Artificial Intelligence And Machine Learning – Principles And Applications

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

PRINCIPLES AND APPLICATIONS

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Principles and Applications

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(**Authors:** Dr. R. SenthilKumar, Dr. S. Gokulraj, Mr. J. Senthil and Mrs. M. Sunandini)

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UNIT 1

ARTIFICIAL INTELLIGENCE AND KNOWLEDGE REPRESENTATION

1.1. Introduction to Artificial Intelligence and its evolution

What we call "artificial intelligence" (AI) is really just a fancy word for machines that can think and learn like humans. This is something that robots can accomplish. Though it has been applied in computer programs for quite some time, artificial intelligence is now found in a diverse range of products and services. Example: certain modern digital cameras can detect objects in a photo just by looking at them. This is made possible by artificial intelligence software. Furthermore, intelligent power grids are only one of many emerging applications of AI that scientists are looking forward to developing in the future. In order to solve practical problems, AI uses techniques from economics, algorithm design, and probability theory. Moreover, AI incorporates ideas from a wide range of disciplines, including linguistics, mathematics, psychology, and computer science. Tools for building algorithms are available in computer science, whereas tools for modeling and solving optimization problems that arise from modeling are available in mathematics. The concept of artificial intelligence has been around since the 19th century, when Alan Turing proposed a "imitation game" to test machines' intelligence. However, it has only been feasible to implement in the last few decades due to the abundance of data and computing power available for AI training. Understanding AI requires first identifying the characteristics that distinguish human intellect from other forms of intelligence. What this means is that we are able to learn from our experiences and then use that information in other contexts. We can accomplish this because our brainpower is unparalleled; no other animal species has as many neurons as humans. Current computer systems are light years ahead of the human biological brain network.

But there's one major advantage machines have over us: the ability to process and analyze vast amounts of data and experiences far more quickly than humans. By using AI, you can prioritize your tasks and make more informed decisions using the information you have. You may use it to help with a lot of hard tasks, including finding the best delivery route, finding cases of credit card fraud, and predicting when maintenance is needed. You can devote more time and energy to what you do best when you use AI to automate a lot of mundane tasks for your company. Making robots that can do tasks that require cognitive activity is a major goal of study in this field. Skills that come under this umbrella include things like the ability to write and read handwriting, understand and interpret natural language, recognize spoken language, move and operate objects, and manage one's time effectively. The capacity to respond to questions posed by customers and medical professionals is also a part of this.

History of AI and how it has progressed over the years

Amidst all the buzz around AI nowadays, it's easy to lose sight of the fact that the field has a long history. various periods of artificial intelligence have focused on various things; for example, trying to mimic the human brain via neurology or proving logical theorems are two ways to categorize them. In 1956, scientists proved that a computer could answer any issue given an infinite amount of memory. This was a major step forward for artificial intelligence. In the late 1940s, pioneers in computing like Alan Turing and John von Neumann started to wonder whether computers could "think." Soon after, a program called the General Problem Solver (GPS) was created, marking the beginning of what is today known as artificial intelligence. For the next two decades, scientists mostly focused on finding practical uses for AI in solving real-world problems. This development led to the creation of expert systems, which let computers learn from their mistakes and use that knowledge to generate predictions.

Expert systems may not have the same level of complexity as human brains, but they can nevertheless learn patterns and make decisions with the right input. Both the medical and industrial sectors make frequent use of them nowadays. The second major turning point came in 1965 with the introduction of popular animated characters like ELIZA and Shakey the robot. These applications might automate the most fundamental interactions between humans and computers. These precursor technologies paved the way for the construction of more sophisticated speech recognition systems, which in turn gave rise to Alexa and Siri. Interest in artificial intelligence peaked roughly a decade ago and has been steadily rising since then. Theorem proving, the development of computer languages, and robotics all saw huge leaps forward as a result. On the other hand, it sparked a backlash against the field's exaggerated claims, and in response, funding was drastically cut in 1974. Interest peaked in the late 1980s, after a decade with no progress. The main reasons for this resurgence were developments in computer vision and speech recognition, along with reports that robots were becoming better than humans in "narrow" activities like playing chess or checkers. This time around, less human intervention was required to build algorithms that could understand and learn from real-world data. Events like this moved at a snail's pace until 1992, when curiosity piqued anew. The first reason why there has been a surge in interest in AI research is because of the technological improvements in computing power and data storage. Following this, in the mid-1990s, there was another major boom, this time spurred by the enormous leaps forward in computer technology that had occurred since the early 1980s. Because of this, computers are now almost as good as humans at certain activities, and performance on a lot of important benchmark problems, like photo identification, has improved significantly. A lot of ground was covered in the realm of artificial intelligence in the early years of this century. The development of an autonomously learning neural network was the first major milestone. It has outperformed humans in many specific fields since 2001, including object classification and

