customer service by providing automated responses to routine inquiries, freeing up staff members for more complex tasks.

LLMs also play a significant role in bolstering security by detecting fraudulent emails, addressing a considerable security risk. Additionally, they generate financial reports, investment recommendations, and market insights with sophistication and precision, improving decision-making in the finance realm. These models also assist in generating code for financial software development and algorithmic trading, automating tasks like data analysis and risk management. They are pivotal in detecting suspicious patterns and potential fraud in financial transactions, enhancing security and risk management.

In summary, LLMs are incredibly useful at JPMorgan, offering a versatile and efficient solution for handling extensive financial data and generating coherent reports. However, their ethical use remains paramount to ensure the integrity and reliability of financial operations.

Lori Beer the CIO at JP morgan has previously said

"We couldn't discuss AI without mentioning GPT and large language models. We recognize the power and opportunity of these tools and are committed to exploring all the ways they can deliver value for the firm. We are actively configuring our environment and capabilities to enable them. In fact, we have a number of use cases leveraging GPT4 and other open-source models currently under testing and evaluation."

Large scale computing:

Large-scale computing combines machine learning (ML) technologies to accelerate complex numerical models and computations. This is essential for managing large amounts of financial data, assessing risk, optimizing portfolios, and making decisions. The automation of investment portfolio optimisation by ML-driven large-scale computing enables data-driven choices for maximizing returns while successfully managing risks. It also plays a crucial part in real-time fraud detection, protecting the company and its clients from fraudulent activities. It is used in the wealth management process in steps such as establishing financial goals, recommending plans and can also be used to monitor the performance after a plan is implemented.

ML and large-scale computing work together to streamline processes, enable informed decision-making, and reduce risk, improving JPMorgans efficiency in a time-constrained and data-intensive environment.

Representation Learning:

Representation learning automatically extracts from raw data the representations required for feature detection or classification. Representation learning is a valuable tool used by financial institutions like J.P. Morgan for various purposes. It can enhance fraud detection by analyzing transaction data, identifying complex patterns and anomalies more effectively than traditional rule-based systems. Additionally, J.P. Morgan employs representation learning to assess credit risk, using deep learning models to analyze diverse data sources, including credit histories and market conditions, resulting in more accurate creditworthiness

predictions. Moreover, it aids in trading and investment decisions by uncovering hidden patterns and trends that human analysts might overlook when analyzing market data and news sentiment. This is very useful in analyzing a portfolio and recommending a plan later on. Representation learning is a versatile technology utilized by J.P. Morgan to improve risk management, provide personalized services, and gain a competitive edge in the financial sector, with specific applications tailored to their business goals and regulatory requirements.

