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# Artificial Intelligence Algorithms and Their Application in Industries

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**Abstract:** This article provides information about artificial intelligence, which has become a pressing topic in recent times. The article discusses the capabilities, fields of application, and main types of artificial intelligence.

**Key words.** Artificial intelligence, machine learning, Q-learning, cybersecurity, neural networks, programming, algorithm.



## INTRODUCTION

Artificial Intelligence (AI) typically refers to the development of computer systems capable of performing tasks that normally require human intelligence. These tasks include learning, reasoning, problem-solving, perception, language comprehension, speech recognition, and others.

The goal of artificial intelligence is to create machines that mimic human intelligence, allowing them to adapt to new situations, learn through experiments, and perform tasks independently.[1,5]

The term "artificial intelligence" was introduced by John McCarthy in 1955. In 1956, McCarthy and others organized the Dartmouth Summer Research Project on Artificial Intelligence conference. This initiative led to numerous innovations such as machine learning, deep learning, and predictive analytics. Furthermore, this initiative gave rise to an entirely new field - data science.

The 1990s opened a new chapter in the development of artificial intelligence. In 1997, IBM's Deep Blue was the first computer in history to defeat world chess champion Harry Kasparov.Artificial intelligence is based on mimicking human cognitive processes through the creation and application of algorithms in a high-speed computing environment. In simple terms,

artificial intelligence is a technology that guides computers to think and find solutions like humans.[1,32]

Achieving this goal requires three main components:

- Computing systems (high-performance computers);
- Big data and skills in managing it;
- AI algorithms (software code);

The closer artificial intelligence is to human intelligence, the more information and computational resources it requires to create it.There are two main types of artificial intelligence (Table 1):

| | |
|---|---|
| **Narrow or weak AI:** | • This type of artificial intelligence is designed and trained for a specific task, and its capabilities are limited to a specific area. Such as virtual personal assistants, image recognition programs, and chatbots, such as Siri or Alexa. |
| **General or strong AI:** | • It is a more advanced form of artificial intelligence and can be used in a wide range of tasks, such as understanding, learning, and the human mind. |

Table 1. The main types of artificial intelligence.

Artificial intelligence can be further categorized according to its functions, for example (Table 2):

| | |
|---|---|
| **Machine Learning:** | • A subset of artificial intelligence that involves the use of algorithms and statistical models that allow computers to perform work activities when completing a task by learning from data |
| **Natural Language Processing:** | • A NLP specialist helps to analyze data in oral and written speech, draw conclusions based on it, and make people's lives easier in related matters |
| **Computer Visio):** | • Involves the development of algorithms and systems that enable machines to interpret visual data, such as image and video recognition |
| **Robotics:** | • Combines artificial intelligence to control and automate robot movements, allowing them to perform tasks in the physical world. |

Table 2. **The classification of artificial intelligence according to its functions.**

Artificial intelligence (AI) encompasses a wide range of technologies that allow machines to perform tasks that typically require human intelligence. Here is a complete overview of the key AI algorithms and concepts[1,50] (Figure 1):

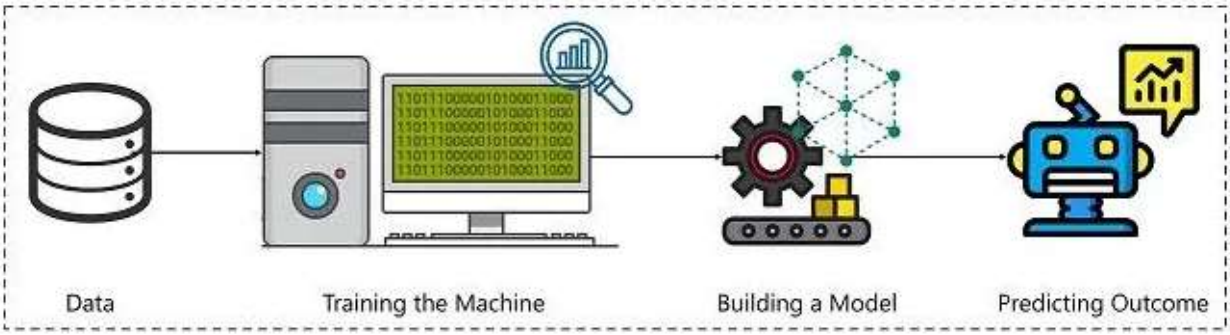



Figure 1. **A complete overview of AI algorithms and concepts.**

**Machine Learning**

1. Machine learning: is a subset of AI that aims to develop algorithms that allow computers to learn from data and predict based on it. It can be divided into several categories:

