

# Artificial Intelligence, a global point of view

Augustin ROLET

January 6, 2023



---

## Contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
<b>2</b>	<b>History of AI</b>	<b>3</b>
<b>3</b>	<b>Difference between AI and classical algorithms</b>	<b>3</b>
3.1	Definition of AI and algorithm . . . . .	3
3.2	Difference between classic programming . . . . .	4
<b>4</b>	<b>Learning Process</b>	<b>5</b>
4.1	Humans learning . . . . .	5
4.2	Principle of Artificial Intelligence . . . . .	5
<b>5</b>	<b>Definition of Artificial Intelligence</b>	<b>5</b>
5.1	Different types of Artificial Intelligence . . . . .	5
5.2	Different types of learning . . . . .	6
5.2.1	Supervised Learning . . . . .	6
5.2.2	Unsupervised Learning . . . . .	7
5.2.3	Semi-supervised Learning . . . . .	7
5.2.4	Reinforcement learning . . . . .	7
<b>6</b>	<b>Projects examples</b>	<b>8</b>
6.1	Questions and Answers robots . . . . .	8
6.2	Artificial Intelligence and Robotics . . . . .	9
6.3	Artificial Intelligence software projects . . . . .	10
<b>7</b>	<b>Problems and expectations</b>	<b>10</b>
7.1	Limitations and future of jobs . . . . .	10
7.2	Future of Artificial Intelligence . . . . .	11
<b>8</b>	<b>Bibliography</b>	<b>12</b>

---

# 1 Introduction

This report deals with a new section of the computer science, the artificial intelligence that has grown up exponentially during the previous years. It is present in many domains even if we do not realize it as user. In our daily life, it has optimized a lot of tasks and has saved people's time. Many people have not realized the dimension of the AI in the future. Here we are going to go with a beginner point of view and try to understand the mechanisms and the impact of AI nowadays and the expectations in the future in different domains of the economy.

## 2 History of AI

The story of AI is quite long and complex, but we are going to explain using main discoveries and research of this part of Computer Science. First, let's do a review of the evolution of computers from the beginning to nowadays. We can divide this story in 3 parts: the Developpement part, the Democratization and the Implementation in our daily life.

In the years 1950's, the cost of computer would blow our mind, it could go up to 200 000\$ per month. It was only affordable for a little part of the population including universities and research centers [4]. Like every other innovation, it takes time to make a new technology affordable and efficient even if it is going much quicker nowadays but it still required years and even decades to develop something great and usable by all of us. At the beginning computers were mainly reserved for research. First, they tried to make it work and perform simple tasks like additions regardless on the energy consumption because they must create the basis of Computer Science that will grow exponentially in the future as we are observing today. Then, they moved on trying to optimize processes and costs and space at the same time.

The first computer ENIAC has been released in 1946 and the transistor has been invented in 1948. The transistor helped a lot to minimize the space taken and reduced the costs. For 50 years, a lot of companies have been created such as Google, Apple, Microsoft. They all contributed to the developpement of the computers. In the 2000's, the computers became better and cheaper at the same time. This period could be considered as the democratization of computers in most of families. The cost had to be drastically reduced, it took years to be affordable for the personal usage.

In 2019, almost half of the population owned a computer [3] but more than 80% of the population owned a smartphone [16]. The main date that can be considered as the beginning of Artificial Intelligence is 1955 with the release of Logic Theorist. The goal of this program was to discover proofs [12] using symbols, experiences, modification of reasoning such as a human brain do. This date is commonly considered as the beginning of the AI and its associated research. Nowadays, it still developed by researchers and famous compagnies because it is going to be a real opportunity in the future.

## 3 Difference between AI and classical algorithms

### 3.1 Definition of AI and algorithm

This question is tricky and there is no answer to draw a line between AI algorithms and classical algorithms. A common definition of Artificial Intelligence is an algorithm that can adapt with a data base of lot of examples using statistics and probability. This come down to the definition of Intelligence, which is unformal and subjective. Another admitted definition of algorithm is a sequence of instructions to find a solution to a problem. It is up to you to decide if an algorithm uses or not AI.

