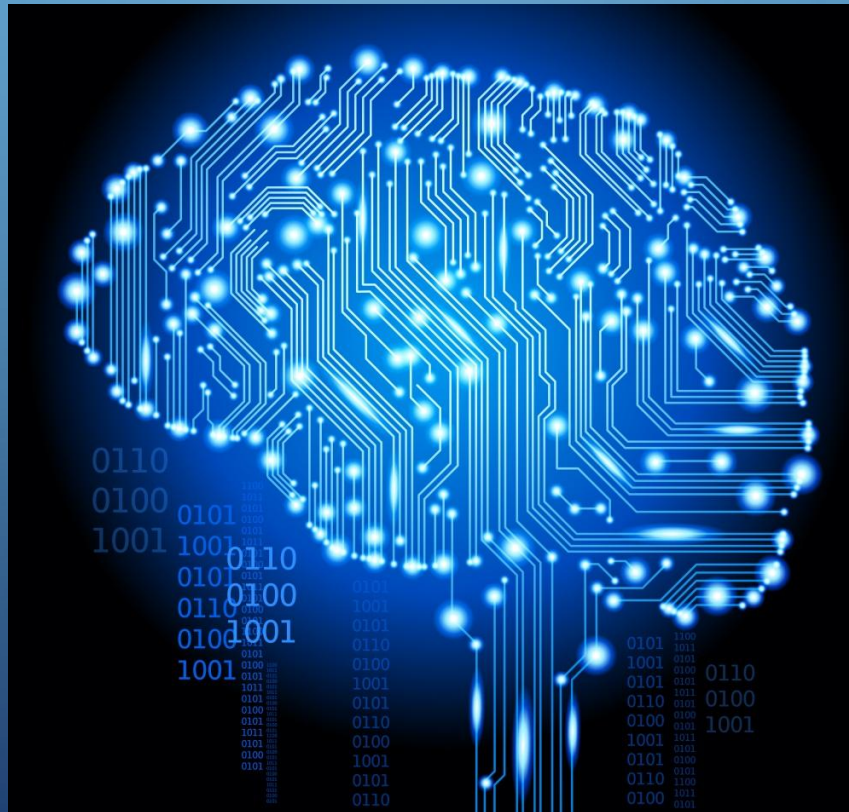


ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS



WHAT IS AN ARTIFICIAL INTELLIGENCE?

- It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.
- AI or *artificial intelligence* is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using the rules to reach approximate or definite conclusions), and self-correction. Particular applications of AI include expert systems, speech recognition, and machine vision.