**Supervised education:**

- Supervised learning involves training a model in a labelled data set, i.e. each learning example is linked to an output label. Common algorithms include[2,15]:
- **Linear regression:** used to predict continuous values.
- **Logistic regression:** Used for binary classification problems.
- **Decision trees:** A model that splits data into subset values based on property values.
- **Random Forests: An ensemble of decision trees to improve predictive accuracy.**
- **Vector machine support (SVM): Finds the hyper plane that best separates data into classes.**
- **Neural networks: models inspired by the human brain are used for various tasks, such as classification and regression.**
- **Uncontrolled learning deals with unlabeled information and tries to find hidden patterns or internal structures. Common algorithms include:**
- **K-Clustering means: data is divided into separate clusters based on similarity.**
- **Hierarchical clustering: Creates a hierarchy of clusters.**
- **Key component analysis (PCA): Decreases the dimensionality of data.**
- **Autocoder: Neural networks used to learn effective coding.**
- **Strengthening learning**

Booster learning involves an agent learning to make decisions by performing actions in an environment to maximize total rewards. Key concepts include:

- **Q-Learning:** A value-based method for finding the best action taking into account the current situation.
- **Q-Networks (DQN):** It combines Q-learning with deep neural networks.
- **Policy gradient methods:** direct policy optimization that compares situations to actions.

**2. Deep learning (DL)**

- Deep Learning is a subset of Ml that uses multi-layered (deep networks) neural networks to model complex patterns in data. Basic architecture includes:

- **Convolutional neural networks (CNN):** Specializes in network-like data processing, such as images.
- **• Duplicate neural networks (RNN): D is intended for sequential data such as time series or text. Options include Long-Term Storage (LSTM) and Gated Recurrent Units (GRU).**
- **Generative competing networks (GNs) consist of two networks, a generator and a discriminator, competing to improve the quality of the generated data.**

**3. Natural language processing (NLP)**

- NLP involves the interaction between computers and human language. Key tasks and techniques include[2,62]:
- **Tokenization: Splitting text into smaller units, such as words or bottom words.**
- **Named object recognition (NER): identification and classification of objects in text.**
- **Emotional analysis: identifying an emotion or emotion expressed in a text.**

- Transformer models such as BERT and GPT, which use self-focusing mechanisms to control context in the text.

**4. Computer vision**

- Computer vision allows machines to interpret and make decisions based on visual data. Basic equipment includes:
- **Image classification: Tagging images based on their content.**
- **Object identification: identifying and placing objects within images.**
- **Image segmentation: Dividing an image into segments or regions.**
- **Posture assessment: Determining the posture of people or objects in images.**

**5. Evolution algorithms**

The natural selection process inspires these algorithms and includes:

- **Genetic algorithms (GA): Use mechanisms like mutation, crossover, and selection to solve problems.**
- **Genetic Programming (GP)**
- Develops programs or expressions to solve problems.

**6. Dirty logic**

Muddy logic deals with approximate thinking, not rigid and precise thinking. This is useful when there is uncertainty or uncertainty.

**7. Bayesian networks**

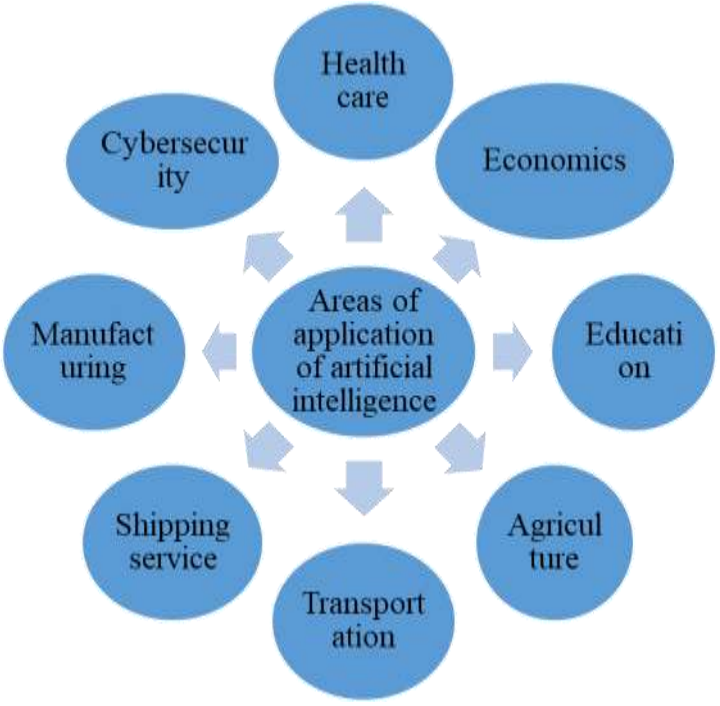
These are probability-graphic models that represent a set of variables and their conditional relationships. They are used to reason under conditions of uncertainty.

**8. Swarm Intelligence**

Common algorithms inspired by the collective behavior of social beings include [4.36]:

- **An ant colony optimization (ACO): Used to find optimal paths.**
- **Particle cluster optimization (PSO): Used to optimize continuous functions.**

AI algorithms have solved millions of problems, so it's impossible to list each of them. However, we can look at broader categories to see where profit arises [4,75] (Figure




2).