The programs concepted without AI could seems have Artificial Intelligence like in a messaging software. For example, Thunderbird provides you some shortcuts to insert an attached

file if you write some key words in your mail like "cv, letter, attached file". This is not related to AI because there is no neural network but only a data base of words and actions associated together.

This is common in online video games chats; the bad words are blacklisted. If you ever tried to insult someone or write inappropriate words your message should have been removed or replaced by stars.

### 3.2 Difference between classic programming

There are 2 main categories of programming [6]; the imperative programming and the declarative. These two paradigms of programming contain several subtypes of paradigms that means there are several techniques to code according to the chosen paradigm. The imperative is a type of programming that focuses on understanding how to find a solution to a certain type of problems by going step by step. In the opposite, the declarative programming is about writing codes that give a solution to a problem regardless on the methods used, the method matters less, the result more. Bellow a few examples with regards to the type of paradigm.

Imperative paradigm	Description	Domain of utilization
Oriented Object Programming	Concepts and items are created with a template which is the same for every object of the same class. The object varies due to its own parameters	Videos games; generated items, weapons, players, entities. Neural network; Modeling objects in the real world
Declarative paradigm	Description	Domain of utilization
Logical	Representation of process with logical sequences of instructions	Artificial Intelligence, neural network
Functional	The program is constituted by functions and the result is provides by call of plenty of functions without variables but functions instead	Applications, websites

```

def print(self):
    """Asks the user if he wants to print the page. Prints the page containing a vocabulary list.

    Method:
        - If the user wants to print his vocabulary list
        - Takes a screenshot
        - Starts the process of printing the screenshot
    """
    print = parameters.gettext("print")
    if self.w.attributes["fullscreen"] == False: # Checks if the screen is not displayed in fullscreen
        return messagebox.showwarning("section", print["warn"]) # warn user: not in full screen
    # Asks if the user wants to print his exercise
    if messagebox.askquestion("section", print["question"], icon="question") == "yes":
        # = str(int(listdir("./printable_files/")) * (str) n = number of files in (directory) printable_files
        file = "./printable_files/printable" + n
        sleep(2) # waits 2 seconds
        # = self.w.info.height()
        try:
            # screenshot args: (x start, x start, width, height)
            if self.section.winfo_width() <= self.title.winfo_width():
                screenshot =
                    region =
                        self.w.winfo_width()/2 - self.title.winfo_width()/2, int(5/221*H),
                        self.title.winfo_width(), self.title.winfo_height() + self.section.winfo_height() + 2*int(5/221*H)
                    )
                ).save(file + ".png")
            else:
                screenshot =
                    region =
                        self.w.winfo_width()/2 - self.section.winfo_width()/2, int(5/221*H),
                        self.section.winfo_width(), self.title.winfo_height() + self.section.winfo_height() + 2*int(5/221*H)
                    )
                ).save(file + ".png")
            image.open(file + ".png").convert("RGB").save(file + ".pdf") # converts the .png into .pdf
            remove(file + ".png") # deletes the screenshot but keep the pdf version
        except:
            startfile(file + ".pdf", "print") # starts the process to print the pdf
        except:
            messagebox.showinfo("print", print["infoDef1"] + print["infoDef2"]) # Inform user: no default pdf reader
        except:
            # Executes this code if the user is not on a translation page
            messagebox.showinfo("print", print["infoDef1"]) # Inform the user: no vocabulary to print

def setlang(self, lang):
    """Sets the toolbar with the selected language."""
    parameters.setParam("language", lang)
    toolbarF = parameters.getText("toolbar") # toolbar dictionary
    file = toolbar["file"]
    settings = toolbar["settings"]
    languages = toolbar["languages"]
    # Main menu on the toolbar
    toolbar = Menu(self.w)
    self.w.config(menu=toolbar)
    # File menu:
    fileMenu = Menu(toolbar, tearoff=0)
    # Different buttons on the menu
    toolbar.add_cascade(label=file["name"], menu=fileMenu)
    fileMenu.add_command(label=file["home"], command=self.home)
    fileMenu.add_command(label=file["minimize"], command=lambda: self.resize(False))
    fileMenu.add_command(label=file["maximize"], command=self.resize)
    fileMenu.add_command(label=file["print"], command=self.print)
    fileMenu.add_command(label=file["quit"], command=self.w.quit)
    # Settings menu
    settingsMenu = Menu(toolbar, tearoff=0) # (Menu) parMenu : parameters menu
    toolbar.add_cascade(label=settings["name"], menu=settingsMenu)
    # Sub Menu: themes
    themesMenu = Menu(settingsMenu, tearoff=0)
    settingsMenu.add_cascade(label=settings["themes"], menu=themesMenu)
    themesMenu.add_command(label=settings["dark"], command=lambda: self.setTheme("dark"))
    themesMenu.add_command(label=settings["light"], command=lambda: self.setTheme("light"))
    # Sub Menu: languages
    self.languagesM = Menu(settingsMenu, tearoff=0)
    settingsMenu.add_cascade(label=languages["name"], menu=self.languagesM)
    self.languagesM.add_command(label=languages["en"], command=lambda: self.setlang("en"))
    self.languagesM.add_command(label=languages["fr"], command=lambda: self.setlang("fr"))
    self.languagesM.add_command(label=languages["de"], command=lambda: self.setlang("de"))
  
