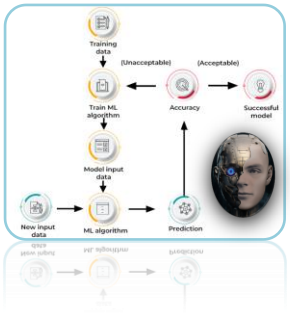
Machine Learning



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ML

Introduction to machine learning.
Why machine learning?
History of machine learning.

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START: Introduction to machine learning. Why machine learning? History of machine learning.

Introduction to Machine Learning

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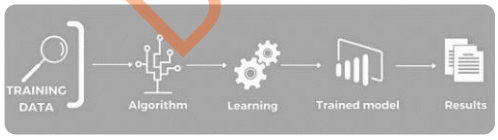
Machine Learning (ML) is a subset of Artificial Intelligence (AI) that focuses on **developing algorithms** and **models** that enable computers to **learn from** and **make predictions** or decisions based on data.

The primary goal of machine learning is to allow computers to **improve their performance** on a specific task through **experience**, without being explicitly programmed for that task.



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Introduction to Machine Learning

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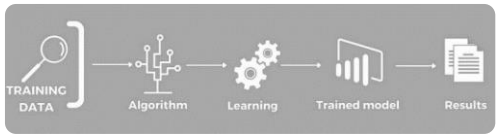
The fundamental concept behind machine learning is to create and utilize algorithms that can **identify patterns** and **relationships in data**. These patterns are used to make **predictions** or **decisions** when encountering **new, unseen data**.

Machine learning algorithms are **trained on a labeled dataset**, which means that the input data is associated with the correct output or target value. During the training process, the algorithm **learns to recognize patterns** in the data and adjust its **internal parameters** accordingly to improve its performance.



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History of Machine Learning

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- 1. **1940s - 1950s**: The Birth of Artificial Intelligence. Alan Turing and John von Neumann laid the theoretical groundwork for computing and artificial intelligence.
- 2. **1950s - 1960s**: The Dartmouth Workshop and Early AI Research. Dartmouth Workshop marked the official birth of AI. Marvin Minsky and John McCarthy created machines that could think and learn.
- 3. **1960s - 1970s**: Early Developments in Machine Learning. Arthur Samuel developed the first machine learning program to play checkers and improve its performance.
- 4. **1970s - 1980s**: Symbolic AI and Expert Systems. AI research during this time was dominated by symbolic AI.

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History of Machine Learning

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- 5. **1980s - 1990s**: The Connectionist Approach and Neural Networks. AI gained popularity but progress was slow due to lack of sufficient data for training these models.
- 6. **1990s - 2000s**: Machine Learning Rejuvenation. Support Vector Machines (SVMs), Decision Trees, and other statistical techniques applied.
- 7. **2000s - 2010s**: Deep Learning and Big Data. Deep learning, a subfield of machine learning based on neural networks with multiple layers, started gaining attention.
- 8. **2010s - Present**: Deep Learning Dominance and Broad Applications. Deep learning dominant approach in machine learning, leading to breakthroughs in areas like computer vision, natural language processing, speech recognition, and robotics.
- **Future Directions**: Machine learning research continues to evolve rapidly. The quest for artificial general intelligence (AGI) and ethical considerations surrounding AI remain areas of active investigation.

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What is learning?

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Learning is an area of artificial intelligence that focuses on the **process of self-improvement**. Learning involves **acquiring general concepts** from specific training examples. Each such concept can be viewed as describing some subset of objects or events defined over a larger set.
Alternatively, each concept can be thought of as a boolean-valued function defined over this larger set.
Ex: A function defined over all reptiles, whose value is TRUE for tortoise or snakes or lizards and FALSE for other animals.

reptiles

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Types of Learning

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- **Explicit Learning**: Intentional and conscious efforts to acquire new knowledge or skills. It often takes place in formal educational settings, where learners actively engage with subjects through reading, lectures, and discussions.
- **Implicit Learning**: In contrast to explicit learning, implicit learning is unconscious and unintentional. It occurs when individuals absorb information or skills without being aware of the learning process.
- **Experiential Learning**: This type of learning occurs through direct experiences and interactions with the environment. People learn by doing, making mistakes, and reflecting on those experiences.
- **Social Learning**: Social learning emphasizes the role of interactions with others in the learning process. Observing and imitating behaviors, attitudes, and skills of peers, family members or instructors can significantly influence how individuals learn and develop.

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Types of Learning

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- **Cognitive Learning**: Cognitive learning focuses on mental processes such as memory, attention, problem-solving, and reasoning.
- **Conditioning**: Conditioning is a form of associative learning where an individual learns to associate certain stimuli with specific responses. Two common types are classical conditioning (associating an involuntary response with a neutral stimulus) and operant conditioning (learning to associate behaviors with rewards or punishments).
- **Collaborative Learning**: Collaborative learning involves group activities where individuals work together to solve problems, share ideas, and contribute to a shared goal. This approach fosters teamwork, communication, and cooperative skills.

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Why Machine Learning?

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Advantages:

- 1. **Automating Complex Tasks**: Image and speech recognition, natural language processing, and data analysis, which can be done more efficiently by machine learning algorithms.
- 2. **Data-Driven Decision Making**: Businesses and organizations to make data-driven decisions. ML models can analyze large datasets, identify patterns, and extract valuable insights to guide decision-making processes.
- 3. **Improved Accuracy and Performance**: Achieve higher accuracy and performance compared to traditional rule-based systems or human experts.
- 4. **Adaptability and Generalization**: Adapt and generalize to new, unseen data.
- 5.**Personalization and Recommendation**: Product recommendations in e-commerce, and personalized marketing strategies.

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Why Machine Learning?

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- 6. **Continuous Improvement**: As new data becomes available, models can be retrained to incorporate the latest information, leading to more accurate predictions.
- 7. **Handling Big Data**: Handle big data efficiently and extract meaningful patterns and insights.
- 8. **Automation in Industry and Robotics**: Robots learn from their experiences and environments, enabling them to perform tasks autonomously and adapt to changes.
- 9. **Medical Applications**: Disease diagnosis, medical image analysis, drug discovery, and personalized treatment recommendations.
- 10. **Innovation and Research**: Natural language processing, computer vision, and scientific research.

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