machine translation, among others. Researchers improved its performance across a broad range of activities during the next few years thanks to developments in the underlying technology. The second significant discovery that happened at this time was the introduction of reinforcement learning algorithms that were based on generative models. Generative models enhance the learning of complex behaviors from sparse data by creating new instances from a specified class. Just twenty minutes of practice behind the wheel might be enough to teach you how to control a car with their help. Along with these two developments, there have been many other noteworthy advances in AI within the last decade. Deep neural networks have recently been the go-to tool for computer vision researchers looking to solve problems like object identification and scene understanding. At the same time, there has been a marked increase in the focus on machine learning technology for NLP tasks including information extraction and question answering. At last, there's been a recent uptick in research into using related technologies for voice recognition applications like SID and automatic speech recognition (ASR). Speaker identification is another example of such a problem.

Here, is Brief history of Artificial Intelligence:

Year	Milestone / Innovation
1923	Karel Čapek plays named "Rossum's Universal Robots, the first use of the word "robot" in English.
1943	Foundations for neural networks laid.
1945	Isaac Asimov, a Columbia University alumni, use the term Robotics.
1956	John McCarthy first used the term Artificial Intelligence. Demonstration of the first running AI program at Carnegie Mellon University.
1964	Danny Bobrow's dissertation at MIT showed how computers could understand natural language.

Year	Milestone / Innovation
1969	Scientists at Stanford Research Institute Developed Shakey. A robot equipped with locomotion and problem-solving.
1979	The world's first computer-controlled autonomous vehicle, Stanford Cart, was built.
1990	Significant demonstrations in machine learning
1997	The Deep Blue Chess Program beat the then world chess champion, Garry Kasparov.
2000	Interactive robot pets have become commercially available. MIT displays Kismet, a robot with a face that expresses emotions.
2006	AI came into the Business world in the year 2006. Companies like Facebook, Netflix, Twitter started using AI.
2012	Google has launched an Android app feature called "Google now", which provides the user with a prediction.
2018	The "Project Debater" from IBM debated complex topics with two master debaters and performed exceptionally well.

1.2. Intelligence and Artificial Intelligence

The goal of this branch of computer science is to create computers or other devices with an intellect comparable to that of a human. Artificial intelligence (AI) refers to the scientific and technological process of developing intelligent systems, mainly intelligent computer programs. Artificial intelligence (AI) is not limited to biologically observable approaches, although it is related to the field that studies human cognition using computers. The goal of artificial intelligence (AI) research is to program computers to carry out hitherto human-only jobs with greater efficiency. American "father" of AI John McCarthy once said, "the science and the engineering of producing intelligent devices, particularly clever computer programs. "Artificial Intelligence" is a method of making a computer, a computer-controlled robot, or a software think intelligently, in a manner that is comparable to the way that intelligent people think.

The study of how the human brain thinks, as well as how people learn, make decisions, and operate while attempting to solve a problem, is the first step in the development of artificial intelligence (AI). The results of this research are then used as a foundation for the creation of intelligent software and systems. Big data, which refers to the growth in speed, amount, and diversity of data that organizations are currently gathering, has been a contributing factor in its recent rise to notoriety among the general public. Artificial intelligence is the ability to do activities such as recognizing patterns in data more effectively than humans, which enables organizations to obtain greater insight from their data collections. The term "artificial intelligence" (AI) refers to a collection of highly effective tools and procedures that may be used to address issues that arise in the commercial world. The study of symbolic programming, problem solving, and search are all included in the field of artificial intelligence from a programming point of view.

AI Vocabulary

Intelligence Tasks requiring more complex cognitive operations, including coming up with novel solutions to problems or tackling complex problems creatively, are what the word "intelligence" alludes to Computing intelligence encompasses a broad range of abilities, such as the following: pattern recognition, classification, learning, induction, deduction, analogy creation, optimization, language processing, knowledge, and many more part of the ability to achieve one's goals. **Intelligent behaviour** intelligent conduct includes things like seeing one's environment, navigating complex situations, learning and understanding via experience, reasoning to solve problems, and so on go into uncharted territory, successfully apply existing knowledge to new contexts, think abstractly, draw parallels, interact with others, and many more. **Science based goals of AI** include, among other things, the creation of new concepts and methodologies, and the understanding of intelligent behavior in biological systems.