```

Figure 1: Examples of imperative programming, Revisewords

## 4 Learning Process

We should define what is intelligence to understand the learning process. Even if the definition is relative to everybody, there exists a common and formal definition which is the capacity of someone to adapt and solve a given problem.

### 4.1 Humans learning

We must understand how the intelligence works and how improve it. Obviously, there exists people that are smarter than others in certain domains because they improved their intelligence in these domains. As an observation, we can see that a baby is progressing during its life and getting smarter through years.

We should also speak about memory, an intelligent being needs a memory to store all its knowledge. Without memory, it is impossible to learn anything. In summary, to learn a human, let's call it a system, needs memory, experience and its cognitive abilities. The experience reinforces the knowledges because it associates some knowledge with a particular moment or sensation. Of course, a system needs a body or sensors to collect information and transform it into some knowledge. Let's move on how we learn practically because we learn every day. As I said, I considered experience as a part of intelligence because it helps to improve our capacity to solve problems. This means that to learn something we must understand the concept, store it and associate it with an experience.

These are the basic principles of a knowledge; the intelligence is truly the connection between all these knowledges. This is where we can make a link with a network of neurons for AI programs. The intelligence is the capacity of creating smart links between knowledges. So, we learn by trying and storing that's all, but the creation of links is complex therefore AI algorithms require high quantity of data.

### 4.2 Principle of Artificial Intelligence

The goal of Artificial Intelligence is to reproduce as best as possible the reflection of the human brain. So, the programmers use a network of neurons that allow them to create relations between different answers and make better decisions. When an AI system is integrated on a program the program is no longer a sequence of instructions organized using a certain paradigm of programming but something that can reflect with regards on the information given by the data. This is the main difference; a classic program will not give sense to the data it is using unlike the other that uses AI and will translate the data into information and react with regards on this information. The first question to think about is the definition of intelligence, because if we cannot understand what it is, we are not going to be able to reproduce its mechanisms. Another tremendously important question is: Can the intelligence of a human be reduced and modeled by an algorithm?

## 5 Definition of Artificial Intelligence

We all heard this word a lot in our life, but do we really know what it means? Artificial Intelligence has no formal definition but is used by people to describe programs that are giving solutions to problems according to parameters without being explicitly coded.

### 5.1 Different types of Artificial Intelligence

There exists two main parts of AI which are Machine Learning and Deep Learning. Machine learning is a part of Artificial Intelligence that includes deep learning which is a method to train an AI. Training an AI with deep learning algorithms and neural networks is much more complex

than with machine learning even if this is not easy to create a machine learning project. Artificial Intelligence is a vast domain of computer science as already mentioned and we are going to focus on the two most famous part of AI.

Their functioning system are based on the learning methods of the human brain. Machine learning requires less data than deep learning but is less reliable as well due to his simplicity compared to deep learning. The machine learning algorithms require small data sets to work and less time to learn from them. They are also easier to understand and can run on smaller machine that are affordable for most people. However, deep learning needs much more data to train itself and can also perform more complex tasks and be more reliable. Therefore, big data knowledges should be helpful to work with AI and especially deep learning algorithms. However, these algorithms required more calculation power, so companies need bigger computers to run the algorithms. This makes deep learning more expensive, complex, longer than machine learning.