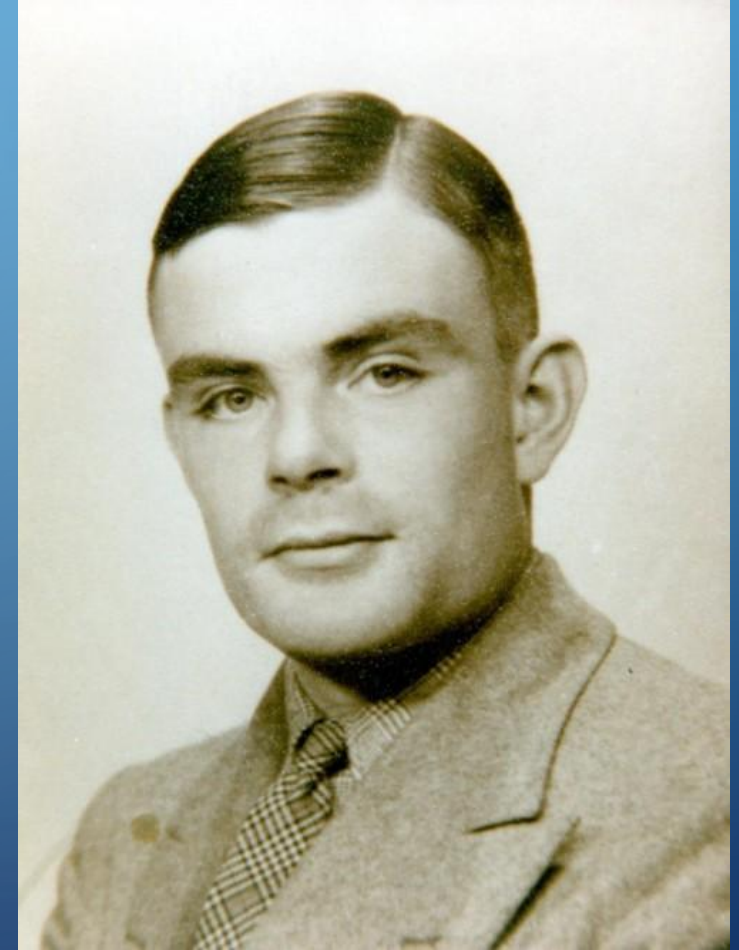
HISTORY OF AI

- 1943: early beginnings
 - McCulloch & Pitts: Boolean circuit model of brain
- 1950: Turing
 - Turings "Computing Machinery and Intelligence"
- 1951: beginning promise
 - Early AI programs, including
 - Samuels checkers program
 - Newell & Simons Logic Theorist
- 1956: birth of AI
 - Dartmouth meeting: "Artificial Intelligence" name adopted



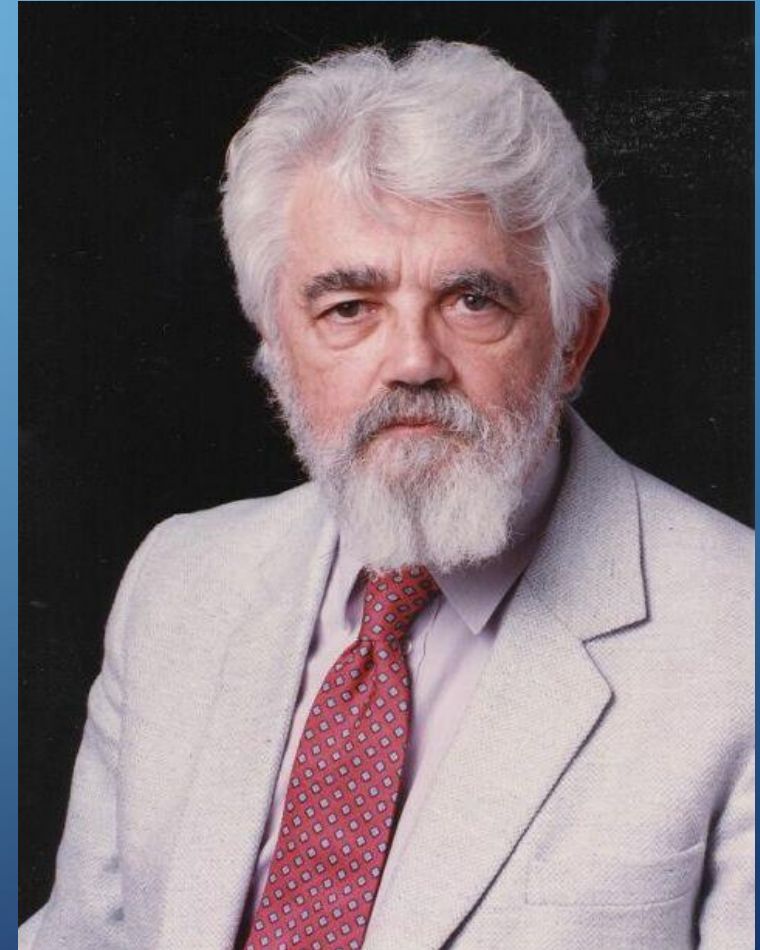
THE TURING TEST

- In 1950 Alan Turing published a landmark paper in which he speculated about the possibility of creating machines with true intelligence. He noted that "intelligence" is difficult to define and devised his famous Turing Test. If a machine could carry on a conversation (over a teletype) that was indistinguishable from a conversation with a human being, then the machine could be called "intelligent." This simplified version of the problem allowed Turing to argue convincingly that a "thinking machine" was at least *plausible* and the paper answered all the most common objections to the proposition. The Turing Test was the first serious proposal in the philosophy of artificial intelligence.