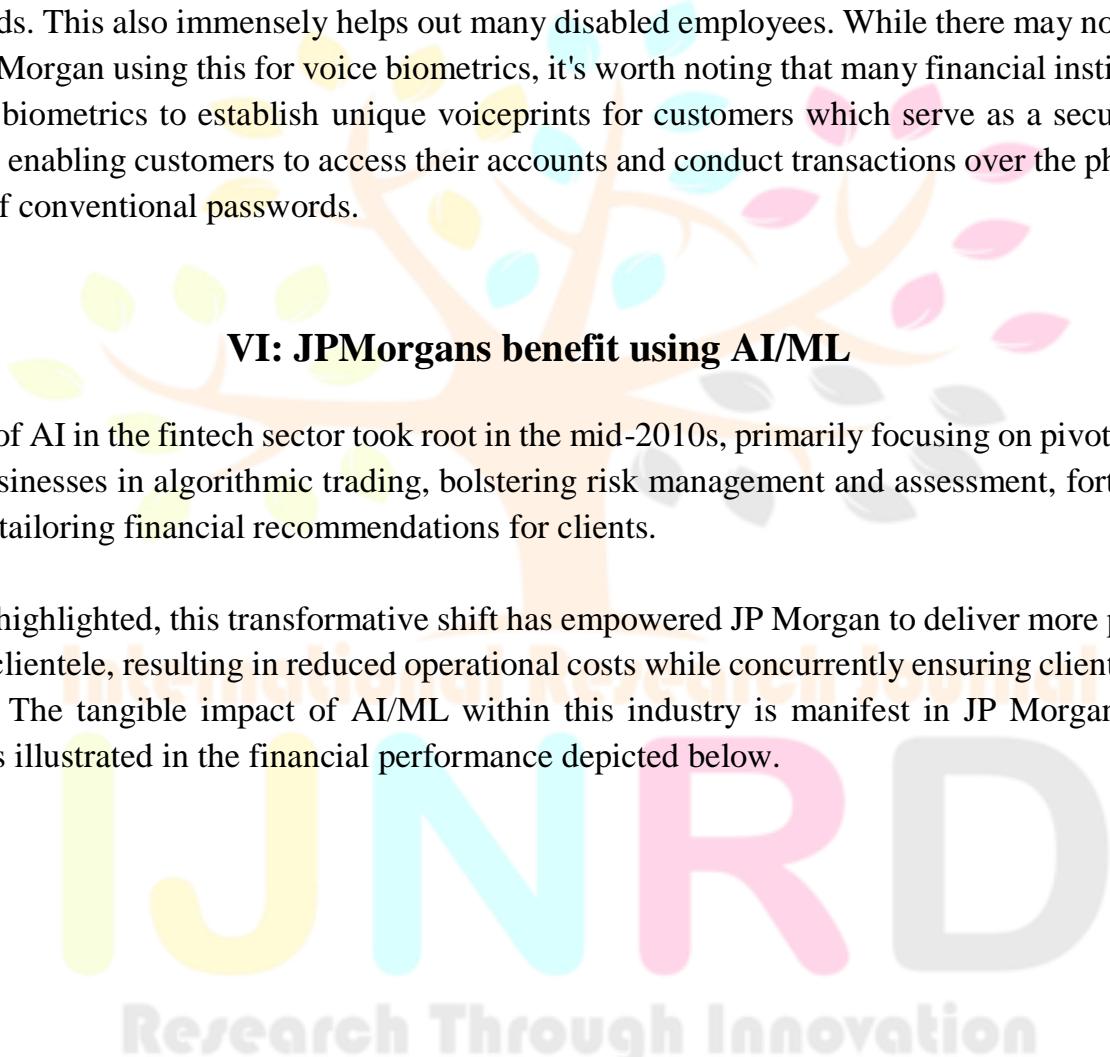
Speech recognition:

JP Morgan uses speech recognition to transcribe spoken language into a written format. This can help with recording and storing customer interactions, meetings, and call recordings to ensure compliance and maintain records. This also immensely helps out many disabled employees. While there may not be specific evidence of JPMorgan using this for voice biometrics, it's worth noting that many financial institutions have adopted voice biometrics to establish unique voiceprints for customers which serve as a secure means of authentication, enabling customers to access their accounts and conduct transactions over the phone without the necessity of conventional passwords.