Engineering based goals of AI which has engineering-based goals such as the development of concepts, theories, and techniques for the construction of intelligent machines. **AI Techniques** methods show how people express, manipulate, and reason with data to solve issues. Knowledge is a set of "facts." In order for a computer program to change this data, a Appropriate representation is required. The capacity to solve issues is aided by a proper representation. **Learning** allows programs to gain knowledge from the facts or actions they represent.includes changes to the systems that are flexible; in other words, it enables the system to do thedoing the same action(s) with enhanced efficiency thereafter. **Applications of AI** has many practical uses, such as problem solving, creating better search and control methods, improving speech recognition, and many more.Expert systems, computer vision, and natural language processing are just a few examples.

1.3. How AI is affecting on real life?

The field of modern computer science and engineering known as artificial intelligence (AI) is concerned with the development of computer programs that mimic human intelligence in order to solve problems in ways that humans can. AI is an umbrella term for technologies that aim to mimic the human brain more closely. An increasing number of students are opting to pursue a master's degree in artificial intelligence or a related field. This trend has an effect on students' career prospects, but AI impacts not only academia and the workforce, but also every person's life, which we will discuss further.

1.3.1 Positive Impacts of AI in our Daily Lives

The impact of AI on our daily lives is becoming more apparent. Most of the things we do each day are powered by calculations or algorithms that can outperform humans. Whether in the workplace or in industries, AI has the ability to greatly increase efficiency.

On the flip side, if AI can handle boring or dangerous tasks, it will free up humans to do other things. Here are some positive effects of AI:

1.3.2 On Business

In the business sector, AI might bring about many positive changes. At its core, AI creates many job opportunities for highly qualified individuals, especially those with a master's degree in AI. Data scientists, programmers, and engineers are in great demand because they solve complex problems with complex algorithms that make businesses money. For instance, AI could help businesses increase sales by suggesting products to people based on their search history and other activities.

1.3.3 On Education

Institutions of higher learning may now use AI to personalize lessons for each student according to their current skill level, prior knowledge, preferred subjects, and desired outcomes. A student may study more efficiently with the help of artificial intelligence as it can analyze their past exams and learning history to identify their weak spots and then create individualized learning goals. The impact of AI on education has led to the creation of new courses like the Master of Science in Artificial Intelligence, which teaches students how to articulate the profound changes happening in the field of education. If you are interested in earning a master's degree in AI, you might want to consider the Master of Science in Artificial Intelligence program at IU International University of Applied Sciences and London South Bank University.

1.3.4 On Healthcare

But even though AI is a complicated technology, it is helping healthcare professionals and doctors find new things every day that can never replace the steady hand of a human.

On the other hand, technology may one day make people do less work. There are a lot of ways in which qualified experts, like those with a Master of Science degree in Artificial Intelligence, contribute to the doctors' work. AI has created a lot of tools and methods that have made doctors' jobs easier, especially your own colleagues in surgery.

1.3.5 On Industries

Artificial intelligence has decreased the number of tasks that previously required human labor due to technological advancements. When it comes to enterprises, AI is beneficial and influential since it allows owners to discover new aspects of their job. The level of production speed and quality is the most negatively affected aspect of the industrial sector. The advent of AI has not only boosted long-standing companies, but also paved the way for many startups to launch their operations. The industrial sector has also benefited from these new developments.

1.4. Different branches of AI

Over the last several years, artificial intelligence has achieved remarkable strides in many commercial domains. Systems of artificial intelligence that mimic human intellect may learn, reason, and understand complex tasks so that they can behave accordingly. A thorough familiarity with the many AI concepts that contribute to solving problems in the actual world is crucial. The use of techniques and programs like machine learning, a branch of AI, might make this a reality. The main areas of AI that will be covered in this article are: The following:

- Computer vision
- Fuzzy logic
- Expert systems
- Robotics
- Machine learning
- Neural networks/deep learning

1.4.1 Computer vision

These days, computer vision is among AI's most talked-about subfields. Making techniques so computers can view and understand digital images and videos is its principal goal. Machine learning algorithms, when trained on images, enable computers to identify a vast array of objects, faces, animals, and humans. Automatic learning of visual data contexts is possible with the use of computational models. Beyond that, computers may teach themselves to distinguish between pictures when given enough data via a model. A convolutional neural network works in tandem with a model to deconstruct images into their component pixels and then name or tag each one. The neural network uses the labels to run convolutions, a mathematical procedure that takes two functions and uses them to build a third function. It then uses this function to generate predictions about what it thinks it's seeing. Computer vision has several potential uses in many different industries, such as:

- **Object tracking:** Keeping tabs on newly found objects.
- **Image classification:** An accurate prediction that an image belongs to a certain class is required for picture classification.
- **Facial recognition:** Smartphones with face unlock capabilities enable users to unlock their devices by mapping and matching facial features.