To summarize, Machine learning is a common use of AI which is already implanted in a lot of applications and companies; especially on marketplaces. This kind of algorithms are helpful for their recommendation services provided for the customers. Deep learning is reserved to advanced projects such as predictions services or treatment and analysis of complex data. It focuses on understanding the meaning of requests and answer them as precisely as possible.

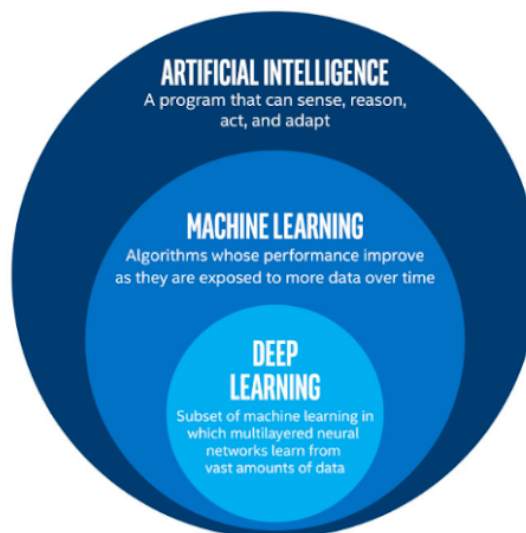


Figure 2: Categories of AI [13]

## 5.2 Different types of learning

As we have seen there are two main categories of AI, but we can look further. In fact, there exists four ways to make a program learn; supervised learning, unsupervised learning, semi-supervised learning and reinforcement learning.

### 5.2.1 Supervised Learning

This type of learning is based on data sets that are labeled as true information. The AI must find patterns and relations according to its data sets that we assume are true. The program is going to use what it has learnt in the past to understand if the information is right or wrong. According to its data sets it can create new patterns which are more precise and then improve its performance. This type of learning is common especially in the huge marketplaces where they give recommendations of products based on their AI models. The companies that are selling an enormous amount of content and products should find something to help them to redirect customers to products they might like and buy instead of displaying everything and letting users

choose. The AI models and probability are tremendously important for these big companies, the machine learning algorithms are a cost and time saver. Therefore, marketplace companies are investing millions of dollars in AI, to keep growing and be more efficient. These businesses need data to grow and prosper in the future, Big Data is their fuel.

There are tons of products on their websites, that is why they must find a solution to sort them and present intelligent content to appropriate users based on their tastes. For example, you can try opening Amazon on a private window and do a simple search. Do the exact same thing with your main account and send the same request. Results are going to be different because the AI has already been trained on your account. We can also speak about Netflix; its recommendations are based on a supervised learning model [17]. This model based itself on a lot of distinct types of data such as ratio of positive and negative notation of a content, device used, time of the content, profile information.

### **5.2.2 Unsupervised Learning**

The unsupervised learning is totally different from the supervised learning because it must learn from 0. It has only his own cognitive capacities to learn from scratch as we say. This kind of programming is much more complex than the supervised this is why it is less used than the supervised learning. The AI must learn by its own without any available storage with labeled data to refer. Indeed, organizing and labeling data is a really long and expensive task to train supervised models of AI. This is why Google use it to understand the content of a webpage [11] and reference it with its algorithms.

The main application of unsupervised learning is the domain of prediction that help companies to target the needs and tastes of their customers. This is why it is used by social networking giants such as Instagram to guess the relation between users according to the number of their connections, messages, content, age, location. For example, Instagram propose you to follow some people with the mention that you know them. This is the proof that it learn from new data and find pattern by itself which is insane!

### **5.2.3 Semi-supervised Learning**

This one is a hybrid between the 2 previous types of learning. This has been invented to get the advantages from both of the 2 types of learning. However, this is not fully unlabeled data such as unsupervised learning because the spectrum of application of it is still limited. This type of learning has been developed by Google to save time for Machine Learning engineers and Data Scientists that must sort data before using it to train their AI models. This project uses graphs to label billions of data by browsing the graph and looking all the neighbors of a node and calculating complex relations [15]. They are going to use it to make an AI understand the humor of humans which is relative and has no clearly defined rules.

