International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 9 Issue 2, Mar-Apr 2025 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Overview on Artificial Intelligence

Matthew N. O. Sadiku[1], Paul A. Adekunte[2], Janet O. Sadiku[3]

[1]Roy G. Perry College of Engineering, Prairie View A&M University, Prairie View, TX, USA
[2]International Institute of Professional Security, Lagos, Nigeria
[3]Juliana King University, Houston, TX, USA

ABSTRACT

Artificial intelligence (AI) refers to the technology that enables computers and machines to simulate human learning, comprehension, problem solving, decision making, creativity, and autonomy. It is a set of technologies that enable computers to perform a variety of advanced functions, including the ability to see, understand and translate spoken and written language, analyze data, make recommendations, and more. AI is a broad field that encompasses many different disciplines, including computer science, data analytics and statistics, hardware and software engineering, linguistics, neuroscience, philosophy, and psychology. In this paper, we will explore what AI actually is, the main types of AI, a quick history of AI, and practical applications of AI powers.

KEYWORDS: *artificial intelligence, AI, machine learning, robotics*

How to cite this paper: Matthew N. O. Sadiku | Paul A. Adekunte | Janet O. Sadiku "Overview on Artificial Intelligence" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-9 | Issue-2, April 2025, pp.898-908, URL: www.ijtsrd.com/papers/ijtsrd78617.pdf

IJTSRD78617

INTRODUCTION

Artificial intelligence (AI) is the branch of computer science that deals with designing intelligent computer systems that mimic human intelligence. It refers to any human-like intelligence exhibited by a computer, robot, or other machine. After a long time perception of AI as science fiction, AI is now part of our everyday lives. AI is transforming how we live, work, and connect with each other. From self-driving cars on the highway to medical tools that detect diseases early, AI is everywhere.

Today, the amount of data in the world is so humongous that humans fall short of absorbing, interpreting, and making decisions of the entire data. This complex decision-making requires higher cognitive skills than human beings. This is why we build intelligent machines like AI to perform this task. AI is stand-alone independent electronic entity that functions much like human expert. AI is integrated into our daily lives in several forms, such as personal assistants, automated mass transportation, aviation, computer gaming, facial recognition at passport control, voice recognition on virtual assistants, driverless cars, companion robots, etc. Figure 1 shows the symbol of AI [1].

HISTORICAL BACKGROUND

From ancient times, humans have been dreaming of creating artificial intelligence. Artificial Intelligence somewhat scares and intrigues us. Early advocates of AI envisioned machines that had a wide variety of human capabilities. Modern AI research started in the mid 1950s, when AI researchers were convinced that "machines will be capable, within twenty years, of doing any work a man can do." In the 1970s, it was obvious that researchers had grossly underestimated the difficulty of the project. In 20 years, AI researchers have been shown to be fundamentally mistaken. By the 1990s, AI researchers expect that today's artificial intelligence will eventually evolve into artificial general intelligence (AGI) [2].

In modern age, important events and milestones in the evolution of AI include the following [3]:

- **1950:** Alan Turing publishes *Computing Machinery and Intelligence.* In the paper, Turing—famous for breaking the Nazi's

ENIGMA code during WWII—proposes to answer the question "can machines think?"'

- **1956:** John McCarthy coins the term "artificial intelligence" at the first-ever AI conference at Dartmouth College. This is when the field of AI officially started.
- **1967:** Frank Rosenblatt builds the Mark 1 Perceptron, the first computer based on a neural network that "learned" through trial and error. Just a year later, Marvin Minsky and Seymour Papert publish a book titled *Perceptrons*, which becomes the landmark work on both neural networks and AI.
- **1980s:** Neural networks featuring backpropagation—algorithms for training the network—become widely used in AI applications.
- **1997:** IBM's Deep Blue beats then world chess champion Garry Kasparov, in a chess match.
- **2011:** IBM's Watson captivated the public when it defeated two former champions Ken Jennings and Brad Rutter on the game show Jeopardy!.
- **2015:** Baidu's Minwa supercomputer uses a special kind of deep neural network called a convolutional neural network to identify and categorize images with a higher rate of accuracy than the average human.
- **2016:** DeepMind's AlphaGo program, powered by a deep neural network, beats Lee Sodol, the world champion Go player, in a five-game match. The victory is significant given the huge number of possible moves as the game progresses.

The latest focus on AI has given birth to natural language processing, computer vision, robotics, machine learning, deep learning, and more. Figure 2 summarizes the history of AI [4].

HOW AI WORKS

Artificial intelligence (AI) refers to any technology exhibiting some facets of human intelligence, and it has been a prominent field in computer science for decades. AI can be achieved by reading the behavior of humans and using the results to develop intelligent systems. For example, they learn, make decisions and act in certain situations.

AI works by copying human intelligence using computer code. Figure 3 shows the three main processes involved in AI [4]. AI combines data, algorithms, and iterative feedback to do complex tasks, often in the same way we do. It uses a wide range of techniques and approaches that enable machines to simulate human-like intelligence and perform tasks that traditionally require human assistance. AI systems work through a combination of algorithms, data, and computational power to learn from experience, make decisions, and perform tasks autonomously. AI systems learn and improve through exposure to vast amounts of data, identifying patterns and relationships that humans may miss.