1.4.2 Fuzzy Logic

For issues or assertions that might be true or false, fuzzy logic is a useful tool to have at your disposal. This approach seeks to simulate human judgments by considering every possible combination of the binary values "yes" and "no." To rephrase, it is a means to gauge how well a hypothesis holds water. Use this branch of AI if you need to reason about things that aren't black and white.

Using machine learning techniques, it may be possible to logically mimic human cognition in a way that is straightforward and flexible. Fuzzy logic consists of four main parts when broken down into its architecture:

- **Rule base.** Includes all of the rules and criteria that need to be satisfied.
- **Fuzzification.** allows for the transformation of inputs.
- **Inference engine.** This function finds out how well fuzzy inputs and rules work together.
- **Defuzzification.** Translates between fuzzy sets and numeric values.

To control the brakes in dangerous situations, manufacturers like Nissan employ fuzzy logic. Every vehicle's brakes work differently based on its acceleration, speed, and wheel speed.

1.4.3 Expert systems

An expert system is a kind of computer program that mimics the behavior of a human specialist in a certain area. Using decision-making abilities similar to humans, these systems aim to tackle complicated problems. Inference rules are specified for them by a data-supplied knowledge base, and they apply these rules in their work. Their use of if-then logic allows them to tackle complex issues and provide support in many domains, such as data management, virus detection, loan analysis, and more. In the 1970s, substantial strides were achieved in the field of artificial intelligence with the introduction of the first expert system. One kind of expert system is CaDeT. Medical professionals may find it easier to detect cancer in its earliest stages if they use this diagnostic assistance system.

1.4.4 Robotics

A robot is a mechanized machine that may be programmed to carry out a series of complex tasks without human intervention.

One way to control them is using external technology, while another is to put their control systems inside the person themselves. Robots could help with the boring and tedious tasks that people hate to do. Robots driven by artificial intelligence could be useful for NASA and similar organizations, especially in the area of space exploration. Humanoid robots are both a relatively new development and a prominent example of robotic evolution. The Hanson Robotics-built robot Sophia uses a combination of AI and neural networks to carry out its tasks. She can not only communicate with people, but also recognize their faces, read their emotions and body language, and even manipulate them. Everyday robots are used in many different industries, including manufacturing, healthcare, retail, and many more.

1.4.5 Machine learning

Machine learning refers to computers' ability to learn autonomously via data and algorithms. Among the many branches of AI, machine learning is notoriously difficult. Utilizing past experiences via machine learning, which may also make judgments without being explicitly educated to do so, may enhance performance. The initial step is to gather historical information, such as instructions and personal experience, so that logical models may be built upon which to draw conclusions. The amount of data used to train the model determines the quality of the output; more data means a more precise model, which means better accuracy overall. Generally speaking, there are three types of algorithms utilized in ML:

- **Supervised learning.** Machine learning relies on labelled data to train models to reliably predict outcomes.
- **Unsupervised learning.** Instruction offered without direct supervision. Machines are taught to function with data that has not been tagged. In order for the model to provide an output, it first has to extract data from the input so that it can identify patterns and characteristics.

1.4.6 Neural networks/deep learning

Another term for neural networks is ANNs, which stands for artificial neural networks. Another moniker for neural networks is SNNs, which stands for simulated neural networks. At their heart, deep learning algorithms are neural networks that mimic the way the human brain operates. The interconnections between actual neurons are mimicked by neural networks. The building blocks of these ANNs are the node layers, which consist of an input layer, a hidden layer (or layers), and an output layer. Interconnected with other neurons, each node—also called an artificial neuron—has a weight and a threshold. Bypassing an intermediate network layer is possible if and only if a node's output is higher above an arbitrary threshold. Neural networks can't learn and get more accurate without training data.