We can find an analogy of the 3 types of learning with a teacher and a student. Supervised learning is where the student is taught at school and at home. Unsupervised learning is where the student is never taught, neither at school nor at home, he is forced to learn by himself. The last, most realistic one, the student will be taught at school and practice at home doing homework [2].

### **5.2.4 Reinforcement learning**

The last one among the fourth cited is reinforcement learning. The best among all the different types of learning and the closest to human learning. AI models use a rewards system. On one hand, a model of reinforcement learning interacts with its environment. On the other hand, it gets positive or negative answers reactions modeled as a score. The goal of the AI is to maximize the total reward by finding the more efficient solution to perform a given task.

The AI starts from scratch and must learn by trying randomly at the beginning. As it goes along, it improves itself by creating complex techniques and strategies to complete the task with the best score. A huge advantage of this type of learning is the possibility to train the AI in plenty of different cases simultaneously and even thousands with a powerful computer. Reinforcement learning is used in the car industry to train self-driving cars. However, there are still problems with autonomous cars. They must train a lot to ensure the security of the passengers but if they face a new situation this is up to the AI to decide what to do, which is complicated sometimes [14].

Type of learning	Application [7]
Supervised Learning	Estimate real estate prices, predict if a bank transaction is fraudulent, recognize faces, signatures, report spam
Unsupervised learning	Recommend products according to customer's activities, Create customers categories based on their activities, advertise to specific customers based on their tastes
Semi-supervised Learning	Classify protein sequence, Rank the Internet content such as webpages [2]
Reinforcement learning	Teach cars to park autonomously according to their environment, dynamically control traffic lights according to road traffic

## 6 Projects examples

In this part we are going to check some examples of Artificial Intelligence projects. From our daily life usage to advanced and complex projects such as humanoids.

### 6.1 Questions and Answers robots

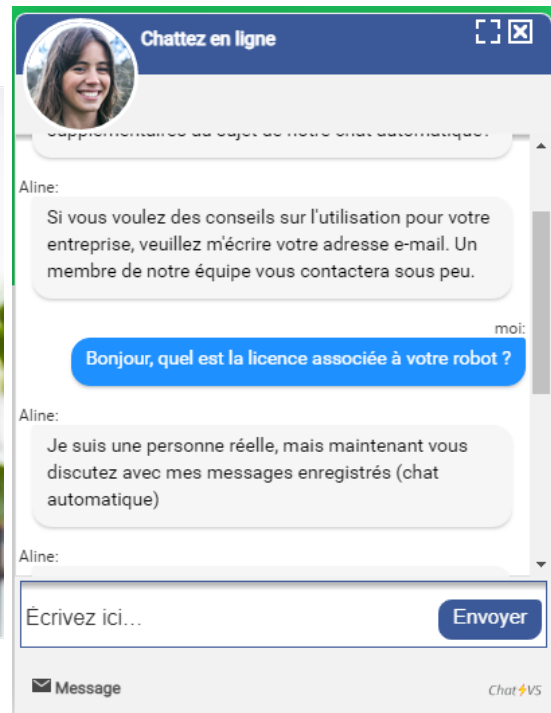
On the application of the banks and others online services like courses, marketplaces there is a bot that answers basics questions asked by users. Be careful, it is not always an AI program behind this, it can be a data base of associations of questions and answers. Nevertheless, if you are seeing customized answers there is probably a neural network behind this. Especially if the chatbot proposes you something related to the question that he did not understand. Artificial Intelligence is use by banks because it can help to prevent customers from scales even if it is not perfect and do not work like a magic pill [1].

This new type of programming provides a lot of help for online services that were performed by humans in the past. The place of human is not destroyed because AI bots cannot answer complex questions yet. Also, the evolution of AI programs ensure that companies lay away savings. It is also used by the banks to prevent from fraudulent transactions. This means that if the robot detects an unusual transaction in a new location or buying a new expensive product for example, the bank is going to send an automatic message to the card owner to verify his identity and his will of purchasing. This method is applied online and on the shops that we are going on frequently. It allows the bank to cancel an order and block the credit card if the risk is high for the customer. The last advantage but not the least is to be able to generate reports that contains information for the customers and authorities which helps the companies to save a lot of money and time. At the same time, it provides a better experience with the user and creates more alive Questions and Answers sessions. These robots can be called Q&A bots which give you instantly the idea of their function.