COMPONENTS OF ARTIFICIAL INTELLIGENCE

Today, AI is already everywhere and it drives many aspects of our lives. AI is not a single technology but a range of computational models and algorithms. Artificial intelligence has the following main components [5,6]:

1. *Expert systems:* Expert system (ES) was the first successful implementation of artificial intelligence and may be regarded as a branch of AI mainly concerned with specialized knowledge-intensive domain like medicine. An expert system is a computer software that simulates the judgment and behavior of a human expert. It is also known as intelligent system or knowledge-based system. It encapsulates specialist knowledge of a particular domain of expertise and can make intelligent decisions. It has a knowledge base and a set of rules that infer new facts from the knowledge base. Expert systems solve problems with an inference engine that draws from a knowledge base equipped with information about a specialized domain, mainly in the form of if-then rules [7].
2. *Fuzzy logic:* This makes it possible to create rules for how machines respond to inputs that account for a continuum of possible conditions, rather than straightforward binary. Where each variable is either true or false (yes or no), the system needs absolute answers. However, these are not always available. Fuzzy logic allows variables to have a "'truth value" between 0 and 1. It uses approximate human reasoning in knowledge-based systems. It was introduced in 1960s by Lotfi Zadeh of University of California, Berkeley known as father of fuzzy set theory. Fuzzy logic is useful in manufacturing processes as it can handle situations that cannot be adequately handled by traditional true/false logic [8].
3. *Machine learning:* Machine learning (ML) is essentially the study of computer algorithms that improve automatically through experience. It is the field that focuses on how computers learn from data. This includes a broad range of algorithms and statistical models that make it possible for systems to find patterns, draw

inferences, and learn to perform tasks without specific instructions. Machine learning is a process that involves the application of AI to automatically perform a specific task without explicitly programming it. Today, artificial intelligence is narrow and mainly based on machine learning.

There are two types of learning: supervised learning and unsupervised learning. Supervised learning focuses on classification and prediction. It involves building a statistical model for predicting or estimating an outcome based on one or more inputs. It is often used to estimate risk. Unsupervised learning looks for internal structure in the data. Unsupervised learning algorithms are common in neural network models. Machine learning techniques have been currently applied in the analysis of data in various fields including medicine, finance, business, education, advertising, cyber security, and energy applications [9].

4. *Neural networks:* These are specific types of machine learning systems that consist of artificial synapses designed to imitate the structure and function of brains. An artificial neural network (ANN) is an information processing device that is inspired by the way the brain processes information. They were originally developed to mimic the learning process of human brain. The idea of ANNs was inspired by the structure of the human brain and what the brain can do. They may be regarded as a sort of parallel processor designed to imitate the way the brain accomplishes tasks. They are made up of artificial neurons, take in multiple inputs, and produce a single output. The network observes and learns as the synapses transmit data to one another, processing information as it passes through multiple layers [10]. As shown in Figure 4, artificial neural networks are multi-layer fully-connected neural nets.

5. *Deep learning*: This is a form of machine learning based on artificial neural networks. Deep learning (DL) architectures are able to process hierarchies of increasingly abstract features, making them especially useful for purposes like speech and image recognition and natural language processing. Deep learning networks can deal with complex non-linear problems. It extracts complex features from high-dimensional data and applies them to develop a model that relates inputs to outputs. The most common form of deep learning architectures is multi-layer neural networks. Deep learning has many advantages over shallow learning. Although DL has achieved some success and found applications in various fields, it is still in its infancy [11]. Figure 5 shows how artificial intelligence, machine learning, and deep learning fit together [12].

6. *Natural Language Processors*: For AI to be useful to us humans, it needs to be able to communicate with us in our language. Computer programs can translate or interpret language as it is spoken by normal people. Language is crucial around the world in communication, entertainment, media, culture, drama, movie, and economy. Natural language processing (NLP) refers to the field of study that focuses on the interactions between human language and computers. It is a computational approach to text analysis. It involves the study of mathematical and computational modeling of various aspects of language. It is an interdisciplinary field involving computer science, linguistics, logic, and psychology. NLP is important because of the major role language such as English plays in human intelligence and because of the wealth of potential applications [11].

7. *Robots*: AI is heavily used in robots, which are computer-based programmable machines that have physical manipulators and sensors. Sensors can monitor temperature, humidity, pressure, time, and record data, and make critical decisions in some cases. Robots have moved from science fiction to your local hospital. In jobs with repetitive and monotonous functions they might even completely replace humans. Robotics and autonomous systems are regarded as the fourth industrial revolution. Robotics is a branch of engineering and computer science that involves the conception, design, manufacture, and operation of robots. Future robots will operate in highly networked environments where they will communicate with other systems such as industrial control systems and cloud services [12]. How would you feel about being cared for by a robot nurse, or your elderly relatives being cared for by robot caregivers?

These AI tools are illustrated in Figure 6. Each AI tool has its own advantages. Using a combination of these models, rather than a single model, is recommended. Other areas of AI research in evolutionary computation, artificial general intelligence, and explainable AI. Figure 7 show the relationship between AI and its tools.

APPLICATIONS

Artificial intelligence (AI) is rapidly transforming our world. It is incorporated into a variety of different

types of technology. AI has the potential to impact nearly all aspects of our society, including automation, healthcare, business, education, engineering, law, manufacturing, transportation, and security. Some of these applications are briefly discussed here [13]:

