UNIVERSITÀ POLITECNICA DELLE MARCHE

FACOLTÀ DI ECONOMIA "GIORGIO FUÀ"

Corso di Laurea triennale in Economia e Commercio

APPLICAZIONE DELL'INTELLIGENZA ARTIFICIALE (IA) IN FINANZA

APPLICATION OF ARTIFICIAL INTELLIGENCE (AI) IN FINANCE

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Anno Accademico 2023/2024

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INTRODUCTION

Artificial intelligence has radically transformed the financial field, becoming a fundamental aspect for many operations, ranging from daily operations to the most complex and elaborate ones. This technology, that is generated by algorithms and machine learning, has revolutionized financial data analysis, increasing precision levels, reducing risk, and optimizing investments.

An unparalleled advantage of artificial intelligence is certainly its timing: in incredibly rapid times, it can process a vast amount of data, identifying highly complex trends. Thanks to this, financial operators can make more informed decisions, improving their responsiveness to the ever-changing markets.

Artificial intelligence analyzes an enormous compilation of historical data, seeking to build an accurate picture of the surrounding situations. It can adapt to constant market fluctuations or more broadly to global changes and variables that are more commonly recurrent in the current times, it has the capacity to constantly update itself in almost every field to be prepared to face new scenarios and unexpected events. This flexibility allows for real-time risk management and consequently making more reasoned decisions regarding financial operations.

Another fundamental element is the reduction of human error. Artificial intelligence helps minimize human involvement in financial decisions, minimizing possible errors that might result from emotional factors and subjective evaluations that are outside of the professional scope. This increases the system's neutrality, making it fairer and more neutral, it also helps the efficiency and performance.

To summarize, the appearance of artificial intelligence in the finance sector has generated a radical change in how decision-making is made, investments are managed, and risks is evaluated. The ongoing innovation is making the system increasingly efficient, this progression and innovation has the goal of achieving growth and success that were until some years ago unimaginable.

This document aims to illustrate, describe, and fully immerse the reader in the world of artificial intelligence, its countless applications, challenges, and ethical aspects. We will explore how AI is applied to the world of finance, its advantages and disadvantages, the related challenges faced, and how it is fundamental today to achieve economic system efficiency.

1. GENERAL OVERVIEW OF ARTIFICIAL INTELLIGENCE

1.1. AI HISTORY: A LEAP BACK TO 1956

The term "artificial intelligence" was first coined in 1956 by John McCarthy when he invited a group of researchers from a wide variety of disciplines, such as neural network scholars or complexity theory scientists, to a summer workshop called the "Dartmouth Summer Research Project on Artificial Intelligence" to discuss what would later become the field of AI. The main purpose of that meeting was to clarify and develop concepts around "thinking machines" that until then had been several discordant with each other. McCarthy is said to have chosen the name "artificial intelligence" for its neutrality in order to avoid emphasizing one of the tracks pursued at the time that included cybernetics, automata theory and complex information processing.

1.2. CAPTURING THE ESSENCE OF ARTIFICIAL INTELIGENCE: THREE DEFINITIONAL PERSPECTIVES

Today, modern dictionary definitions focus on AI as a subfield of computer science and how machines can mimic human intelligence.

The English Oxford Living Dictionary provides this definition for the term AI: "The theory and development of computer systems capable of performing tasks that normally require

human intelligence, such as visual perception, speech recognition, decision making, and translation between languages." [1]

The Treccani Italian dictionary, on the other hand, tends to emphasize how this discipline is split into two complementary paths: "Artificial intelligence (AI): A discipline that studies whether and how more complex mental processes can be reproduced through the use of a computer. Such research is developed along two complementary paths: on the one hand, artificial intelligence seeks to approximate the operation of computers to the capabilities of human intelligence, and on the other it uses computer simulations to make hypotheses about the mechanisms used by the human mind."[2]

Finally, we directly consulted artificial intelligence itself to obtain a definition of "artificial intelligence," and we obtained the following response:

"Artificial intelligence is a field of computer science that focuses on creating systems and algorithms that can emulate certain human capabilities, such as reasoning, learning, perception, and adaptation to the environment. These systems are designed to process data, learn from it, and make decisions or perform actions based on previous patterns, algorithms, or experiences. The main goal is to create machines that can perform tasks that would otherwise require human intelligence."

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[1] "The theory […] languages". Retrieved from https://languages.oup.com/
[2] "Artificial Intelligence […] mind". Retrieved from https://www.treccani.it/enciclopedia/intelligenza-artificiale/#

These three definitions, while similar in the context of artificial intelligence, offer different perspectives that together provide a thorough and comprehensive understanding of the topic. Each definition contributes a unique aspect, allowing for a broader and more detailed picture of artificial intelligence and its many dimensions.

1.3. INNOVATIVE APPLICATIONS OF ARTIFICIAL INTELLIGENCE

We are in the middle of a global technological revolution, in which all countries and institutions around the world are striving to create ever better technological innovations in the subject of artificial intelligence. It has therefore become commonplace today to observe the application of artificial intelligence in an extremely wide and diverse range of fields, covering virtually every imaginable and possible area of activity.

1.4. THE TOP FIVE APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN 2023

Among the many applications of artificial intelligence, five areas in which it is most widely used in the current year of 2023 stand out.

The five most popular uses in 2023 are:

- <u>E-commerce and retail:</u> In this sector artificial intelligence is mainly used to collect data about the consumer to improve the customer retention aspect.

- Healthcare: Artificial intelligence is being used in a variety of areas in the healthcare sector, finding countless and diverse applications, some examples of which are: the development of sophisticated machines that can detect diseases and identify cancer cells, accurately measure heart rates, analyze large amounts of data where a lot of time is required, and more.

- Agriculture: AI helps farmers detect diseases, pests or inadequate feed. Through the application of computer vision, robotics and machine learning can help to monitor the growth of grasses to avoid disasters and waste.

