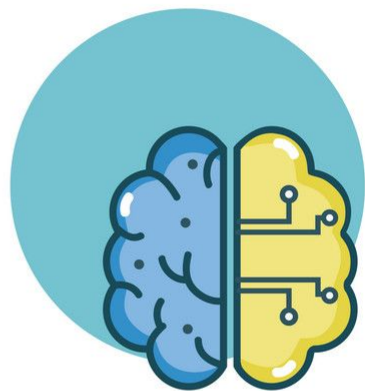


# INTRODUCTION TO MACHINE LEARNING

## INTRODUCTION



Elisa Ricci



# MACHINE LEARNING IS...

Machine learning is the study of computer algorithms that improve automatically through experience. It is seen as a part of artificial intelligence.



WIKIPEDIA  
The Free Encyclopedia

# MACHINE LEARNING IS...

ChatGPT 3.5 ▾

In supervised learning, the algorithm learns from labeled data, where the inputs are paired with corresponding outputs. The goal is to learn a mapping from inputs to outputs, which can then be used to make predictions on new, unseen data.

In unsupervised learning, the algorithm learns from unlabeled data, where there are no predefined output labels. Instead, the algorithm seeks to find patterns, structure, or relationships in the data.

Semi-supervised learning combines elements of both supervised and unsupervised learning, using a small amount of labeled data along with a larger amount of unlabeled data.

Reinforcement learning involves training an algorithm to make sequences of decisions by rewarding it for good decisions and penalizing it for bad ones, based on feedback from its environment.

Machine learning has a wide range of applications, including but not limited to image and speech recognition, natural language processing, recommendation systems, medical diagnosis, and autonomous vehicles.

 **You**

what is machine learning (in a sentence)?



**ChatGPT**

Machine learning is the field of study that gives computers the ability to learn and improve from experience without being explicitly programmed.



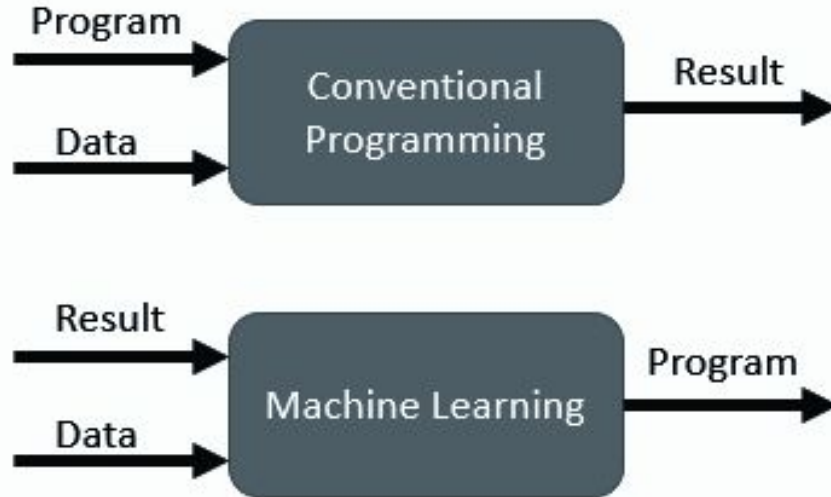
Message ChatGPT...