- *Automation*: AI can automate workflows and processes or work independently and autonomously from a human team. When paired with AI technologies, automation tools can expand the volume and types of tasks performed. The most common type was the automation of digital and physical tasks using robotic process automation technologies. Robots are intelligent machines used in automation to manufacture, assemble, paint, clean, and entertain.
- *Self-driving cars:* Autonomous vehicles use a combination of computer vision, image recognition and deep learning to build automated skill at piloting a vehicle. They are equipped with LIDARS (light detection and ranging) and remote sensors that gather information from the vehicle's surroundings We can also expect to see driverless cars on the road in the next twenty years..
- *Healthcare:* Artificial intelligence is revolutionizing healthcare. AI applications in healthcare are many, include using online virtual health assistants and chatbots to help patients and healthcare customers find medical information, schedule appointments, understand the billing process and complete other administrative processes. There are now chatbots that ask patients about their symptoms to make a pattern-based diagnosis.
- *Business:* In the sphere of business, AI is poised have a transformational impact. Chatbots have been incorporated into websites to provide immediate service to customers. Other programs, such as IBM Watson, have been applied to the process of buying a home. Banks are successfully employing chatbots to make their customers aware of services and offerings and to handle some transactions.
- *Government:* AI in government is represented by intelligent software and hardware to boost smart government, reducing costs, minimizing corruption; and increasing transparency. Although AI will replace people from their jobs, it will create the need for other professionals as the data scientists for the government.
- *Education:* AI technology in education is allowing a degree of flexibility and customization that was never before possible. It is revolutionalizing schools and classrooms, making educator's job a lot easier. AI can automate grading and assess students. It is poised to revolutionize education.
- *Manufacturing*: Manufacturing has been at the forefront of incorporating robots into the workflow. Artificial intelligence appears to have significant application potential to many important manufacturing problems ranging from production planning and control processes to shop floor automation.
- *Finance:* Finance is one of the fastest growing sectors where applied AI tools are being deployed: from retail online banking to investment advice and insurance. Smart technology enables the assessment of risks and opportunities, improving investment and lending decisions as well as providing personalized financial advice through virtual assistants.
- *Fraud Detection*: AI algorithms are employed by financial institutions to detect fraudulent activities in real-time. Machine learning and deep learning algorithms can analyze transaction patterns and flag anomalies, such as unusual spending or login locations, that indicate fraudulent transactions. This enables organizations to respond more quickly to potential fraud and limit its impact, giving themselves and customers greater peace of mind.
- *Virtual Personal Assistants:* These enable always-on support, provide faster answers to frequently asked questions (FAQs), free human agents to focus on higher-level tasks, and give customers faster, more consistent service. Popular examples like Siri, Google Assistant, and Amazon Alexa utilize AI to understand and respond to user commands. These assistants employ natural language processing (NLP) and machine learning algorithms to improve their accuracy and provide more personalized responses over time. Virtual assistants serve a variety of functions, including helping users schedule tasks, making and receiving calls, and guiding users on the road. Generative AI tools and services are starting to creep into the real world beyond novelty chatbots like ChatGPT.

Other areas of application of AI include ecommerce, social media, food industry, travel industry, engineering, law, gaming, agriculture, transportation, smart city, smart grid, security, and military.

WEAK AND STRONG AI

Two different approaches have developed in the history of AI. In 1980, John Searle introduced the

terms “weak AI” and "strong AI." Narrow AI is what we have now, while general AI is what we wish to achieve. These are also referred as specialized and general AI.

A strong artificial intelligence is in principle identical to human intelligence, i.e. strong AI can *think* and have a *mind*. Strong AI can be developed by combining the programs that solve various sub-problems. Strong AI is for machines capable of experiencing consciousness, which is the capacity to recall memories and dream about the future. Strong AI is now referred as AGI. Some AGI projects are currently underway, including DeepMind, OpenCog, and OpenAI. The IEEE has developed its own recommendations for building safe AGI systems, which include that AGI systems should be transparent, that "safe and secure" environments should be developed, and that such systems should resist being shutdown by operators.

Weak AI is everywhere around us and is the most successful realization of AI to date. A weak artificial intelligence is less ambitious than strong AI, and therefore less controversial, i.e. weak or narrow AI can (only) *act like* it thinks and has a mind. Weak or specialized AI is the application of AI to specific tasks such as industrial robots, virtual personal assistants, such as Apple's Siri, Internet searching, driving a car, or playing a video game. Weak AI is sometimes called artificial narrow intelligence (ANI). Weak AI is AI as known today. Weak AI is limited to the use of software to study or accomplish specific problem solving. IBM's Watson supercomputer, expert systems, and the self-driving car are all examples of weak AI. Freely accessible weak AIs include Google AI or Apple's Siri and others. Today, narrow AI tools have become mainstream in business and society [14]. The progression of artificial intelligence (AI) is shown in Figure 8.

BENEFITS

Rapid expansion in the artificial intelligence field will result in more high-paying jobs, which, in turn, will require more highly-educated employees. The largest criticism of AI is that it will automate low-skill jobs and increase the unemployment rate for less-educated people. Companies attempting to achieve a competitive advantage can leverage AI to optimize their business. Other benefits include [15,16]:

- *Automation:* AI can automate routine, repetitive and often tedious tasks. This automation frees humans to work on higher value, more creative work.
- *Enhanced Decision-making*: Whether used for decision support or for fully automated decision-making, AI enables faster, more accurate predictions and reliable, data-driven decisions. Combined with automation, AI enables businesses to act on opportunities and respond to crises as they emerge, in real time and without human intervention. AI facilitates faster, more informed decision-making for both individuals and enterprises. It can be used to diagnose medical ailments and predict stock market movements.
- *Fewer Human Errors:* AI can reduce human errors in various ways, from guiding people through the proper steps of a process, to flagging potential errors before they occur, and fully automating processes without human intervention. This is especially important in industries such as healthcare where, for example, AI-guided surgical robotics enable consistent precision.
- *Round-the-clock Availability*: AI is always on, available around the clock, and delivers consistent performance every time. Tools such as AI chatbots or virtual assistants can lighten staffing demands for customer service or support. AI can help maintain consistent work quality and output levels when used to complete repetitive or tedious tasks.
- *Reduced Physical Risk*: By automating dangerous work—such as handling explosives, performing tasks in deep ocean water—AI can eliminate the need to put human workers at risk of injury. While they have yet to be perfected, self-driving cars and other vehicles offer the potential to reduce the risk of injury to passengers.
- *Productivity:* Increasing economic productivity leads to more satisfied customers and strengthened corporate profitability. In the airline industry, AI will drive customer satisfaction through accurately scheduled and safer flights. Businesses that harness AI can improve their value proposition to customers while improving profitability at the same time.
- *Increased Efficiency*: Repetitive duties can be automated by AI, freeing humans up to focus on more significant or imaginative activities. Artificial intelligence is increasing efficiency in a variety of industries, from email response automation to office workflow optimization.
- *Cost Savings:* By increasing productivity, lowering errors, and providing more specialized services, artificial intelligence can save operating costs in sectors like healthcare and retail.

CHALLENGES

Adopting and maintaining AI workflows comes with challenges and risks. While AI promises numerous benefits, it also poses significant risks that need to be carefully managed. Other challenges include the following [15,16]:

- *Data Risks:* AI systems rely on data sets that might be vulnerable to data poisoning, data tampering, data bias or cyberattacks that can lead to data breaches. Organizations can mitigate these risks by protecting data integrity and implementing security and availability throughout the entire AI lifecycle.
- *Operational Risks:* Like all technologies, models are susceptible to operational risks such as model drift, bias and breakdowns in the governance structure. Left unaddressed, these risks can lead to system failures and cybersecurity vulnerabilities that threat actors can us.
- *Privacy Violation:* This is another aspect of AI that concerns experts. As AI often involves collecting and processing large amounts of data, there is the risk that this data will be accessed by the wrong people or organizations. With generative AI, it is even possible to manipulate images and create fake profiles. The collection and analysis of large amounts of data to feed AI algorithms can raise concerns about the privacy of people's information if not handled properly. Data breaches may even encourage the proliferation of potential cyber attacks.
- *Ethics and Legal Risks:* If organizations do not prioritize safety and ethics when developing and deploying AI systems, they risk committing privacy violations and producing biased outcomes. For example, biased training data used for hiring decisions might reinforce gender or racial stereotypes and create AI models that favor certain demographic groups over others.
- *Ethics and Governance*: AI ethics is a multidisciplinary field that studies how to optimize AI's beneficial impact while reducing risks and adverse outcomes. Principles of AI ethics are applied through a system of AI governance consisted of guardrails that help ensure that AI tools and systems remain safe and ethical.
- *Bias and Fairness:* AI can inherit the biases in its training data. This can lead to unfair decisions in hiring, lending or law enforcement. Making sure AI is bias-free is a top priority. As AI techniques become more complex, they are progressively involved in decision-making processes that affect individuals' lives. We must prevent blindly accepting AI-generated results without considering potential biases or errors.
- *Accountability*: The more AI decides on its own the harder it is to assign blame. Transparent and accountable design is essential.
- *Job Displacement*: As more tasks become automated, especially in such industries as marketing, healthcare, manufacturing, and customer service, many workers are poised to lose their jobs. Although AI may create some new jobs, these may require more technical skills than the jobs AI has replaced. Society needs to plan for these changes and support the affected workers.
- *Superintelligence*: Some experts have raised concerns about a possible risk associated with the development of super-intelligent AI in the long term. The main fear is that if we were to create an AI with higher-than-human intelligence, it could become autonomous and surpass our ability to control it. Artificial super intelligence is the stage of artificial intelligence when the capability of computers will surpass human beings.

CONCLUSION

Artificial intelligence refers to machines that mimic human. It has silently changed the way we live, work, and relate to the world around us. It has made our life easier than before. It has attracted attention as a key for growth and development in developed nations such as Europe and the United States and developing nations such as China and India. The artificial intelligence revolution is upon us, and companies must prepare to adapt to this change.

Artificial general intelligence (AGI) is a newly emerging field that aims at building "thinking machines" with intelligence comparable to that of humans. It is essentially a hypothesized system that could replicate any task now requiring human intelligence. Although advocates argue that they will be able to realize AGI using deep learning and big data, we have not come much closer to developing AGI. The future of artificial intelligence appears bright with continued advancements in technology. The future is likely to involve continued advancements in machine learning, natural language processing, and computer vision, which will enable AI systems to become increasingly capable and integrated into a wide range of applications and industries.

Some academic institutions are now offering courses on AI. More information on AI is available in the books in [17-40] and the following related journals:

- Artificial Intelligence

- Journal of Artificial Intelligence and Consciousness
- AI Magazine
- AI & Society
- Artificial Intelligence in Agriculture
- IEEE Transactions on Artificial Intelligence
- Journal of Artificial General Intelligence
- Journal of Experimental & Theoretical Artificial Intelligence

REFERENCES

[1] "Artificial intelligence (AI)," https://www.livescience.com/technology/artificial-intelligence/what-is-artificial-intelligence-ai

[2] M. N. O. Sadiku, "Artificial intelligence", *IEEE Potentials,* May 1989, pp. 35-39.

[3] IBM Cloud Education, "Artificial intelligence (AI)," June 2020, https://www.ibm.com/cloud/learn/what-is-artificial-intelligence

[4] "What is artificial intelligence? Types, history and examples," February 2025, https://www.mygreatlearning.com/blog/what-is-artificial-intelligence/

[5] M. N. O. Sadiku, Y. Zhou, and S. M. Musa, "Natural language processing in healthcare," *International Journal of Advanced Research in Computer Science and Software Engineering*, vol. 8, no. 5, May 2018, pp. 39-42.