- Lifestyle: Technology is profoundly shaping the way we live, and it is progressively enriching our daily lives through new applications that rely on Artificial Intelligence. One example is for sure e-mails, which thanks to AI are filtered so that they can be divided into two folders: advertisements are placed in the spam section, while relevant e-mails are shown on the homepage.

- Robotics: A robot using AI can detect obstacles in real time and plan its path in advance.

1.5. COMPUTED TOMOGRAPHY AND VOICE ASSISTANT

Certainly, among the best applications of artificial intelligence there are voice assistants and computed tomography, both tools of great relevance and impact.

- Computerized tomography: is a diagnostic imaging technique that allows different parts of the body to be examined for diagnostic and therapeutic purposes. It is a radiological examination that involves the collection of data related to the passage of various X-ray beams over the affected area and their reprocessing by a computer to reconstruct a three-dimensional image of the different types of tissue being analyzed[3].

- Voice assistant: in 2011 Apple introduced Siri as a voice assistant within its iPhones. Siri makes Machine Learning and Artificial Intelligence its extra weapons: in fact, it is the AI that is responsible for recognizing the sentences heard and deducing grammatical constructs.[4]

2. THE REVOLUTIONARY IMPACT OF ARTIFICIAL INTELLIGENCE IN THE WORLD OF FINANCE

With AI, routine tasks have been overtaken by technology, revolutionizing work management and its entire organization. The use of artificial intelligence in the financial market has led to a significant and radical transformation of industry. These new solutions are totally changing the way financial decisions are made, from data analysis to optimization

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[3] "Computerized tomography is […] being analyzed". Retrieved from https://www.airc.it/cancro/affronta-la-malattia/guida-agli-esami/tc-tomografia-computerizzata

[4] Retrieved from https://machinelearning.apple.com/research/siri-voices

of operations. This has led to improved financial forecasting, more efficient risk management and the creation of new opportunities in the business world. New technologies are increasingly creating a responsive and efficient financial environment to adapt to constant market changes.

According to Forbes, 70 per cent of financial companies use machine learning to predict cash flow events, adjust credit scores and detect fraud.[5]

The market is becoming increasingly competitive, requiring companies to keep up to date with the latest technology trends to stay in the market.

The digital transformation of the financial sector has increased the competitiveness of the sector, and led to the creation of so-called neo-banks, such as Chime or Varo, which only operate online. Their flexibility, absence of hidden fees and focus on users' experience are often the strengths that attract customers.

As quoted in the article 'Applications of AI in Finance' by 'Jelvix', it is predicted that by 2030, AI, by simplifying multiple business processes, will save financial companies around $1 trillion.[6]

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[5] Retrieved from https://www.forbes.com/sites/bernardmarr/2018/02/14/the-key-definitions-of-artificial-intelligence-ai-that-explain-its-importance/?sh=748295994f5d
[6]https://jelvix.com/blog/ai-in-finance

2.1. IMPACT IN DATA ANALYSIS, RISK MANAGEMENT AND TRADING

In the vast field of finance, artificial intelligence manifests itself through an articulated network of applications, crucial to its functioning.

To exhaustively list all these applications would be impossible, given their vastness and complexity. For this reason, to focus on aspects of significant relevance, we have chosen to examine three central pillars of AI in finance: data analysis, risk management and algorithmic trading. These three macro-topics not only embody broad and comprehensive concepts regarding the use of artificial intelligence in the financial sector, but also represent areas of major importance, as they contribute substantially to the optimization of financial decisions, risk management and the conduct of wide-ranging financial transactions.

2.2. FINANCIAL RISK MANAGEMENT

Risk management is a crucial element within the financial sector, as it deals with managing uncertainties and market fluctuations that can negatively affect the stability and prosperity of financial activities. This process is necessary to protect companies and their clients from potential losses and to ensure adaptability to changing scenarios.

Nowadays, artificial intelligence offers new perspectives and more efficient tools to manage financial risks more accurately and precisely, improving the reliability of financial operations.

Risk management can be divided into three phases:

Risk identification:

One of the significant benefits of artificial intelligence and machine learning in risk management is the ability to identify risks more efficiently. This is enabled by AI capacity to deal with large volumes of data from various sources, both historical data but also topical data taken from social networks and newspaper reports.

Risk analysis:

Once the risk has been identified, AI provides further help by analyzing and assessing the risk. AI algorithms examine the impact and likelihood of a risk occurring, investigating it from various sources.

Risk mitigation:

After having identified and analyzed the risk, companies work on creating and developing a good plan to mitigate this risk. AI can also help with the identification and creation of an optimal strategy to apply by inspecting the track record of other similar companies and studying the correlated data available.

The Role of AI in Risk Management

Identifiying Risks

Analyzing Risks

Managing Risks

AI — Automate the Process — Resulting in more — Efficient and Accurate Risk Management Strategies