1.4.7 Natural language processing

Through the use of natural language processing, computers can mimic human comprehension of both written and spoken language. The integration of deep learning models, linguistics, and machine learning allows computers to understand human language in text or voice media. In this way, computers are able to understand the whole intent, tone, and meaning of the language.One example is speech-to-text or speech recognition, which reliably converts spoken words into text. This could be challenging since people's speech displays a wide range of intonations, accents, and dialects. Programmers must train computers to understand and recognize data using applications powered by natural language if computers are to have early data comprehension capabilities. Some examples of when NLP might be useful are:

- **Virtual chatbots.** They have the ability to understand context, which allows them to gradually enhance their responses for customers.

- **Spam detection.** Emails may be analyzed for signs of spam or phishing using a text classification system that use natural language processing.
- **Sentiment analysis.** Reading people's social media posts is a great way to get a sense of how they feel about certain products.

1.5. Limitations of AI

Among the many computer-related technologies now seeing explosive growth is artificial intelligence (AI). With this innovation, a computer may mimic human thought processes. Artificial intelligence (AI) is a computer program that aims to simulate human intellect. Its goal is to enable computers to think and behave similarly to humans. Between 1943 and 1956, a renowned computer scientist by the name of John McCarthy developed the idea of artificial intelligence. An early 1950s publication popularized the term "artificial intelligence" (AI). The first idea was supposedly proposed by McCarthy. Businesses have been able to increase productivity, decrease costs, and improve operations in a variety of ways thanks to artificial intelligence, which has been a game-changer for humanity. Having said that, it does have certain problems. The following are some of the major limitations that artificial intelligence currently possesses.

1.5.1 Inaccurate Data Analysis

Machine learning algorithms can only improve their performance with the help of human input. However, if the program is fed faulty or misleading information, the outcomes could be biased or incorrect. To that end, artificial intelligence (AI) can only process data of a high enough quality to be useful. To be adopted, artificial intelligence must overcome this, among the most fundamental hurdles. Businesses have obstacles when trying to use AI on a wide scale due to AI's often fragmented, inconsistent, and low-quality

implementations. From the start, we need to have a clear plan for gathering the information that AI can use to stop this. Consider Amazon: in 2014, the tech giant started evaluating potential new hires with the help of AI technologies. As part of its training, it reviewed resumes over the last decade, with men making up the vast majority of applicants. For some reason, the algorithm began to exclude female job candidates since it mistakenly believed that being male was the most desired attribute.

1.5.2 Bias in Algorithmic

An algorithm is a collection of rules that a computer must follow to complete a task. A human programmer may have penned these suggestions, but it's far from certain. Conversely, if algorithms are prejudiced or inaccurate, we can't rely on them; otherwise, we'd only get bad outcomes. The fundamental source of biases is the incomplete algorithm design by programmers, who placed certain desirable or self-serving criteria at the forefront. Algorithmic bias is a common consequence of using algorithms on big platforms like social networking websites and search engines. An example would be Facebook's algorithm that, in 2017, removed hate speech from the site. Meanwhile, it was later discovered that the algorithm enabled hate speech aimed against Black children but not white men. Because the algorithm was only meant to reject broad categories like "whites," "blacks," "Muslims," "terrorists," and "Nazis," it did not prevent the creation of these vile phrases.

1.5.3 Relatively Expensive (Cost vs Benefits)

When choosing an AI system, cost is another important factor to think about. Data storage, data mining, and data analysis are all energy and technology intensive activities that can set you back a pretty penny. Issues with cost and maintenance arise when businesses are compelled to outsource due to a lack of in-house expertise or familiarity with artificial intelligence.

Smart technologies may be pricey due to their complexity, and there's also a chance that you'll have to shell out more money for repairs and upkeep down the road. Computing costs associated with building data models are one example of what may be seen as extra expenses. Companies have moved beyond the experimental phase in making Artificial Intelligence (AI) technology a reality during the last several years. Companies with a greater marketing budget are more likely to invest in AI with the goal of optimizing its return on investment (ROI), and this strategy is paying off for these companies. Among larger companies, 63% reported higher revenues and 44% reported lower expenditures across all business divisions that have used AI, according to a 2019 survey by McKinsey. Many businesses are still experiencing project failures related to machine learning and artificial intelligence (ML) at this time. Results from a recent IDC study of 2,000 enterprise IT experts and decision-makers show that 28% of AI/ML initiatives failed. We believe that leaders still need direction in one area: calculating the true costs and benefits of widespread AI and ML implementation. Contrary to popular belief, doing a cost-benefit analysis for an AI or ML project is a very complex and challenging task. Adopting AI does not always come at a fixed cost; rather, the benefits gained from AI are directly proportional to the capital invested. For instance, when it comes to creating AI chatbot services, businesses that deal with customers often, like e-commerce, can benefit from reducing the number of human customer service representatives needed to answer generic questions about sales and product availability. However, small businesses or businesses providing complex customer service, like digital farming, may find that AI chatbots aren't up to the task, and the associated costs are high.