[6] "Applications of AI and machine learning in electrical and computer engineering," July, 2020, https://online.egr.msu.edu/articles/ai-machine-learning-electrical-computer-engineering-applications/#:~:text=Machine%20learning%20and%20electrical%20engineering,can%20%E2%80%9Csee%E2%80%9D%20the%20environment.

[7] M. N. O. Sadiku, Y. Wang, S. Cui, S. M. Musa, "Expert systems: A primer," *International Journal of Advanced Research in Computer Science and Software Engineering*, vol. 8, no. 6, June 2018, pp. 59-62.

[8] G. Singh, A. Mishra, and D. Sagar, "An overview of artificial intelligence," *SBIT Journal of Sciences and Technology,* vol.2, no. 1, 2003.

[9] M. N. O. Sadiku, S. M. Musa, and O. S. Musa, "Machine learning, " *International Research Journal of Advanced Engineering and Science,* vol. 2, no. 4, 2017, pp. 79-81.

[10] A. Dertat, "Applied deep learning - Part 1: Artificial neural networks," August 2017, https://towardsdatascience.com/applied-deep-learning-part-1-artificial-neural-networks-d7834f67a4f6

[11] M. N.O. Sadiku, M. Tembely, and S.M. Musa, "Deep learning," *International Research Journal of Advanced Engineering and Science*, vol. 2, no. 1, 2017, pp. 77,78.

[12] K. Abhishek, "Introduction to artificial intelligence," May 2022, https://www.red-gate.com/simple-talk/business-intelligence/data-science/introduction-to-artificial-intelligence/

[13] M. N. O. Sadiku, Y. Zhou, and S. M. Musa, "Natural language processing," *International Journal of Advances in Scientific Research and Engineering,* vol. 4, no. 5, May 2018, pp. 68-70.

[14] M. N. O. Sadiku, S. Alam, and S.M. Musa, "Intelligent robotics and applications," *International Journal of Trends in Research and Development,* vol. 5. No. 1, January-February 2018, pp. 101-103.

[15] "Artificial intelligence," https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence

[16] T. Angrignon, "AI definitions, and narrow vs. general vs. super intelligence," June 2020, https://productiveai.com/ai-definitions-and-narrow-vs-general-vs-super-intelligence/

[17] "What is artificial intelligence (AI)?" https://cloud.google.com/learn/what-is-artificial-intelligence

[18] "History of artificial intelligence: Artificial intelligence: Birth, applications and future trends," https://www.iberdrola.com/innovation/history-artificial-intelligence

[19] B. Goertzel, *AGI Revolution: An Inside View of the Rise of Artificial General Intelligence*. Humanity Press, 2016.

[20] M Ginsberg, *Essentials of Artificial Intelligence.* Elsevier, 2012.

[21] M. Flasiński, *Introduction To Artificial Intelligence.* Springer, 2016.

[22] D. Li and Y. Du, *Artificial Intelligence With Uncertainty.* Boca Raton, FL: CRC Press, 2nd edition, 2017.

[23] B. Goertzel and C. Pennachin, *Artificial General Intelligence.* Springer, 2007.

[24] N. Talagala and S. Ghanta, *Fundamentals of Artificial Intelligence: Volume 1 (Introduction to Artificial Intelligence).* Independently Published, 2022.

[25] S. Marsland, *Machine Learning: An Algorithmic Perspective.* Boca Raton, FL: CRC Press, 2nd edition, 2018.

[26] K. Hammond, *Practical Artificial for Dummies, Narrative Science Edition* Hoboken, NJ: John Wiley & Sons, 2015.

[27] M. Hutter, *Universal Artificial Intelligence: Sequential Decisions Based on Algorithmic Probability.* Springer, 2005.

[28] B. Goertzel and P. Wang (eds.), *Advances in Artificial General Intelligence: Concepts, Architectures and Algorithms.* IOS Press, 2007.

[29] E. R. Ranschaert, S. Morozov,and P. R. Algra (eds.), *Artificial Intelligence in Medical Imaging Opportunities, Applications and Risks*. Springer 2019

[30] R. Mitchell, J. Michalski, and T. Carbonell, *An artificial Intelligence Approach.* Springer, 2013.

[31] P. Joshi, *Artificial Intelligence with Python: A Comprehensive Guide to Building Intelligent Apps for Python Beginners and Developers Paperback*. Packt Publishing, 2017.

[32] V. Dignum, *Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way*. Springer 2019.

[33] J. Finlay and A. Dix, *An Introduction to Artificial Intelligence.* Boca Raton, FL: CRC Press, 2020.

[34] K Warwick, *Artificial Intelligence: The Basics*. Routledge, 2013.

[35] S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach.* Pearson, 4th Edition, 2020.

[36] M. Mitchell, *Artificial Intelligence: A Guide for Thinking Humans.* Farrar, Straus and Giroux, 2019.

[37] N. J. Nilsson, *Principles of Artificial Intelligence*. Elsevier, 2014.

[38] N. J. Nilsson, *The Quest For Artificial Intelligence.* Cambridge University Press, 2009.

[39] A. Barr and E.A. Feigenbaum, *The Handbook of Artificial Intelligence: Volume 2.* Elsevier, 2014.

[40] J Copeland, *Artificial intelligence: A Philosophical Introduction.* Blackwell Publishers, 2015.

[41] W Ertel, *Introduction to Artificial Intelligence*. Springer, 2018

[42] J Haugeland, *Artificial intelligence: The Very Idea.* MIT Press, 1989.