v/sure
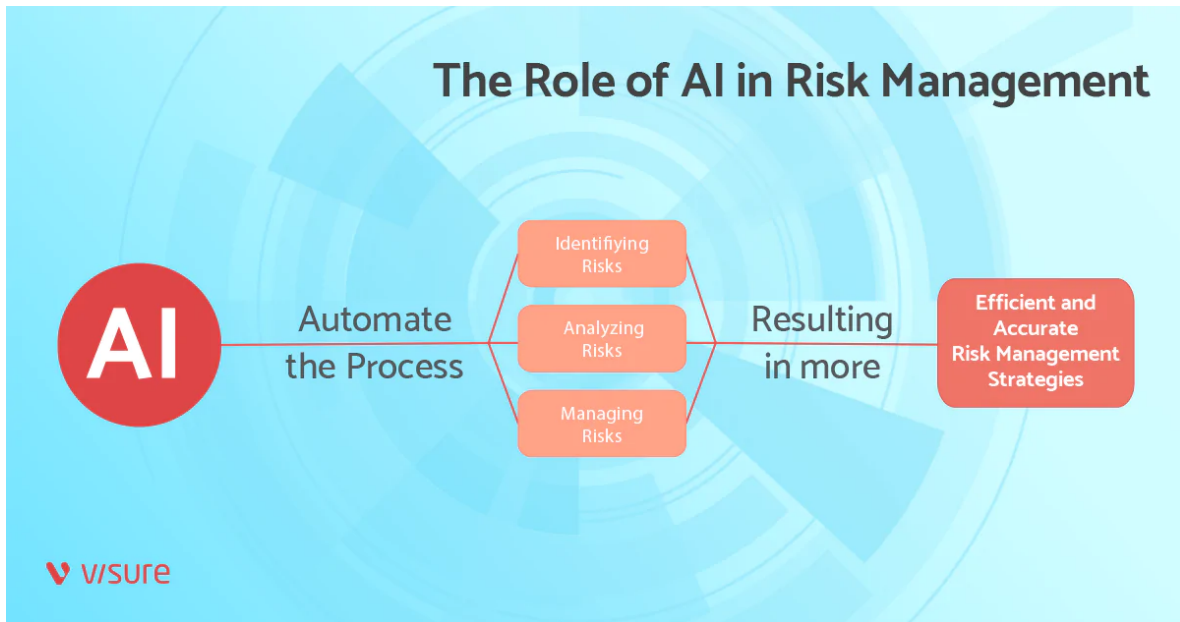
I.3[7]

The advantages of using artificial intelligence for risk management as we can see are numerous, it can certainly analyze a greater volume of data than a company would with its employees, but it can also provide more accurate reviews while minimizing human error. Furthermore, by studying data in real time, companies can respond more quickly to emerging risks, reducing the impact of damage. By using AI, the company also saves large sums of money that it would have invested in managing a risk event study.

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[7] Retrieved from https://visuresolutions.com/it/blog/ai-and-machine-learning-for-risk-management/

2.3. DATA ANALYSIS AND FRAUD MANAGEMENT

The analysis of financial data is one of the main aspects that has changed with the implementation of artificial intelligence, the way they are used and analyzed has been completely revolutionized with the arrival of these new technologies.

AI allows us to process huge amounts of financial data in a very short time, enabling us to extract fundamental data in an easier and more efficient way, for then to be used in post research. Artificial intelligence can then take care of different sources at once, creating a large and complete table of data.

AI uses advanced predictive models and sophisticated algorithms to study the data. These models help predict market fluctuations and then the subsequent conduct of other financial investors.

It is also used in the creation of an optimal financial portfolio. By studying historical and current data we can identify suitable investment opportunities that reduce risks and maximize returns.

The most important aspect of data analysis is that, with the help of AI, it is possible to detect irregular data and suspicious activities more effectively, reducing financial fraud.

Thanks to AI, fraud detection systems can study people's purchasing behavior and trigger alerts if something is out of the ordinary.

Summarizing, the in-depth risk analysis approach adopted by AI has led to better portfolio management and greater efficiency. At the same time, the ability to detect fraud at an early stage has helped to make all financial transactions more secure.

2.4.   TRADING AND ARTIFICIAL INTELLIGENCE

Artificial intelligence helps financial firms secure a return of investment through the algorithmic trading of commodities and financial products. AI can recommend a range of financial solutions that help both high and low risk individuals meet their expected risk tolerance.

2.5.   ALGORITHMIC TRADING

Algorithmic trading, also known as automated trading or quantitative trading, consists of the schematization of participants' behavior into mathematical models. These quantitative models provide a general set of rules that help generate trading signals that will help in the guidance of the various investments in the financial markets.

Today, algorithmic trading in the US uses AI to analyze financial data and make automated trading decisions in real time. Advanced algorithms use AI-based predictive models to look for market opportunities and optimize trades.

2.5.1.   The structure of a trading system:

The fundamental aspects of the structure of a trading system are the entry and exit rules, and the position and portfolio management.

The logic that the system follows can be divided into two macro categories:

- Fundamental analysis

- Technical analysis: the analysis of market prices.

The combination of complex algorithms and AI has enabled the execution of automatic, rapid financial transactions based on predetermined logic. This approach has reduced the impact of human emotions in trading decisions.

AI, through machine learning and data analysis, has also improved the ability to identify patterns, forecasts, and market trends of algorithmic trading systems.

However, while AI-supported algorithmic trading offers numerous advantages, it also requires constant human supervision. It's essential to ensure that algorithms are adapted and optimized in response to changing market conditions, thus avoiding excessive risk.

In conclusion, the integration of AI in algorithmic trading has redefined the way investments are executed, providing a fast and accurate combination.

3. AI IMPLEMENTATION, ADVANTAGES AND DISADVANTAGES

Artificial Intelligence, as we already introduced in the previous sections, brought innumerous possibilities of application in the world of finance, and can be now said to be an essential and indispensable component of this sector.

In the past decades there has been a rapid and exponential growth of data regarding financial markets, and datasets have been worldwide enriched with search trends, financial information coming both from users and institutions, online views and patterns, social medias accounts' details and much more, thus bringing to light a lot of information and data that can be easily analyzed and studied with the help of the new technology available nowadays. This availability of new data enabled financial institutions and other financial entities to get to know more about markets and consumers daily and continues to give them the possibility to develop new systems and tasks according to these.

3.1. FACTORS THAT LED TO RAPID AI TOOLS IMPLEMENTATION

We have to say that all these AI applications have been driven by several factors without which their implementation wouldn't have been possible, both from the supply side and from the demand side of the industry.

Supply factors such as, first, technology, were in fact indispensable to reach the level of development that we can now find in artificial intelligence uses, as the technology advances

gained in the last years, with several improvements in computing power and algorithms, combined with new data availability and costs optimizations, were key to the process. But other factors such as the availability of the financial sector's data and infrastructure have been a really important component to apply new techniques too.