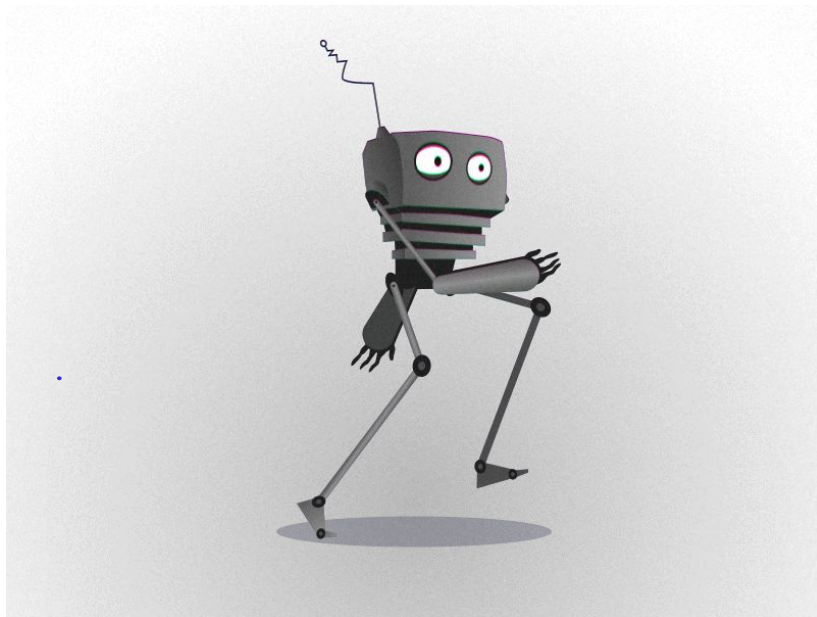
ChatGPT can make mistakes. Consider checking important information.



# MACHINE LEARNING IDEA



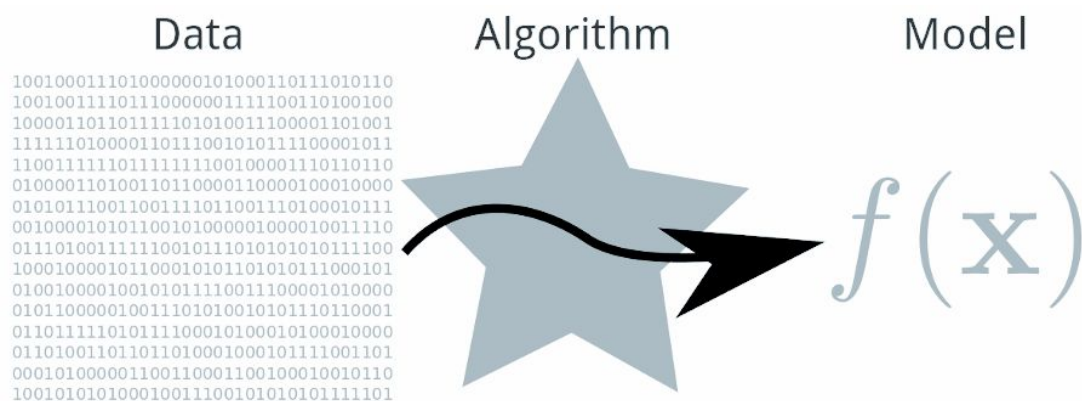
# MACHINE LEARNING IDEA



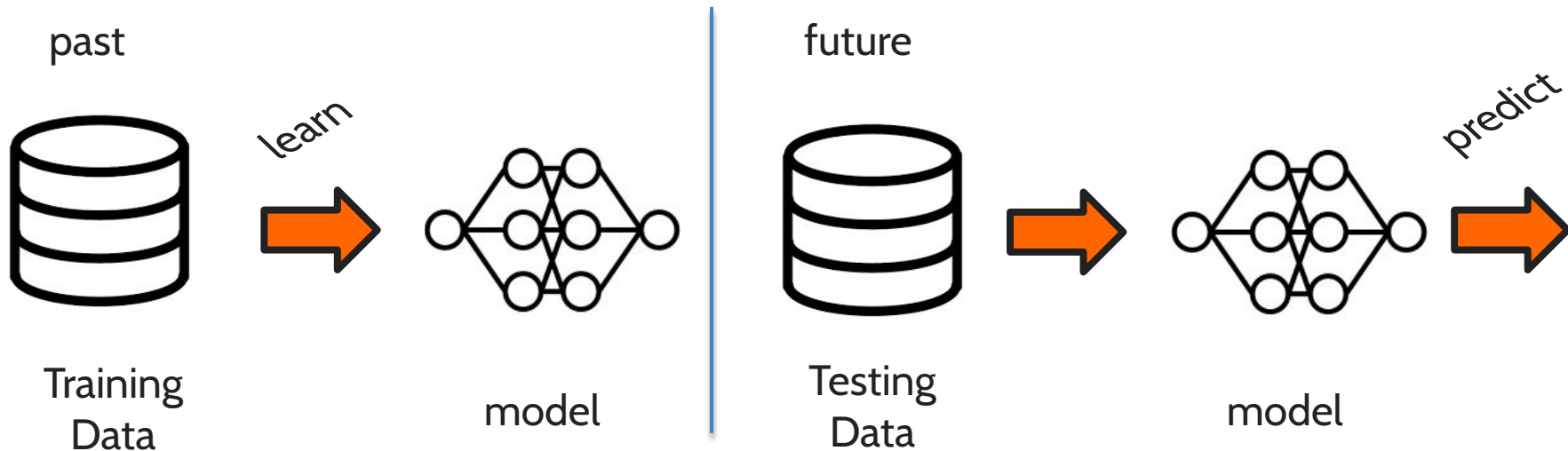
...if we want a robot to be able to walk, we could program the robot to **learn to walk**, or we could attempt to **directly write a program** that specifies how to walk manually.