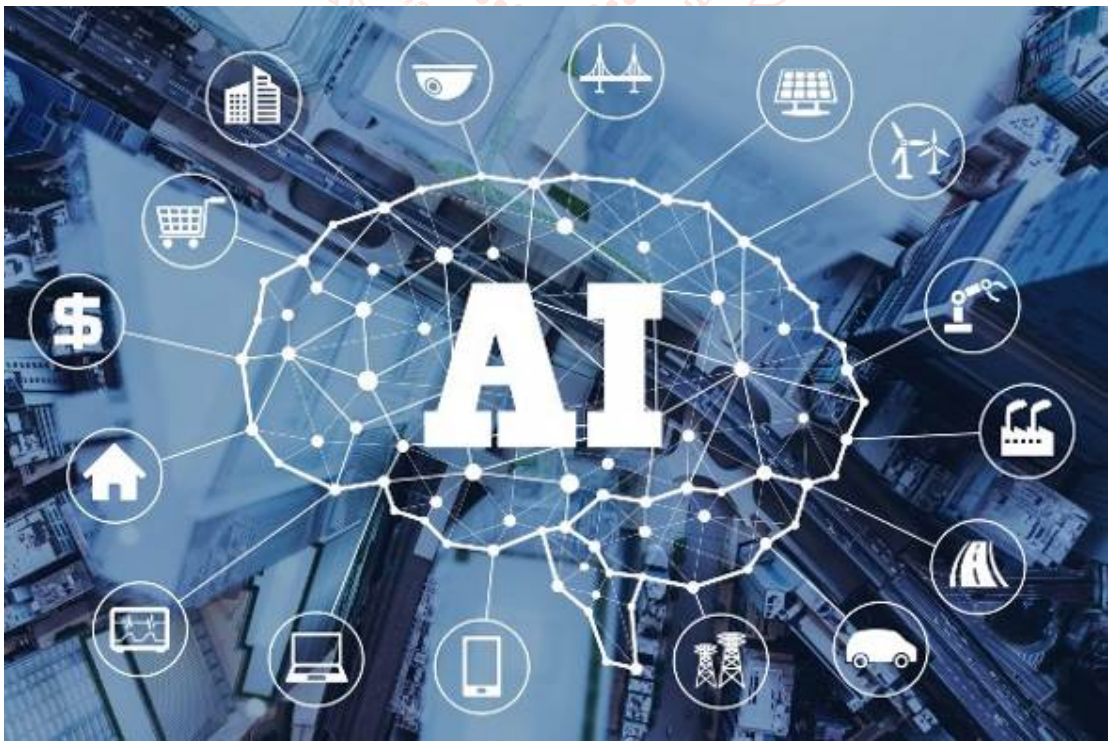

Figure 1 A symbol of AI [1].

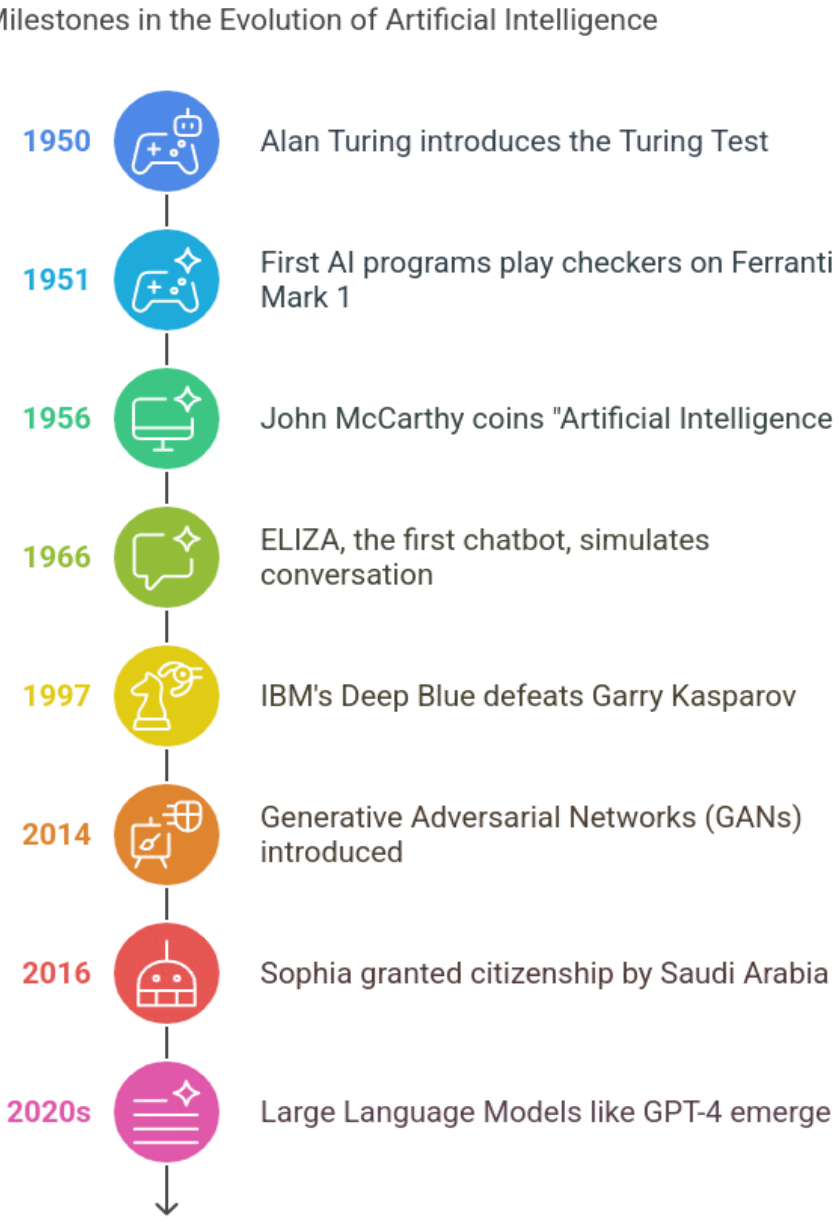

Figure 2 Summary of the history of AI [4].