Several demand factors also helped, as institutions and firms were prompted to invest and investigate in the AI scenario and area to achieve and reach new goals, demands and needs. Financial entities knew that artificial intelligence and machine learning could have helped them in terms of profitability needs, as AI tools can help with costs reduction, revenues gains and improved risk management. Also, constant competition within financial institutions and firms led to real "arms races" that only increased and accelerated the introduction of technological tools, and demands of financial regulation stimulated a better and more accurate execution of prudential regulations, data reporting and policies compliance.

All these factors acted as motivators for the financial sector and benefitted it by encouraging and stimulating firms to develop new skills, tasks, and capabilities in the field of artificial intelligence, in the view of the possibility of long-term benefits.

3.2.   BENEFITS OF AI TOOLS

Benefits started to emerge rapidly, even if accompanied by some challenges as well.

Artificial intelligence soon helped to provide more efficient processing of information, such as in credit decisions, financial and trading markets, insurance contracts, or customer interaction, all leading to a more efficient financial system.

AI can help improve regulatory compliance and increase supervisory effectiveness, and several applications of artificial intelligence can also improve risk management, fraud detection and compliance with regulatory reliance, all at lower costs, enabling entities to maximize their profits, invest in more projects or in research and development.

It can be an important tool to deal with risk assessment and management, as machine learning can help experts analyze data to identify risks, study future planning steps, determining more easily and accurately if a customer is eligible for a loan or credit and much more.

3.2.1. Improvements in fraud detection and risk management

New software upgrades can give warnings and send alarms if something seems out of the ordinary through financial advisory services. New tools are also able to help with the prevention of cyberattacks, even if cybercriminals and hackers are constantly developing new tactics. This because AI has the possibility to use machine learning to quickly adapt to the hackers' strategies, allowing the developing of solutions to prevent the loss of data and avoid the spread of customers' personal information, boosting companies' security and easily detecting unusual activities and transactions.

3.2.2. Advantages in the trading field

AI can also bring efficiency-advantages in the area of trading as, by being able to analyze huge amounts of information and really large data sets, AI-powered computers and machines can filter data way more rapidly than humans, saving people time and providing them with some help by giving opinions different from the ones of other current investors. Particularly, in the trading sector many investors have found it really advantageous to have the possibility to receive objective and impartial recommendations, also depending on customers preferences and according to each person's requirements and willingness. If a customer referred to AI as being more of a high-risk appetite person, machine learning will help him chose whether he should purchase or sell a particular stock according to market conditions and product history, while when dealing with lower appetite people it might help them decide whether they want to remain or exit a market, notifying them when markets have the scope of falling.

3.2.3. More efficient customer service

Lastly, there is to consider the huge breakthrough in the field of customer service. In this area in fact, both institutions and customers benefited.

Thanks to AI clients don't have to wait entire hours on the phone waiting to speak with representatives or stressing to take an appointment in the bank (even if just for minor doubts

or problems that could be rather solved with a simple "click" directly from home using our smartphone or computer) anymore.

AI tools enabled the introduction of 24/7 customer interactions thanks to the invention of chatbots and virtual assistants, automated programs able to interact with clients and that use machine learning algorithms to improve over time.[8]

Chatbots are being introduced by most financial services firms as well as banks, often in their mobile apps or social media. Many are still in the trial phase, but there is a constant perspective of growth linked with increased usage, especially within the younger generations, and with increasing sophistication.

Such tools are able, for example, to provide immediate services such as customers' possibility to check their balance, schedule appointments, ask questions when in doubt, and receive personalized banking advice whenever they need to.

This constant interconnectedness was not only advantageous for clients but also for financial institutions, as it reduced the time and effort spent on customer queries, leaving thus teams free to focus on longer-terms and more complex projects without losing precious time. Thanks to this, representatives' intervention will only be needed in case of non-resolution or situations, so that they can give priority to more elaborate requests and issues. In addition to

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[8] "Automated programmes […] time. Retrieved from https://www.fsb.org/wp-content/uploads/P011117.pdf

assisting customers in making financial decisions, institutions can benefit by gaining information about their customers based on interactions with chatbots.

Approximately all banks nowadays offer mobile apps that allow clients to manage their bank accounts from wherever they are, also reminding them of appointments, bills, schedules, or letting them monitor transactions online.

3.2.4. Automation processes

Artificial intelligence also enabled companies to save time and money in the documentation and administration areas. It, in fact, reduced at almost zero the need for repetitive work to be done, as repetitive and time-consuming tasks such as checking administrative files, reviewing documents, dividing information according to patterns, taking care of firms' collections and approvals have been completely automated. This implies the freeing up of employees and personnel, so that they can tackle other projects and pass on to additional responsibilities and work without the need to hire new workers, and the possibility to have lower operating costs. Automation processes also ensure the reduction of false positives and human errors, thus improving the protection of customer data.

3.2.5. Targets identification

Also, if Artificial intelligence and machine learning help to identify customers' needs and better target products and services needed and requested by profitable customers, financial

institutions could allocate resources more efficiently toward serving those customers that have the potential for future growth.

One of the greatest opportunities given by AI is thus that it can be used in a wide variety of ways, as it can be advantageous for many different areas of the same financial company or institution. From the improved security and more efficient regulatory compliance to the automated processes and customer service, and new possibilities in the credit and trading sectors, new analytical tools that include the use of AI and machine learning are continuing to show cost effective and proactive solutions that are enabling institutions and firms of the finance world to grow and improve the quality of their services in a projection of a more efficient, improved and innovated future in the field.

3.3.   CHALLENGES OF AI APPLICATIONS

All these services that Artificial Intelligence enabled to provide in the financial sector are for sure extremely useful and advantageous for firms, and can ensure qualitative and fast results, but there are certain implications of their uses that shouldn't be overlooked.

There are, in fact, different challenges that come along with AI applications and, despite the elevate number of advantages and benefits, these shouldn't be ignored but rather acknowledged to monitor them or come up with solutions in the coming years and as more data becomes available.