1.5.4 No Ethics and Emotionless

Computers and other machines do not have feelings, as we were taught in school. The superiority of robots over humans in terms of

productivity is undeniable. Having said that, it's also true that machines can't take the place of the personal connections that make teams tick. While ethics and morality are two of the most crucial aspects of human nature, they are also two of the most difficult aspects of AI to include. It is feasible that humans may become extinct in the next several decades due to the unexpected and fast spread of artificial intelligence throughout all areas of the economy. The development process for artificial intelligence cannot compare to that of humans since AI is a technology that comes fully equipped with data and experience. It may repeat the same process; but, in order to make changes or improvements, we will have to change the command. We may not be able to access or use it in the same way that a human brain can, but it can store an infinite amount of data. A great deal of ground remains to be covered in order to define the boundaries of AI's potential use. AI safety must be prioritized, and immediate action is needed to address the current limitations. Many of the people who are against AI also have concerns about the ethics of using it. The conceptual character of these issues is just as significant as the fact that it does away with privacy altogether. Intelligence is something that we humans have by definition, in our opinion. It may seem that providing it for free is at odds with the idea of exclusivity. A common and often-discussed question is whether or not machines should be granted human rights if they can do all the tasks that humans can. This would put them on par with humans. If that's the case, how do you feel about the rights of these machines? No reasonable conclusion can be drawn from this situation.

1.5.5 Adversarial Attacks

Because it lacks the inherent flexibility of humans, artificial intelligence is ill-equipped to deal with unexpected developments. Applying tape on the wrong side of the road, for instance, may cause an autonomous vehicle to swerve into oncoming traffic and crash. No one could respond to the footage even if they saw it.

1.6. Need of knowledge Representation

Information representation in AI is called "knowledge representation." AI is essentially an exploration of how an intelligent agent's beliefs, intentions, and judgments can be expressed in a way that is suitable for reasoning automatically. An agent's ability to mimic human intelligence is only one of many significant uses for knowledge representation. Knowledge Representation and Reasoning (KR, KRR) is a way to represent real-world knowledge in a way that computers can understand it better. With this data in hand, the machine may be able to do complex real-world tasks, including having natural-language conversations with humans. In the context of AI, knowledge representation involves more than just putting information into a database; it allows a computer to learn from that material and act intelligently, exactly like a human. Here are just a few examples of the numerous forms of information that AI systems must account for:

- Everything
- Events
- Its execution
- The verity
- A System for Meta-Knowledge
- An educational foundation

Moving on to other subjects, let's study about the numerous types of knowledge now that you know how AI expresses information. Because it allows computers to understand, store, and modify human information, knowledge representation is crucial in artificial intelligence (AI). Because of this, computers can now do tasks that require intelligence, make decisions, and solve complex problems. The primary goal of artificial intelligence's knowledge base is to gather data from human experts so that it may aid in decision-making, problem-solving, and other tasks.

1.7. Knowledge Representation and Mapping schemes

You need a lot of data and a way to manipulate that data to solve the tough problems in artificial intelligence. Separate from one another are the ideas of representation and knowing. You should know that they all play a different role in the intelligent system. Knowledge provides a prism through which the universe may be seen. In order to determine its degree of competence, a system relies on its knowledge. Representation is one of the encoding mechanisms for knowledge. It defines the efficiency with which a system completes a given job. It is necessary to employ different representational styles for different types of information. Knowledge representation models and techniques typically draw from:

- Using reasoning
- Rules
- The photo frames
- A Syntactic Web

Knowledge is categorized into two major types. The many ways in which knowledge can be expressed have all found their way into AI systems. There are two different kinds of entities, we are dealing with.

- First, the facts: the veracity of a key reality. Things that we would like to highlight.
- A graphical depiction of the facts drawn from whichever formalist is preferred. We shall really be able to exert some control over these things.

These entities are structured at two levels:

- This refers to the degree of knowledge at which things are stated.