# MACHINE LEARNING IDEA

- ML allows computers to acquire knowledge.
- Knowledge is acquired through **algorithms** by learning and inferring from **data**.
- Knowledge is represented by a **model**.
- The model is used on future data.



# MACHINE LEARNING IS...



# MACHINE LEARNING IS...

- Machine Learning is the study of algorithms that:
  - improve their performance  $P$
  - at some task  $T$
  - with experience  $E$
- A well-defined learning task is given by **a triplet  $\langle T, P, E \rangle$** .
- *Can you give some examples?*



# MACHINE LEARNING IS...

- A well-defined learning task is given by  $\langle T, P, E \rangle$ .

*T: Recognizing handwritten words*

*P: Percentage of words correctly classified*

*E: Database of human-labeled images of handwritten words*

*T: Driving on four-lane highways using vision sensors*

*P: Average distance traveled before a human-judged error*

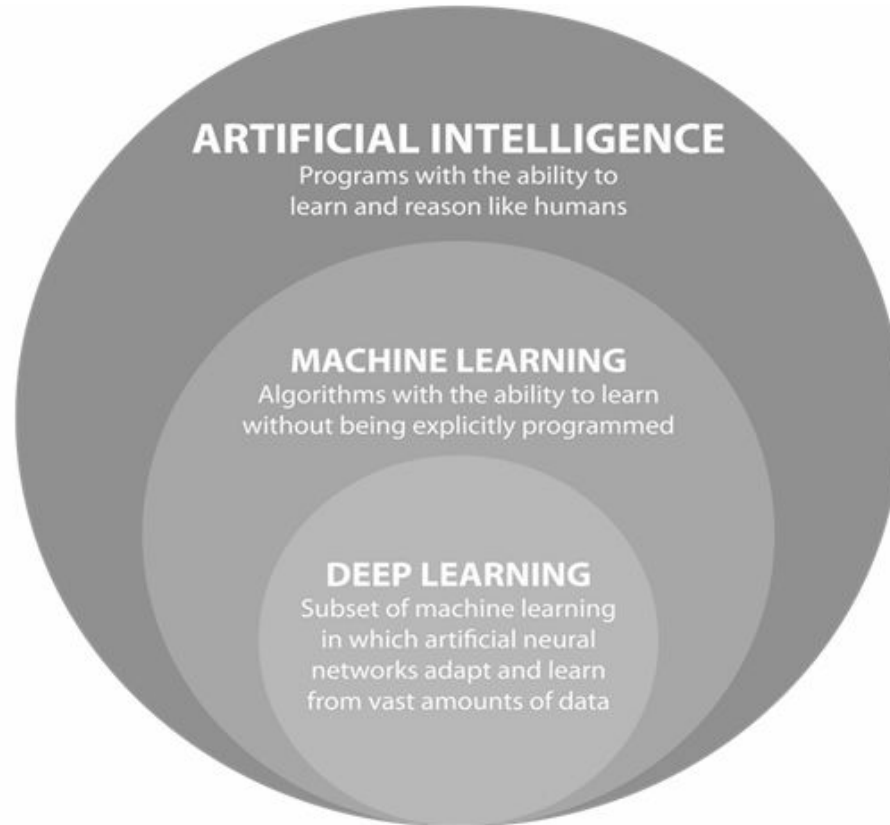
*E: A sequence of images and steering commands recorded while observing a human driver.*