3.3.1. Effectiveness of new credit opportunities

Artificial Intelligence is frequently said to bring more possibilities to people. For example, in the credit field, people without a credit history or credit score may be able to get a loan or credit card thanks to AI. This because Artificial Intelligence doesn't look just at credit history to make credit decisions but also evaluates potential customers by taking in consideration different factors such as smartphone data, spending patterns, digital footprint and other elements that help to give a complete picture of the loan applicant to understand if he's trustworthy. So, where a lack of credit history has traditionally been a constraining factor as alternative indicators of the likelihood to repay have been lacking in conventional credit scoring models, AI gave to more people the opportunity to be helped.

But how can we be sure that AI methods are secure and effective?

3.3.2. Transparency and interpretability

The use of its complex algorithms could result in a lack of transparency, and it's not always easy to tell how these systems arrive at certain conclusions. It may be difficult for human users and employees at financial institutions, and for regulators too, to get how decisions, such as those for trading, investment, and creditworthiness, have been formulated. In addition, the communication mechanism used by these tools might be incomprehensible to humans, imposing monitoring challenges to the human operators of such solutions.

For this reason, some institutions still state that they're not comfortable in fully automating and implementing a model if they cannot understand how a particular decision or prediction is made. In these cases, a complete trust in the process should be present to fully adopt AI methods, because the basis of certain decisions is not completely clear and might be erroneous.

Interpretability and accuracy are key elements that should be taken care of in the next years, as they are important if we want Artificial intelligence technology to continue to develop successfully and usefully to be adopted.

3.3.3. AI dependency

Another challenge involves the fact that Artificial Intelligence, just like every other entity, could fail. Concerns stay in the fact that in the future we might become too dependent on these tools, so that, in case of error, complete chaos would be generated in the system.

Another problem regarding dependency arises from the fact that in the development of Artificial intelligence and machine learning today there is a high reliance on a relatively small number of third-party technological developers and service providers. This reliance might be relevant for market participants and financial institutions in the future, and we must consider that in the case in which a major provider of AI tools was to face default or suffer an operational risk event, this could lead to operational disruptions at many financial institutions at the same time.

This is therefore another circumstance and factor that should be monitored, especially if AI applications in the future will conduct more important and critical tasks for financial institutions.

3.3.4. <u>Regulatory requirements and compliance</u>

Another challenge that we should mention regards regulatory compliance. The continuous implementation of new AI applications leads, in fact, to the need for new regulatory requirements to be settled. Furthermore, as the current regulatory framework is not designed with the use of such tools in mind, some regulatory practices may need to be revised or extended.

As machine learning is a relatively new concept, there are really few international standards in this area for example. Several international standards-setters are however starting to consider risks associated with AI activities, including The International Organization of Securities Commissions (OISCO)[9], which reported on the impact of new technologies, including algorithmic trading on market surveillance, and made recommendations to consider regarding data collection, and The Senior Supervisors' Group (SSG)[10], a forum for senior representatives of supervisory authorities from around the world, which, for example,

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[9] IOSCO, "Regulatory Issues raised by the Impact of Technological Changes on Market Integrity and Efficiency", July 2011
IOSCO, "Technological Challenges to Effective Market Surveillance Issues and Regulatory Tools", April 2013
[10] Senior Supervisors' Group, "Algorithmic Trading Briefing Note", April 2015

issued principles for supervisors to consider when assessing practices and key controls over algorithmic activities at banks.

4. IMPACTS ON EMPLOYMENT AND ETHICAL ASPECTS

4.1. AI IMPACT ON FINANCIAL SECTOR WORKFORCE

The application of Artificial Intelligence and machine learning to financial services has an important impact on financial markets, institutions, and consumers, but also on the financial sector workforce.

Routine tasks have been, to a certain extent, overtaken by technology, and it is common belief to think that technology might "steal" jobs and positions to human employees.

The rapid progress in the technology of artificial intelligence is continuing to change the labor market and modify the competences that firms and institutions want to find in their employees.

The World Economic Forum recently made a study that resulted in the affirmation that, before 2025, 75 millions of jobs globally will be automized[11]. But this doesn't mean, as a lot of people believe, that humans are starting to being replaced by machines, robots, or technology, but rather that artificial intelligence is allowing firms to automize all those jobs that are just

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[11] "75 millions […]". Retrieved from https://www.eseibusinessschool.com/artificial-intelligence-affecting-work/

time-losing or less important, to give people the space and time to focus on other tasks and projects.

Increasing implementation of AI and machine learning is, on the contrary, creating more job opportunities as more jobs in the field of AI are created. So, yes, a lot of jobs will be automized, but the study shows that it will leave space for the creation of another 133 millions of new job opportunities.[12]

4.2.   ETHICAL CHALLENGES

Other than the fear of AI taking over human jobs positions, several ethical challenges also come up when it comes to protecting people's personal and financial information. The belief that Artificial intelligence and machine learning tools might be utilized for unethical purposes, such as hacking into people's data, still brings serious skepticism to a lot of people.

4.2.1. Bias problem

Some people argue that the use of alternative data sources, such as non-traditional financial information like online behavior, could introduce bias into, for example, credit decisions. Specifically, consumer advocacy groups point out that machine learning tools can yield combinations of borrower characteristics that predict race or gender, factors that fair lending

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[12] "133 millions […]. Retrieved from https://www.eseibusinessschool.com/artificial-intelligence-affecting-work/

laws prohibit considering in many jurisdictions. According to this, Artificial intelligence algorithms could rate a credit borrower from an ethnic minority, for example, at higher risk of default because similar borrowers have traditionally been given less favorable loan conditions.

Even if models used for determining creditworthiness, insurance pricing and other financial activities are based on large datasets and numerous variables, algorithms can entail biases that can lead to discrimination and could thus reinforce human prejudices.

It is therefore an important social aspect that should be taken care of, and decisions should be taken regarding the desired extent or risk sharing, how algorithms are conceived, and which information is admissible to take decisions.