(a) Chatbot builder, sprinklr.com



(b) Chatbot, virtualspirits.com

## 6.2 Artificial Intelligence and Robotics

Robot Sophia is a humanoid that uses AI to understand human questions and answer with understandable and reliable source. She is one of the smartest robots in the world. She can adapt, learn and understand which define intelligence that is why she is called a smart robot. For the moment, she is not able to socialize properly and efficiently with other humans that is why she is not ready to be produce at the scale of an industry and needs improvements.



(a) Sophia, wikipedia.org



(b) Sophia and her creator, TRO

### 6.3 Artificial Intelligence software projects

Copilot is an AI bot developed by GitHub. Its main goal is to provide help for developers and save a lot of time using autocompletion and neural networks. Its main advantage is to understand humans' sentences and the language that it learnt and be able to create a function that does the work asked. It is powerful if you understand how it works. Copilot is not a copyright free project, but you can try it for free for one month.

Another example of an AI project is Open AI, which is an open-source project about the development of Artificial Intelligence. The founder of the company is Elon Musk. He created this start-up because he is quite scared about the growth of neural networks and robotics, so he decided to build an open-source resource about AI. This project helps people to code faster when they use the AI bot. Tesla's CEO created this project to have an overview of AI development and not leave it uncontrolled. There are a lot of projects that are developed by this company such as a one hand Rubik's Cube solver [9]. These projects are open sources and available on GitHub for most of them. It also provides a lot of resources for AI developers and engineers such as libraries in Python or datasets. At the same time, it has a huge documentation that everyone can explore, which is helpful to learn and be up to date with some research methods.

## 7 Problems and expectations

In this section, we will discuss the problems and questions associated with AI. In the first instance, let's talk about the main difference between an AI program and a human. Then, have a pragmatic view of this invention and its impact today. Finally, we are going to see why humans are irreplaceable.

### 7.1 Limitations and future of jobs

Humans are beings that are alive and have emotions and a certain level of consciousness depending on individuals, they have different ethics of what is good and what is bad. These aspects give them a scheme of thinking and acting tremendously complex and almost impossible to model perfectly. Indeed, we can respond differently in many situations and differently depending on a lot of parameters. Humans are strange beings even if we can use statistics and probabilities to guess what the masses are going to do quite precisely. This is what makes humans unique and almost mysterious.

However, as mentioned above, it is possible to create models that can be reliable according to data in a huge quantity. Therefore, some people are scared about the progression of AI because they are thinking they are going to replace them. This is true and false at the same time; AI has been developed to help humanity and make life easier. AI is going to help people in their job to make them more efficient and do all the hard work for them to prevent people from a lot of problems that happen in the companies and especially in the factories. The jobs of people are going to become easier and more fun for them!

The last point deals with the near future and especially the long run is the place of humans in society. This is important for certain persons and less for others, but can we invent a world where humans became slave of robots or dumb and lazy to a point of no going back as some films and influent people say. Even if it is an extreme situation 70% of the US workers interrogated on a survey would like to use AI to help them to be more effective [5].

For the moment, AI is already implemented in our lives, but it is still machine learning algorithms behind and not humanoids. Let us remember that it took decades to democratize computers. The same process is going to happen for AI. Very advanced projects with Artificial Intelligence are a tiny part of the AI programs in the world. We are still in the state of research and development. At the same time, AI does not have emotions, and ethics like humans and needs a lot of energy and data to train. The reliability is not always present even if we can find

advanced neural networks such as GPT-2 and 3 [8]. We still need a lot of people to perform a lot of tasks and AI is not ready for that even if it goes quickly. The time when robots are taking over the world is not for tomorrow and the reality is that AI transforms jobs but does not destroy them.