JOHN MCCARTHY

- In 1956 John McCarthy regarded as the father of AI, organized a conference to draw the talent and expertise of others interested in machine intelligence for a month of brainstorming. He invited them to Vermont for "The Dartmouth summer research project on artificial intelligence." From that point on, because of McCarthy, the field would be known as Artificial intelligence. Although not a huge success, the Dartmouth conference did bring together the founders in AI, and served to lay the groundwork for the future of AI research.

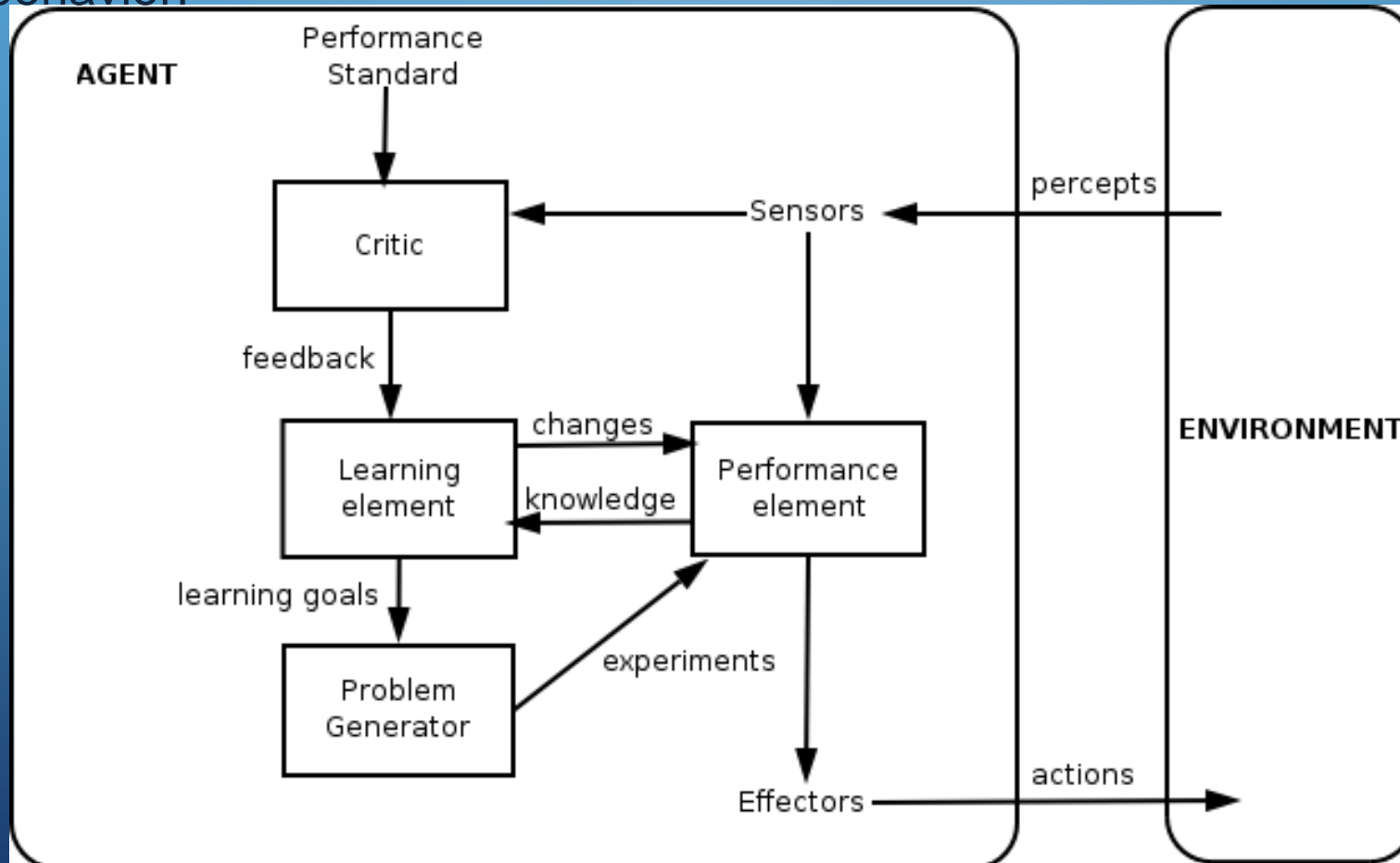


SUBAREAS OF ARTIFICIAL INTELLIGENCE

- neural networks
- game theory
- programming languages
- expert systems
- genetic algorithms
- speech/handwriting recognition
- vision
- robotics
- search algorithms
- learning systems
- natural language processing
- common knowledge databases
- logic
- agents
- planning and prediction
- automation software

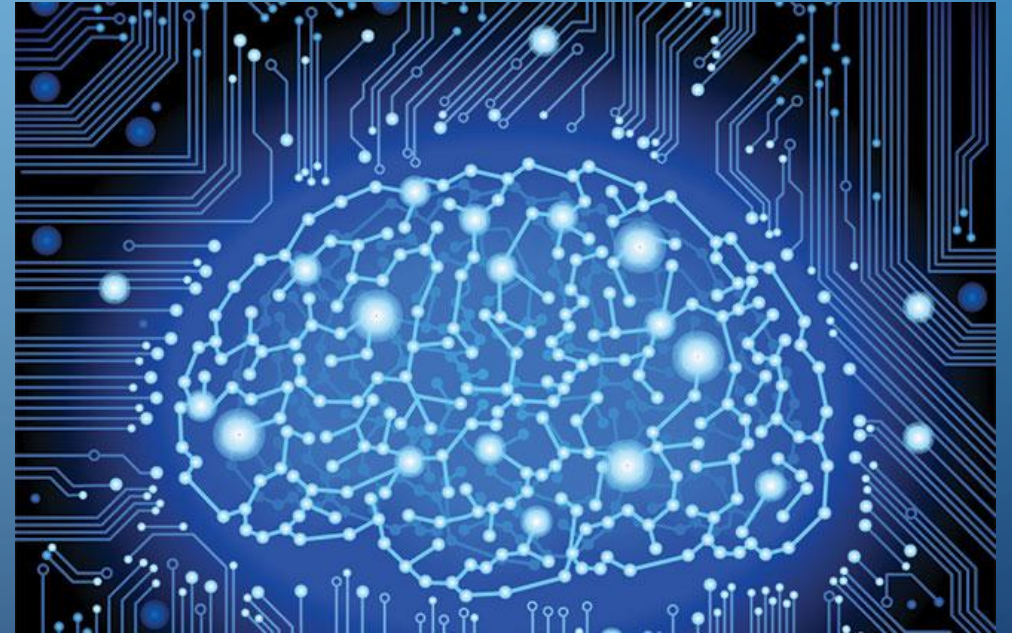
INTELLIGENCE AGENT

The question is: What is an Intelligent Software Agent? It is an autonomous software with a reactive, proactive and intelligent behavior!