But failures regarding bias can occur also in other ways that don't relate to discrimination, as it could also happen that if an AI system calculating creditworthiness of a customer is tasked to optimize profits, it could soon get into predatory behavior, even if considered unethical in society, because AI tools don't understand such things, and could thus end up takin advantage of vulnerable individuals or situations.

4.2.2. <u>Accountability and transparency</u>

Other areas of ethical concern include accountability, as it's difficult to determine who will be seen as responsible in the case in which an artificial intelligence tool would fail or take an

incorrect decision, and, as we already previously anticipated, transparency, as it's not always easy to tell how or why algorithms come to conclusions.

5. LEGAL ASPECTS

The legal framework regarding relevant data is another factor that will be impacting the adoption of Artificial Intelligence and machine learning tools in the finance sector. Breaches of personal data or use of data that are not in the interests of consumers are expected to lead to added data protection legislation.

Of course, the development of new data standards and reporting requirements, or other institutional changes in financial services, can impact deeply on the adoption of AI.

5.1. DATA PRIVACY AND PROTECTION

As we can easily deduce, the use of personal data in AI applications can raise several policy issues, starting first from those related to data privacy and data protection.

Besides being applied to the monitoring of behavior and communication of traders for transparency and market conduct, machine learning can interpret data inputs such as e-mails, spoken work, instant messaging, documents and metadata. Of course, this makes it ring a bell to a lot of people that might not believe that privacy is respected at all.

"Knowing the identity of customers"[13] is another area where AI and machine learning are applied in finance, and this involves user experience and regulator expectations. This method of "knowing your customer" is increasingly more used and allows financial sector's firms and institutions to perform identity and background pre-checks of clients.

For example, it can measure risk and determine which individuals need to receive additional scrutiny. Machine learning-based risk scores are also used in ongoing periodic checks based on public sources such as police registers of offenders and social media services.

Trading firms are also looking to AI and machine learning applications to utilize data to improve their ability to sell to clients. For example, analyzing past trading behaviors and past purchases, bucket lists or searching histories could help anticipate a client's next order.

The fact that Artificial Intelligence tools can look deeply into every person's personal data and activities, going from personal emails to online behavior, to internet searching and buying history, scares a lot of people.

For this reason, in many cases firms now need to ask for an active consent of the user whenever data protection regulation asks them to, but as AI tools continue to improve and increase, maybe new regulations and standards should be incremented to monitor privacy and a person' own rights to keep his own information private.

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[13] Retrieved from https://www.fsb.org/wp-content/uploads/P011117.pdf

Combining AI and machine learning with human judgment and other analytical tools and methods may be more effective to avoid some consumer protection concerns.

6. STUDY CASE EXAMPLE

6.1. FRAUD CASE

One of the big uses of AI in finance is in the fraud detection department in the Banking sector.

Fraud has always been one of the biggest issues when it comes to the Banking sector, since the early days people have always tried to find new ways of cheating the system and taking advantage of it. Now that banking has gone digital, this type of problem has just increased in size. Due to the higher amount of fraud that is possible to commit in easier and bigger ways, when compared to old physical/in person methods. Cyber fraud damages the economy by about 600 billion USD of GDP on a global basis.

6.1.1. Frauds typology

There are two types of frauds in banking, corporate and non-corporate e-banking frauds. Corporate frauds involve primarily bank loans and the abuse of the banking systems. While non-corporate e-banking frauds involve the theft of accounts passwords, cloning, stolen pins and other customer side theft of information. The most common types of fraud that occur are

usually the theft of your identity and the skimming of your card that generally done thanks to a device placed on top of the pos/ATM. This device then sends/stores the card information on it, the criminal has then the choice to use it or sell it to third parties.

6.1.2. AI help in fraud prevention

What can AI do in all this, well it can be very useful when it comes to preventing fraud before it even happens, but it can also read and then authorize or decline the transaction based on various conditions. AI can be able to learn from past cases and experiences but also the capacity to take into consideration big amounts of current and past data/information. These are things that a normal human being lacks the capacity and concentration to do, on this scale. There are usually millions of transactions every day, from small little transactions to big multimillion dollar exchanges of currency. All these must be checked and accepted or denied depending on the situation, to be able to do this AI can help and make progress faster and more efficient.

To be able to detect fraud, there can be an implementation of self-learning AI modules and programs, that use special types of AI that use machine learning to learn on its own. By feeding it data and information this type of AI learns and creates models and outcomes for all the various possibilities. If this type of AI is trained well enough, he can be able to discover patterns and start watching out for new trends. In the case of fraud usually scammers tend to have and systematic way of doing things, and this tends to lead to some repetitive patterns

and behaviors. The problem with this type of system is that at the beginning you must input huge amounts of data, this data must be checked double checked with the supervision of a human to be sure that the AI is learning the right things. Bad training of the system can lead to problems along the way, due to the system not being able to then detect the real fraud from a normal transaction. You also must be careful and check the quality of data you are ingesting, as better-quality data will lead to better learning results for the AI, in some cases bad quality data can lead the AI to become more stupid than before.