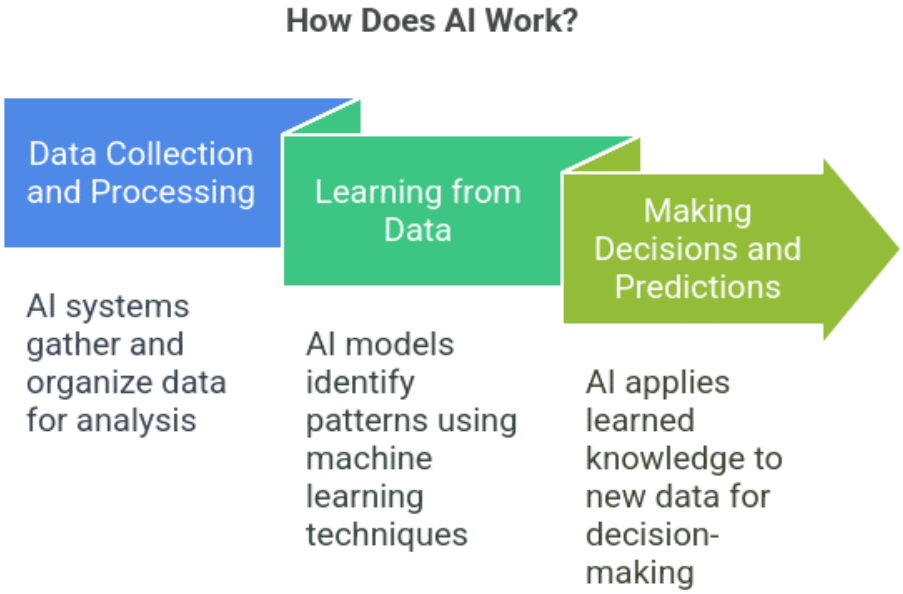

Figure 3 Three main processes involved in AI [4].

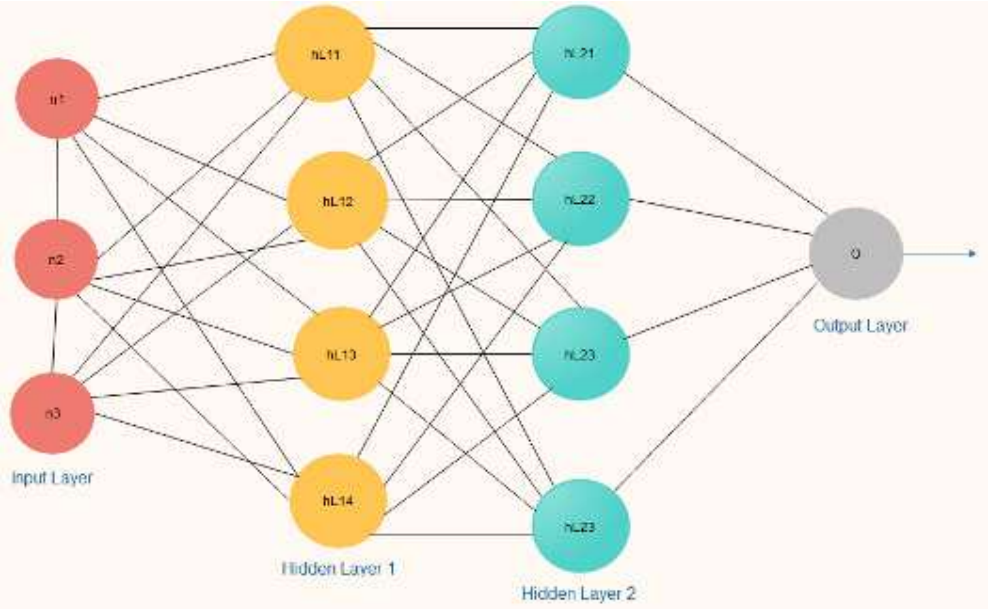

Figure 4 Artificial neural networks.

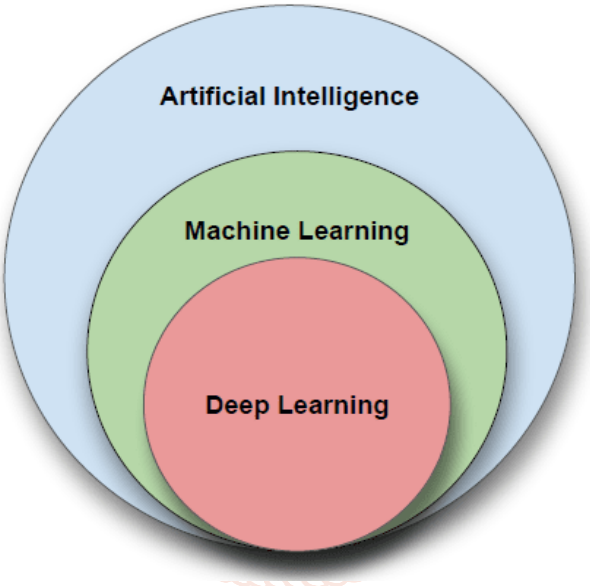

Figure 5 How AI, machine learning, and deep learning fit together [12].