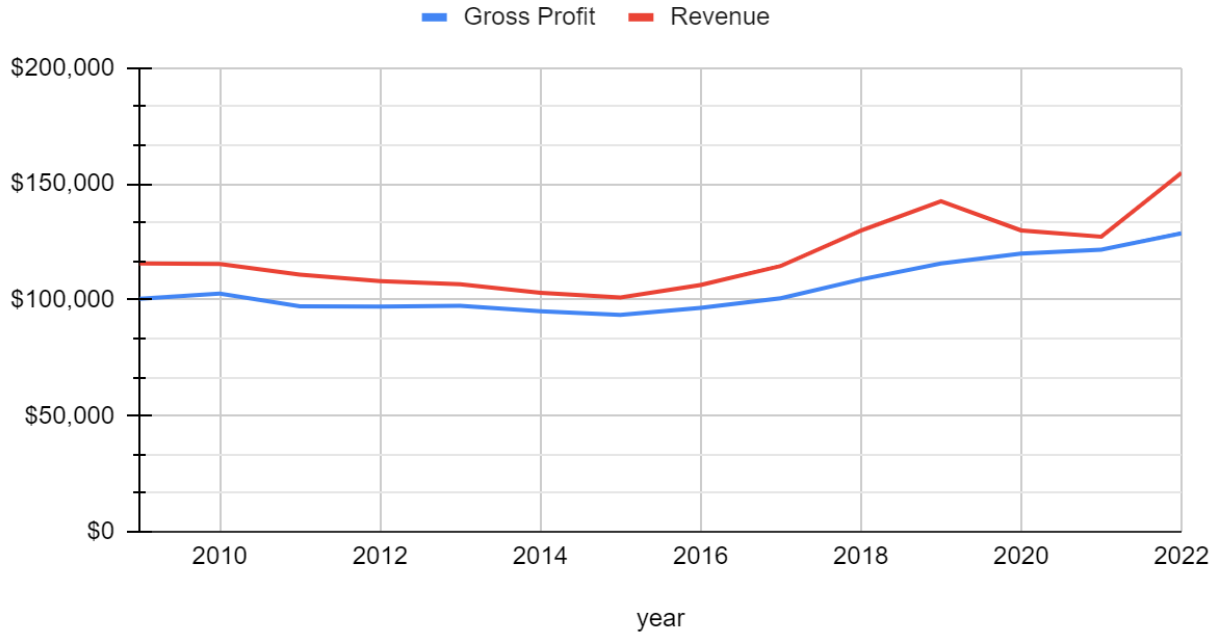
VI: JPMorgans benefit using AI/ML

The inception of AI in the fintech sector took root in the mid-2010s, primarily focusing on pivotal roles such as assisting businesses in algorithmic trading, bolstering risk management and assessment, fortifying fraud detection, and tailoring financial recommendations for clients.

As previously highlighted, this transformative shift has empowered JP Morgan to deliver more personalized services to its clientele, resulting in reduced operational costs while concurrently ensuring client satisfaction in the market. The tangible impact of AI/ML within this industry is manifest in JP Morgan's sustained profitability, as illustrated in the financial performance depicted below.



Gross profit and revenue of JP Morgan



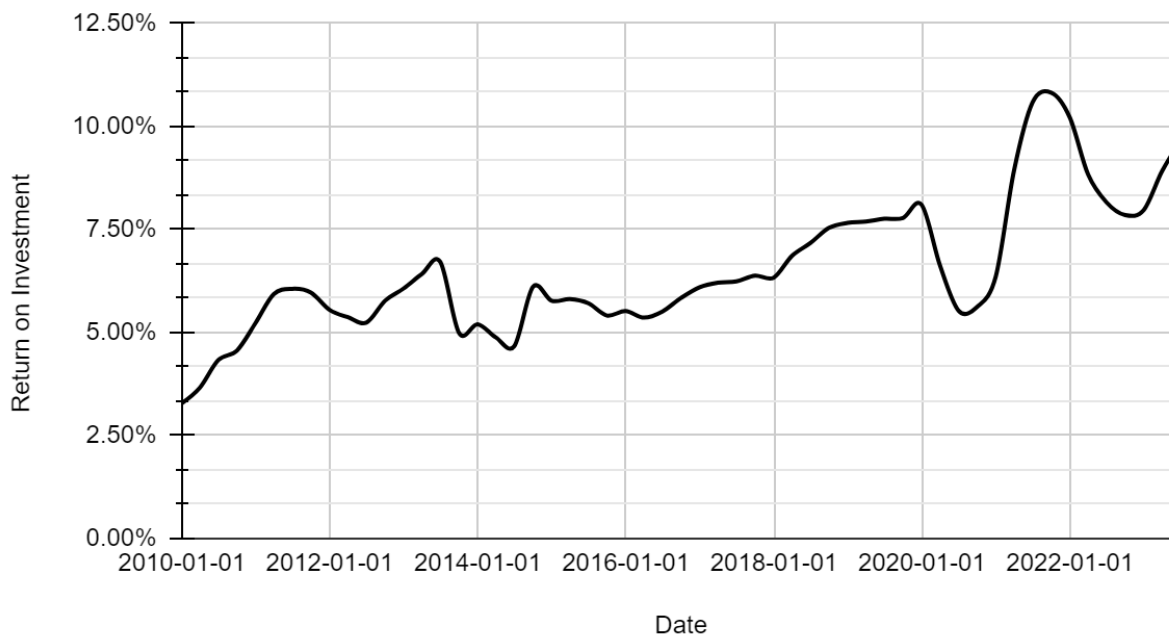
The graph reveals a minor decline in both revenue and gross profit figures between 2012 and 2015. This dip can plausibly be attributed to JP Morgan's substantial expenditures during this period as it embraced new technologies. Adapting to the intricate realm of AI/ML likely incurred significant costs related to development and infrastructure, training and testing, and the integration of these technologies into existing systems, among other factors.

However, it is noteworthy that the subsequent years, starting from 2015, witnessed an upturn in the company's profitability. This observation substantiates the notion that the implementation of AI/ML tools has had a positive and enduring impact on the firm.



The graph below shows the return on investment for JP Morgan over the years.

Return on JP Morgan's investment



The area under this graph can help observe the cumulative return on JP Morgan's investment. Using the trapezium rule, the figure is calculated to be 163.43%. This value can be interpreted as the overall return on investment. In conclusion, a large figure such as this can explain the returns to JP Morgan as a result of investing heavily into artificial intelligence and machine learning over time. Its capabilities of handling financial matters have opened many possibilities for businesses to prosper.