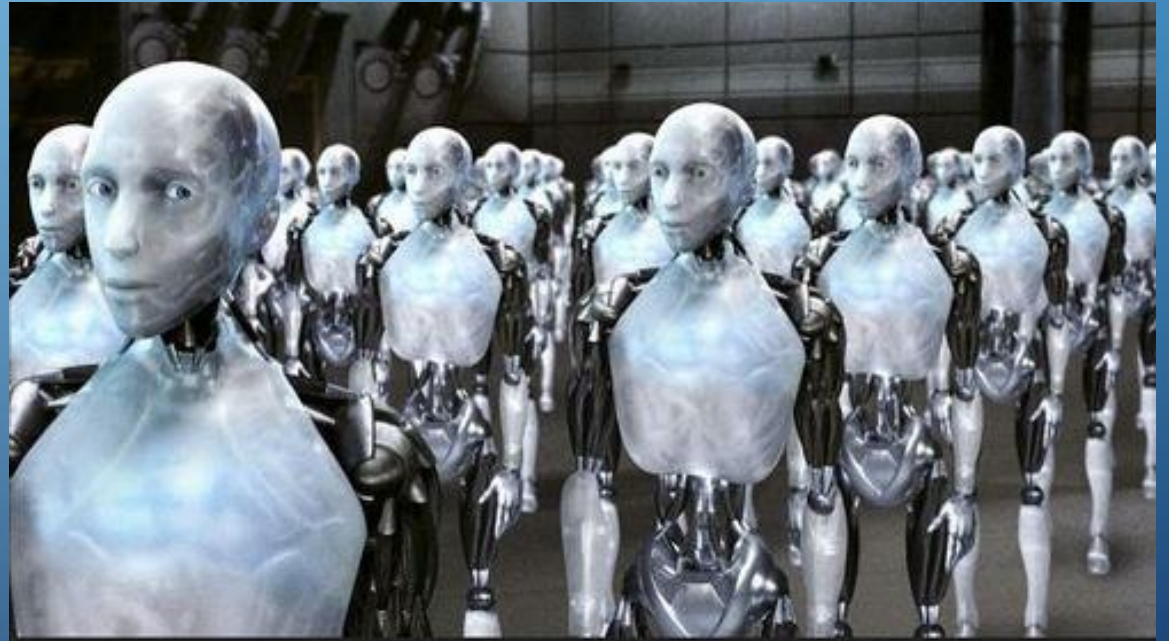
COMPONENTS OF AI

- Perception
- Learning
- Reasoning
- Problem-solving
- Language-understanding



AREAS OF SPECIALIZATION OF AI

- Game playing
- Expert Systems
- Natural Language Processing
- Neural Networks
- Robotics




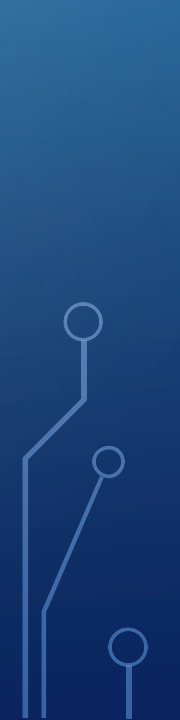
SOME EXAMPLES OF AI

- Expert systems.
- Natural Language Processing (NLP)
- Speech recognition.
- Computer vision.
- Robotics.
- Automatic Programming.