In general, this type of AI implementation is every day being more needed and helpful to the banking system. Having a system that can go through huge amounts of data and information in a short amount of time, and then being able to detect small imperfections and unusual transactions is essential in cyber frauds and fraud prevention. Thanks to this evolution in AI and machine learning programs, banks can prevent many of these types of frauds before they even happen, preventing and reducing possible damage to the customer or bank itself in financial and legal ways. A small example is the identification and block by part of the system of weird and unusual transactions that may take place, such as a random transaction at 4 in the morning that takes place in India, on a card that has always being used in Europe. The automation of this entire process has also removed the human error and slowness out of the equation, as it provides faster and more accurate solutions that any human could ever come up with, while also being able to function constantly without any breaks.
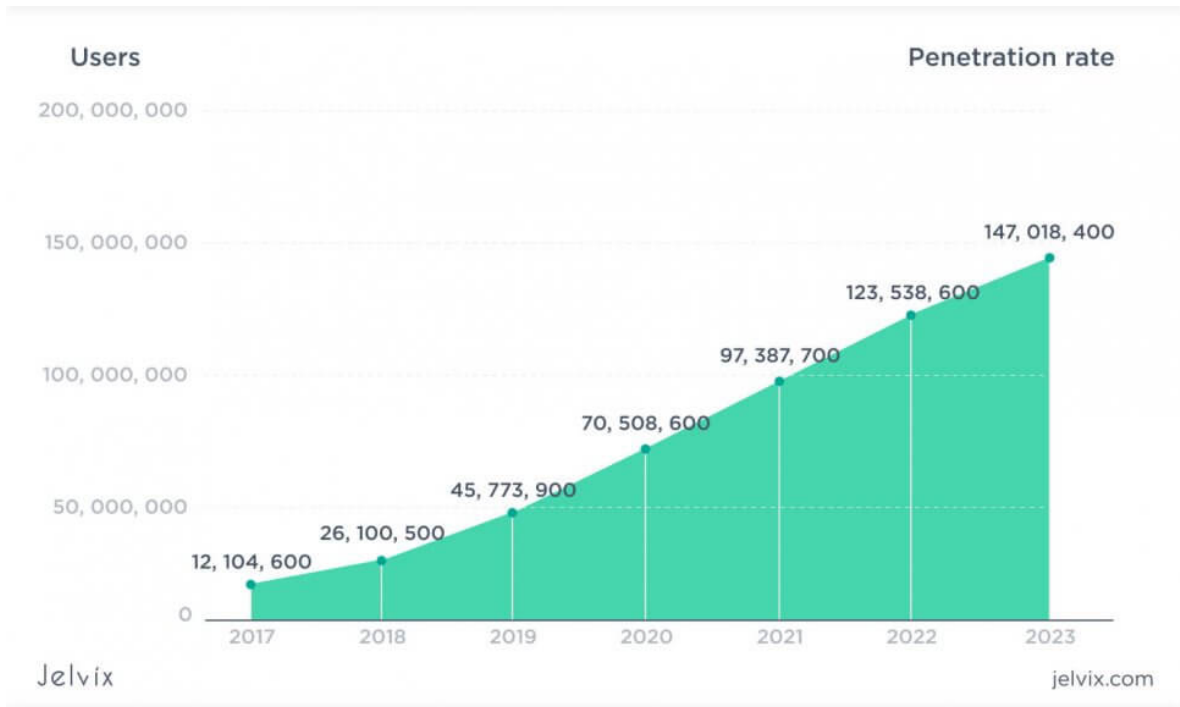
6.2. ROBO ADVISORS

6.2.1. How Robo advisor's work

Robo advisors have been one of the biggest changes that the investment management industry has received in these past few years, it's a spark of innovation and revolution for the entire industry. Robo advisors bring financial technology into portfolio management, generating a union of both the classic investment theory with the new modern AI-technology.

In today's environment this AI powered Robo advisor's models are in the most part based on Modern Portfolio theory (MPT). This type of portfolio theory was constructed on the idea of generating an ideal portfolio that reflects the risk level the investor is comfortable with, all this is then goes along with justification for passive investing, that is provided by the efficient market hypothesis.

With this type of system, the consumer has the power to change the amount of risk he wants to take, and with this decision the Robo advisor will then start the work on the problem. The main objective of this process is to receive information and data that will further help the decision-making process for the consumer. As this type of program can solve most complex problems giving a considerate solution, that is dependent on the given the data but is also capable of then showing a more direct and understandable answer to the problem, so that this solution that is given its then easier to be comprehended by the final user.

Users						Penetration rate

200, 000, 000

150, 000, 000   147, 018, 400

123, 538, 600

97, 387, 700

100, 000, 000

70, 508, 600

45, 773, 900

50, 000, 000

26, 100, 500

12, 104, 600

0

| 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |

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II.7

All this process helps to lighten the workload of the employees and help them take better decisions, as they receive 2 opinions and ideas that they can then evaluate with their own thinking. But it also has another function, helping decision making be fairer and more neutral, as the thinking behind the idea tends to be less one-sided and less dependent on the relation of people or their emotional state. Furthermore, they have the capacity to take more things into consideration than normal, when it comes to planning or opinion about a problem. As they have the capability and capacity to consider future results and things that are usually harder to be calculated, while also changing the impact and importance of the various

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variables and giving them the proper weight when it comes to their predicted impact and importance.

6.3. MOBILE BANKING/ONLINE BANKING

Mobile banking has been one of the most useful and convenient system banks have created. The idea you can do most of your transactions, management of the accounts, and payments directly with the touch of a button is very convenient for the consumers. This removes in most cases the need to go to a physical location to do a specific task, and for the banks the system also helps them reduce costs related to their physical location and employees. Online banking has also meant for banks a huge change in their developing strategies and resource allocation, due to the system's increasing need for new technologies and services for its correct functioning.

AI has been implemented in many of these systems to help with the automation and managing of data, and its correct functioning. It also has helped provide the customer with a more personalized and personal recommendation of products they might be interested in, but also frequent information they may want to have to hand.

The implementation of AI Chatbots in this type of application has also changed how technical support is provided. The system tends to take over a major part of the smaller task, reducing furthermore the pressure on the support personnel. This system also reduces the cost for the bank, as they can have less people do the same job. The chatbots also improve

with time, if they are given more data to learn and have their parameters adjusted to be able to better focus on their cases.

The switch to a more digital and global way of personal management has also increased communication between the bank and the end user. The bank can now simply just send a message or email to the user, notifying them of any payment that might be pending or that is about to happen. There are also programmed and set various types of tracking systems that help users take a better look at their finances and assess a better management strategy. This type of system generally shows a graph and gives a more detailed look into the spending, making the consumer see a more direct and understandable representation of their money. Various parameters such as automatic payments, maximum spending can also be set to help facilitate the control of the account.