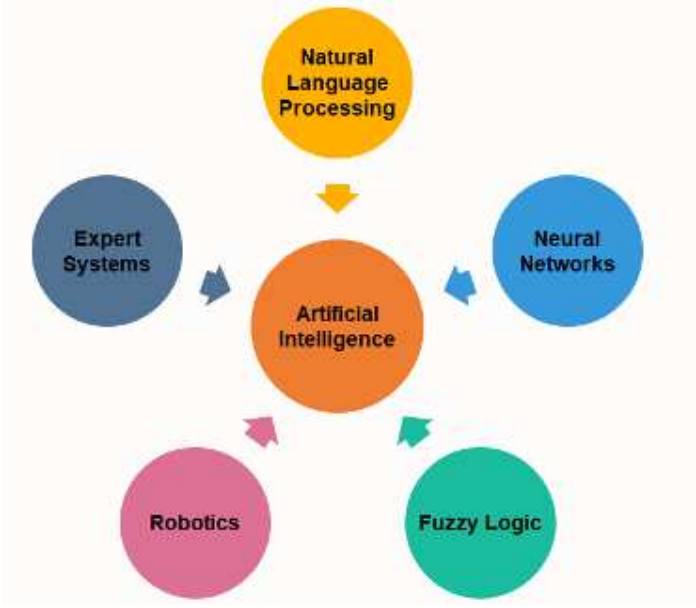

Figure 6 AI tools. REPLACE BY P.234

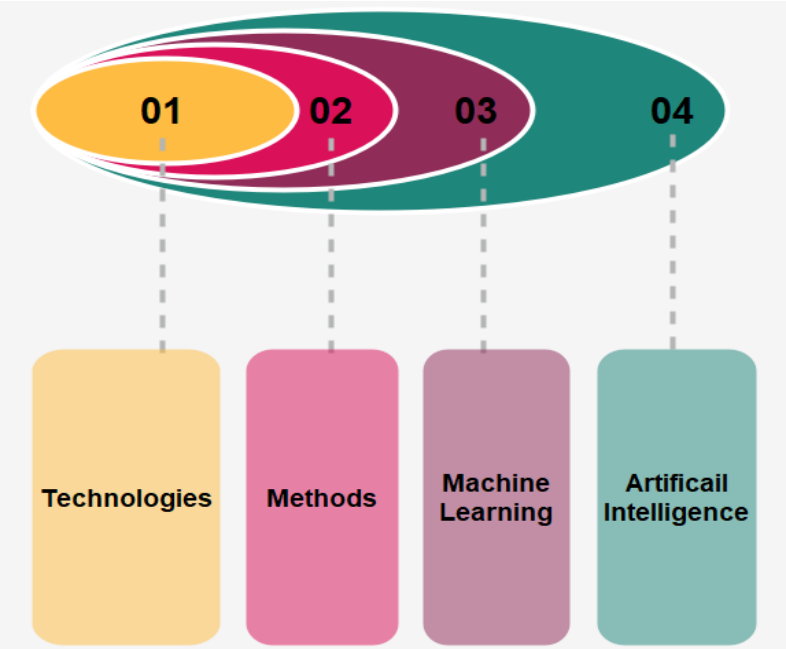

Figure 7 Relationship between AI and its tools.

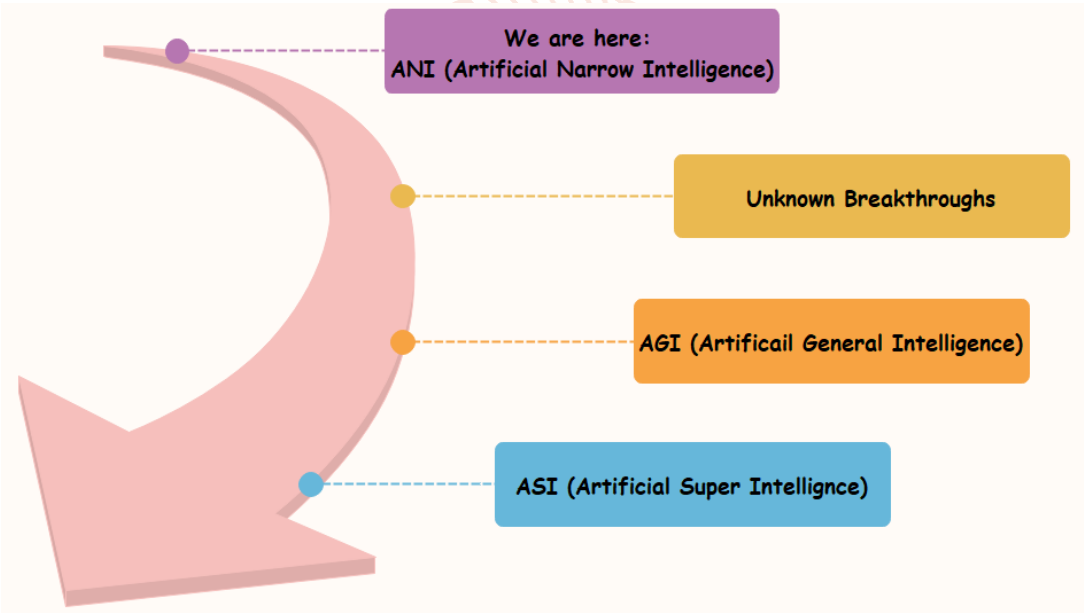

Figure 8 The progression of artificial intelligence (AI).