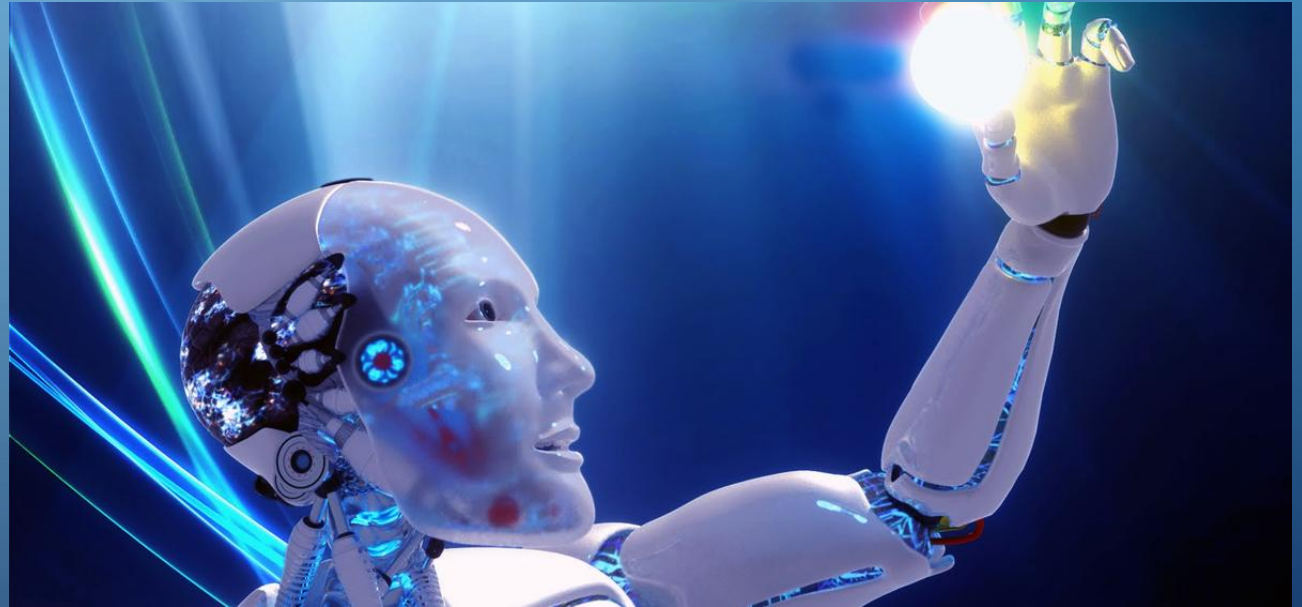


ADVANTAGES OF AI

- Can take on stressful and complex work that humans may struggle/can not do.
 - Can complete task faster than a human can most likely.
 - To discover unexplored things.
 - Less errors and defects.
 - More versatile than humans.
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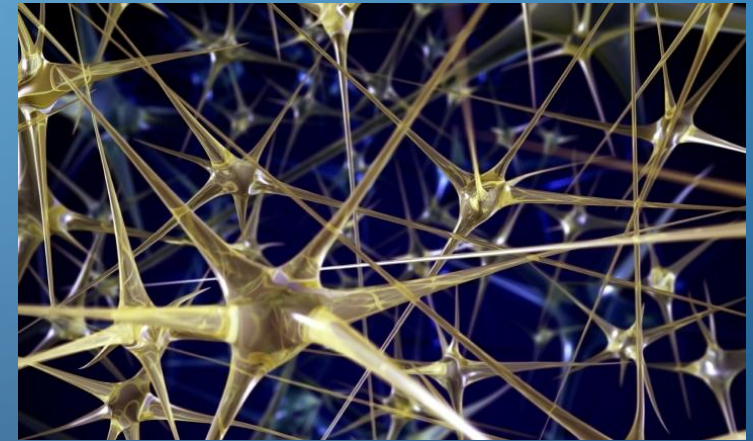
PROGRAMMING LANGUAGE USED IN A.I.

- Lisp
- Python
- Prolog
- Java
- C++




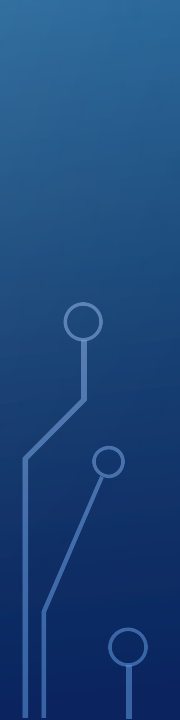
ARTIFICIAL NEURAL NETWORKS

- An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by biological nervous systems.
- It is composed of a large number of highly interconnected processing elements called neurons.
- An ANN is configured for a specific application, such as pattern recognition or data classification