*T: Categorize email messages as spam or legitimate.*

*P: Percentage of email messages correctly classified.*

*E: Database of emails, some with human-given labels*

# MACHINE LEARNING, AI & DEEP LEARNING



# DEEP LEARNING IS...

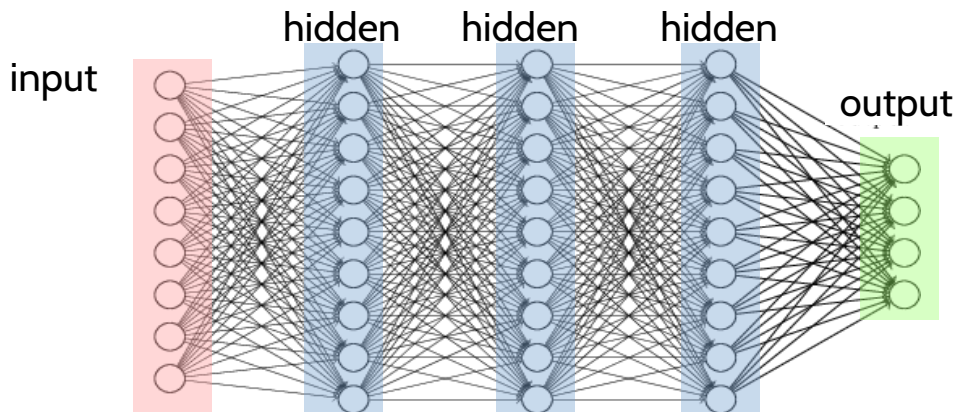


“Deep learning allows computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction”

Nature

# DEEP LEARNING IS...

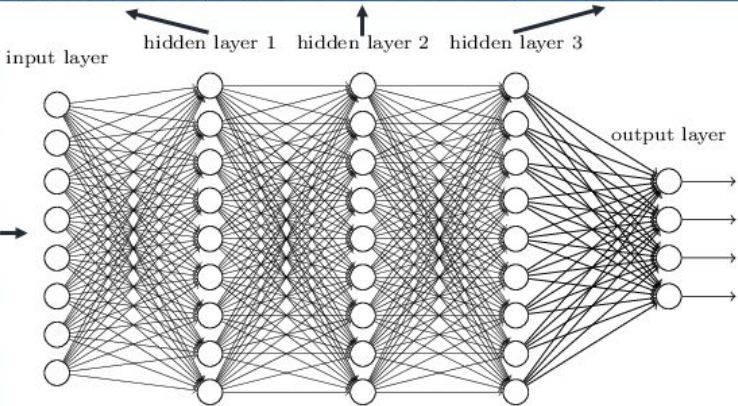
Deep Learning means using a neural network with several layers of nodes between input and output



# DEEP LEARNING IS...

The series of layers between input and output compute relevant features automatically in a series of stages, just as our brains seem to.

Deep neural networks learn hierarchical feature representations



# DEEP LEARNING REVOLUTION: WHY NOW?

- Flood of available data
- Increased computational power
- Growing number of ML algorithms and theory developed by researchers
- Increased support from industry

# BENEFITS



## **Efficiency**

Automate repetitive tasks, increasing efficiency and productivity.



## **Decision Support**

Analyze vast amounts of data to provide valuable insights for decision-making.



## **Accuracy**

ML systems can perform complex tasks with precision and accuracy.



## **Innovation**

Development of innovative solutions and technologies.

# RISKS



## **Algorithmic Bias**

AI can perpetuate biases in decision-making, impacting fairness.



## **Privacy Concerns**

AI technologies raise privacy issues through the collection and analysis of massive amounts of personal data.



# MITIGATING THE RISKS