Figure 2. **Areas of application of artificial intelligence**

| **Fields** | Application |
|---|---|
| **Health care** | Diagnosis, drug identification, medical image analysis |
| **Finance** | Risk assessment, fraud detection, portfolio management |
| **Manufacturing** | Quality control, predictive maintenance, supply chain optimization |
| **Transportation** | Autonomous vehicles, route optimization, traffic management |

Table 3. **Classification of areas of application of artificial intelligence**

**The field of education** is an area where artificial intelligence has made significant progress. Using the capabilities of robotics, machine learning, data analysis, and natural language processing, artificial intelligence is revolutionizing the way we learn and teach (Table 4)

| **Technology** | **Usage** |
|---|---|
| **Machine learning** | algorithms can analyze large amounts of data to identify patterns and personalize learning experience. This technology can be used to create flexible learning platforms and smart tutoring systems. |
| **Natural language processing** | artificial intelligence-based learning tools allow students to understand and respond to human language. These opportunities facilitate language learning, speech therapy, and interactive virtual assistants in the classroom. |

| | |
|---|---|
| **Computer vision** | another area where AI is used in education. Using image recognition and object recognition algorithms, AI technology can be used to analyze student activity, track attendance, and provide visual aids in classes. |
| **Robotics** | increasingly used in education. Robots can communicate with students and help them in various activities, such as language learning, mathematical exercises, and coding |

Table 4. **Application of artificial intelligence in education**

Artificial intelligence has many applications in the retail industry, where data analysis, speech recognition, and robotics are widely used. The use of artificial intelligence in retail is widespread, and automation is increasingly used to simplify processes and increase efficiency.

Predictive modeling and machine learning technology are used to accurately forecast and help retailers understand customer behavior. By analyzing large amounts of data, retailers can gain valuable insights and make informed decisions (Table 5)

| **Technology** | **Usege** |
|---|---|
| **Computer vision** | Computer vision is used to track the movement and behavior of customers in retail stores. This technology can be used to optimize store layout and product placement. |
| **Natural language processing** | Natural language processing allows retailers to analyze customer feedback and reviews. This technology helps retailers better understand the opinions of buyers and improve products and services. |

Table 5. **Application of artificial intelligence in retail trade**

Artificial intelligence (AI) is revolutionizing the agricultural industry by providing innovative solutions to various challenges faced by farmers and agricultural enterprises. Artificial intelligence technologies such as natural language processing, computer vision, robotics, data analysis, and predictive modeling are used to increase efficiency, productivity, and sustainability in agriculture (Table 6)

| **Technology** | **Usege** |
|---|---|
| **Natural language processing** | Chatbots, voice assistants |
| **Computer vision** | Crop monitoring, disease detection |
| **Robotics** | Sowing, harvesting, observation |
| **Data analysis** | Crop growth patterns, market trends |
| **Predictive modeling** | Yield of crops, spread of diseases |

Table 6. **Application of artificial intelligence in agriculture**

The potential application of artificial intelligence in healthcare is not limited to these areas. Artificial intelligence can also be used in predictive analysis to identify patients at risk of

developing certain conditions, monitor the patient's life status in real time, and even assist in surgical procedures (Table 7)

| **Field** | Potential applications |
|---|---|
| **Medical image** | Analyze medical imagery to help diagnose |
| **Drug discovery and development** | Identify potential drug candidates and speed up the discovery process |
| **Electronic Health Recordings (EHRs)** | Improve the accuracy and accessibility of patient data |
| **Predictive analysis** | Identify patients at risk of developing specific conditions |
| **Real-time monitoring** | Monitor the patient's vital status in real time |
| **Surgical care** | Help with surgical procedures |

Table 7. **Application of artificial intelligence in healthcare**

Artificial intelligence technologies offer great opportunities in preventive medicine through predictive analysis. AI technologies are yielding effective results in identifying health risks and preventing diseases. However, this process also presents challenges such as the accuracy of predictive models, the management of incorrect positive and negative results, and the constant monitoring and updating of artificial intelligence systems. To overcome these difficulties, it is necessary for medical professionals and technologists to work together. Only in this way will it be possible to widely use artificial intelligence in medicine and obtain more effective results for patients.

## Summary

In conclusion, it should be noted that artificial intelligence is penetrating every aspect of our modern life. Artificial intelligence refers to the fact that it is based on imitating human cognitive processes through the creation and application of algorithms in a fast computing environment, which means that it is a technology that guides computers to think like humans and find solutions like them. Artificial intelligence algorithms can solve millions of problems. Therefore, it is impossible to list each of them.

Artificial intelligence is also an area where significant progress is being made in education. Using the capabilities of robotics, machine learning, data analysis, and natural language processing, artificial intelligence is revolutionizing the way we learn and teach. However, today, the role of artificial intelligence can be seen in all areas.

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