7. FUTURE PROSPECTIVES

7.1. HOW AI MAY EVOLVE AND IMPACT THE FINANCIAL SECTOR

7.1.1. Introduction to AI future

The future of Ai is one that we must follow and take a constant look at it. This type of technology is very possible that is going to follow us into our future job environment and way of doing things, as more and more companies are implementing it into their programs and processes. It has the capacity to facilitate the jobs and steps of the projects in various

sectors. Thanks to the way AI works and learn implementing it, enables you to automate many of the low tier workload that you may do, making the whole process much faster and more efficient. This can release a lot of workload and stress from employees, giving them more time to focus on more important decisions and challenges. This is starting to change the perspective many big firms have about their various ways of working and how processes take place.

7.1.2. Investing in AI future opportunities

As we are watching, every day more and more companies are starting to implement AI into their processes and programs. Investments in this type of technology have also increased dramatically these past few years, as more and more people want to get into the wagon. AI these past few years has had a huge boom in its popularity, this has helped quite a lot with the expansion and investment in this type of technology. Many companies are starting to invest millions/billions of dollars trying to develop their own technologies and system, others are directly buying developing companies to speed the whole process up. AI has been to the top of the popularity, so much so that also universities are starting to develop studying courses and careers regarding this new sector.

The change in the consumer market when it comes to their preferences and requests is generating a demand for new and more digital banking methods and financial systems. As new younger consumers tend to prefer and want more digital technical methods when it

comes to banking and personal management. This is pushing banks into speeding up and improving their IT infrastructure and application to accommodate this new type of demand, making them also adopt AI to help with the process of management and service.

Conceivably the implementation of AI into the security of accounts is also a very plausible use in the future. AI would help make accounts more secure, by setting up stronger and more personal verification systems. Speech recognition and facial recognition would be 2 of the main ways that can provide a stronger verification system, other types of biometric data can also be used. This type of verification can prove more secure and faster than the classic old password, as it's more personal and harder to reproduce. The password can be easily leaked and stolen in database attacks, while biometric information using AI can prove to be a more complex and stronger alternative.

CONCLUSION

AI like many new technologies in the sector, it's a tricky one to say if it's directly good or bad, as the technology itself has its advantages and disadvantages. But we can say that the impact it has generated these past years has been quite bigger than usual new technologies. It's been one of the trendiest new technologies that has been released, making people all around the world talk for months and months about it. Most big corporations have tried to implement it in their systems, and investment and interest has increased exponentially, making it one of the biggest sectors in terms of growth.

 Its application ranges from all sorts of sectors, from finance to healthcare to agriculture, it has the capacity to help. This is thanks to the way the AI and ML go together and improve autonomously from the data they are given or can gather on their own. They can manage big amounts of old and current data, and then provide a report with a possible solution or expectation about the specific case. This is the main reason why this type of system can be implemented in most sectors, the ability to go through vast amounts of data and be able to give a prediction is what makes it helpful. As most sectors need tools that help speed the gathering of data and the processing of it, to have better knowledge of the current and future conditions.

 In finance this type of technology has been an incredible help with the automation of certain types of tasks. The ability to be able to find and predict fraud and risk before it happens has

reduced the impact on the bank stability dramatically. Knowing the possibilities of certain actions can lead you to better decision making, especially when managing assets or loans in millions/billions of dollars, where a tiny mistake can cost bankruptcy. The trading and management of assets has also received a huge boost thanks to AI, as it's now more automated and less manual. The models that have been developed and calculated also offer better estimates when it comes to the outcomes, giving the managers better information to take information off. The development of certain financial managing tools such as Aladdin by Blackrock, have tremendously impacted the decision making of certain big companies and government businesses, that have started to rely on them for risk management in situations of crisis to minimize their impact.

These technologies have brought with them some big innovations that would have never been possible otherwise, both from the supply to demand side. They have brought with them an improved way of processing information and estimation of outputs. They have also helped with the profitability and management of costs, thanks to the implementation of new and more efficient ways that use AI to reduce the consumption and time it takes to process resources. The help in predicting and reducing risk has also been a crucial factor for its adoption. But all this brings with it some downsides that can't be easily overlooked and have to be watched in the next few years. When it comes to the decision-making process one of the biggest issues that might come to mind is the lack of transparency that there can be with this type of system, as not always you can understand or know how the decision-making is

being done. The quality of information is another crucial factor that can generate problems, if bad and wrongful data is provided and the AI doesn't recognize it as incorrect, this can lead to an even bigger bad decisions making and bigger problems if we are in a future where we depend completely on it; finding the problem can be problematic to, as searching a database with tons of data is like searching for a needle in a haystack . There is also a problem with the regulation of AI, as the current regulations still haven't caught up with the technology. They are still operating in a grey area, with a few old regulations that might not be the most appropriate for it.

The ethical problems that might arise with the implementation of AI, is another topic that can't be easily discarded. As this type of system tends to go above and beyond, usually bypassing and not caring about privacy and the use of more private information about people. This type of behavior can then lead to the use of this information for wrong causes and purposes. There is also the loss of a big number of jobs, that are starting to become more and more irrelevant due to the implementation of AI. To this last topic there is also an increase in the number of jobs that work in developing and maintaining this new type of model and program. This last topic about jobs can be a very tricky one as you are switching low-tier jobs for more specialized and skilled jobs, putting the people that were most vulnerable to begging in an even worse situation.

 Summarizing everything we have concluded that as every new technology there are its ups and downs, in this case specifically we think that the implementation of AI in finance and in

other areas as well can be very promising, as there are various results that are starting to show its fruits. But like all new technologies some of the downsides must be considered and further improved. Another factor that we are still lacking as there is currently little to no known information about it, is the long-term implications and effects this technology might have in the industry. Due to how new it is and how rapidly it is evolving, there is still no long-term research in the sector. But as with all things in life you must try and watch them positively, only this way can you drive innovation and creativity into a project, while trying to maximize the benefits of it and reducing the risks to a minimum.

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