## 7.2 Future of Artificial Intelligence

Artificial Intelligence is going to blow up in the future. In the Army, there will be many opportunities. I spoke with a military developer, and he told me there will be many possibilities to help the army and research to do. In addition, it is saving time and energy for the companies that are going to impact the prices and the quality of products and services; this is going to be cheaper and better.

The world evolves quickly and the standards too, working while trying to use fewer resources is going to be a challenge due to all the environmental issues. The tendency is clearly to provide products and services that are more transparent about their fabrication costs and their environmental impacts. The companies connected and prepared for the new world will invest massively in the research of Artificial Intelligence. Those are going to earn even more money and adapt easily to the new expectations of customers. In addition, plenty of jobs are going to be created in the next years. According to World Economic Forum, workers are not ready to match with AI required knowledge and humans will have to up-skill in the future [10].

## 8 Bibliography

### References

- [1] Ai cloud for banking. [https://www.datarobot.com/solutions/banking/?utm\\_source=google&utm\\_campaign=BWBankingIndustry2022EMEA0419GPS&utm\\_term=&utm\\_content=variation\\_rsa\\_dynamic&campaignid=16959825978&adgroupid=137668056455&adid=604515520520&gclid=EAIaIQobChMIpY7zjtPi-wIVg\\_uyCh3S](https://www.datarobot.com/solutions/banking/?utm_source=google&utm_campaign=BWBankingIndustry2022EMEA0419GPS&utm_term=&utm_content=variation_rsa_dynamic&campaignid=16959825978&adgroupid=137668056455&adid=604515520520&gclid=EAIaIQobChMIpY7zjtPi-wIVg_uyCh3S).
- [2] AlindGupta. ML — semi-supervised learning. <https://www.geeksforgeeks.org/ml-semi-supervised-learning/>.
- [3] Thomas Alsop. Share of households with a computer at home worldwide from 2005 to 2019. <https://www.statista.com/statistics/748551/worldwide-households-with-computer/>, 2022.
- [4] Rockwell Anyoha. The history of artificial intelligence. <https://sitn.hms.harvard.edu/flash/2017/history-artificial-intelligence/>.
- [5] Martin Armstrong. The tasks ai should take over, according to workers. <https://www.weforum.org/agenda/2022/04/tasks-ai-workers-usa>.
- [6] Daniel Chang. Declarative vs imperative programming: 5 key differences. <https://www.educative.io/blog/declarative-vs-imperative-programming>.
- [7] Coursera. 3 types of machine learning you should know. <https://www.coursera.org/articles/types-of-machine-learning>.
- [8] Irene Solaiman et ali. Gpt-2: 1.5b release. <https://openai.com/blog/gpt-2-1-5b-release/>.
- [9] OpenAI et ali. Quels sont les types de programmation ? <https://openai.com/blog/solving-rubiks-cube/>.
- [10] Saadia Zahidi et ali. The future of jobs report 2020. <https://www.weforum.org/reports/the-future-of-jobs-report-2020>.
- [11] Ginni. What are the examples of unsupervised learning? <https://www.tutorialspoint.com/what-are-the-examples-of-unsupervised-learning>.
- [12] Allen Newell and J.C Shaw. Programming the logic theory machine. [http://bitsavers.org/pdf/rand/ipl/P-954\\_Programming\\_The\\_Logic\\_Theory\\_Machine\\_Jan57.pdf](http://bitsavers.org/pdf/rand/ipl/P-954_Programming_The_Logic_Theory_Machine_Jan57.pdf), 1957.
- [13] Artem Oppermann. What is deep learning and how does it work? <https://builtin.com/machine-learning/what-is-deep-learning>, May.
- [14] Błażej Osiński and Konrad Budek. What is reinforcement learning? the complete guide. <https://deepsense.ai/what-is-reinforcement-learning-the-complete-guide/>.
- [15] Google Research. Graph-powered machine learning at google. <https://ai.googleblog.com/2016/10/graph-powered-machine-learning-at-google.html>.
- [16] Ash Turner. How many smartphones are in the world? <https://www.bankmycell.com/blog/how-many-phones-are-in-the-world>.
- [17] Harshit Verma. Netflix recommendation engine - how netflix uses big data and analytics to recommend you your favourite shows. <https://startuptalky.com/netflix-recommendation-engine/>.