VII: Challenges of using AI/ML in decision making

Data inconsistency:

The data compiled by ai/ml is usually gathered from various sources such as financial institutions, market data providers, and even specific customers. Integrating data from different sources can lead to inconsistencies, including variations in formats, standards, and data quality. There might also be other issues such as data not being regularly updated by all the sources and other anomalies that can lead to the data being inconsistent.

Regulatory compliance:

While numerous countries have developed dedicated AI strategies, only a few jurisdictions currently have specific regulations for AI-based algorithms and models. In most cases, oversight of machine learning applications relies on overarching requirements for systems and controls. This involves rigorous testing of algorithms before market deployment and continuous monitoring of their performance throughout their lifecycle. The focus is on ensuring the reliability, safety, and effectiveness of AI applications rather than

implementing specialized regulations for AI models. Companies utilizing AI/ML in wealth management need to comply with data privacy and security laws such as GDPR and CCPA, ensuring lawful processing and explicit consent. This means that transparency is crucial, and algorithms need to be open, understandable, and compliant. Financial regulations, such as KYC and AML must also be met. Cybersecurity standards are also essential to protect sensitive client data. The regulations can also frequently change as the world learns more about AI/ML. AI/ML is also constantly changing as it becomes more advanced. Navigating all of the rules and regulations can be a complex process that can be difficult and pose a challenge to JP Morgan.

Experience/ expertise:

As AI/ML is still emerging, it can be challenging to find the specialized talent and expertise needed for the development and implementation of AI/ML technologies in wealth management. JP Morgan can only partially depend upon the results of the ai/ml in tasks such as recommending a financial plan or establishing financial goals, as it may not take into account any qualitative data and purely be quantitative.

Change:

As with any new change and emerging technology, people might be hesitant to accept this change. Employees may be concerned about future job security and customers might not fully trust the accuracy of the results put out by AI/ML.

Security risk:

The usage of AI/ML can lead to an increase in a number of external interfaces and flow of data leading to higher security risks. Issues also arise concerning data connectivity and cross-border data flow, especially in financial services. It might make data more susceptible to cyber attacks, etc, and maintaining the ability to aggregate, store, process, and transmit data globally is crucial for financial sector development. This requires robust data and cyber security safeguards and strategies to address the complexities and risks associated with this that can increase costs to JP Morgan.

Biased recommendations:

AI, particularly machine learning algorithms, minimizes subjective data interpretation by focusing on variables that enhance predictive accuracy. It has the potential to improve decision-making and fairness, yet evidence indicates that biases, inherent in training data, can be perpetuated at scale. Biases often stem from human decisions, societal inequities, or historical disparities in the data. Word embeddings, trained on biased sources, may reflect societal stereotypes. User-generated data can create feedback loops reinforcing bias. Machine learning may uncover correlations deemed discriminatory, like age affecting mortgage lending. JP Morgan to Mitigate biases in AI must address data issues and ensure ethical considerations in algorithmic design and deployment.

Stock market crashes:

The widespread adoption of identical AI models in financial institutions poses a risk of collective decision-making based on shared criteria. If these models have common flaws or sensitivity to specific data types, it may result in synchronized decision patterns. This synchronized decision-making, especially if flawed, could trigger a sudden market shift. The interconnected nature of financial markets might amplify this, potentially causing a chain reaction and contributing to increased market volatility. Such herd behavior, driven by identical AI models, raises the risk of abrupt and large-scale movements in asset prices, leading to heightened uncertainty and potential systemic risk that can lead the stock market to crash.

VIII: Evaluation

In conclusion, this research navigates the intricate intersection of wealth management and artificial intelligence/machine learning (AI/ML), using JP Morgan as a case study. The investigation explores how AI/ML transforms wealth management processes, exemplified by JP Morgan's adoption of technologies like Natural Language Processing and recommendation systems. While the case study highlights the tangible benefits, such as streamlined operations and tailored financial solutions, challenges like data inconsistency, regulatory compliance, and algorithmic biases underscore the need for responsible AI usage. The evolving landscape demands continuous innovation, positioning AI/ML not just as an efficiency tool but as a catalyst redefining how wealth management operates. The delicate balance between seizing profitable opportunities and mitigating risks through technology, as demonstrated by JP Morgan, shapes a future financial landscape that is intelligent, adaptive, and client-centric.

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