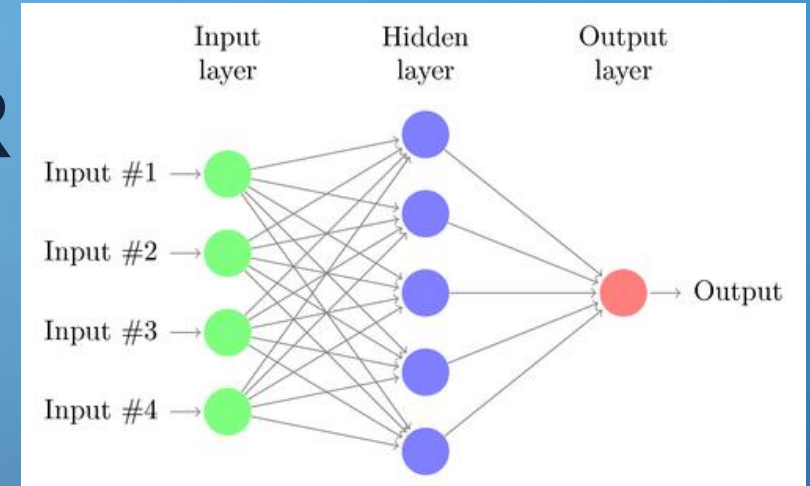




ARTIFICIAL NEURAL NETWORKS

- Artificial neural network (ANN) is a machine learning approach that models human brain and consists of a number of artificial neurons.
 - Neuron in ANNs tend to have fewer connections than biological neurons.
 - Each neuron in ANN receives a number of inputs.
 - An activation function is applied to these inputs which results in activation level of neuron (output value of the neuron).
 - Knowledge about the learning task is given in the form of examples called training examples.
- 
- 

ARTIFICIAL NEURAL NETWORK

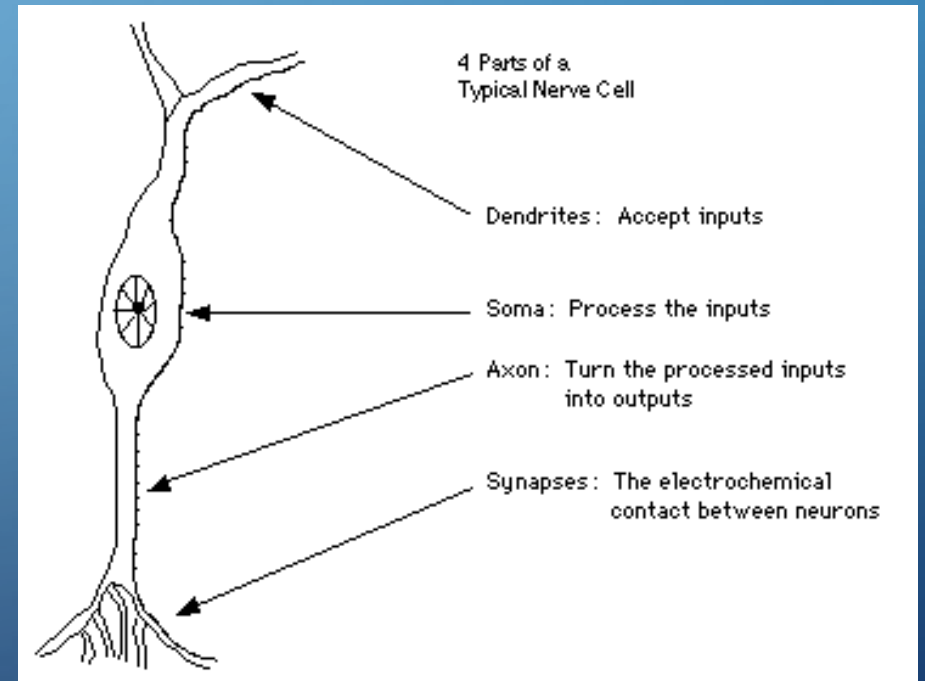


- An Artificial Neural Network is specified by:
 - **neuron model**: the information processing unit of the NN,
 - **an architecture**: a set of neurons and links connecting neurons. Each link has a weight,
 - **a learning algorithm**: used for training the NN by modifying the weights in order to model a particular learning task correctly on the training examples.
- The aim is to obtain a NN that is trained and generalizes well.
- It should behaves correctly on new instances of the learning task.

BIOLOGICAL NEURON MODEL

Four parts of a typical nerve cell :

- DENDRITES: Accepts the inputs
- SOMA : Process the inputs
- AXON : Turns the processed inputs into outputs.
- SYNAPSES : The electrochemical contact between the neurons.

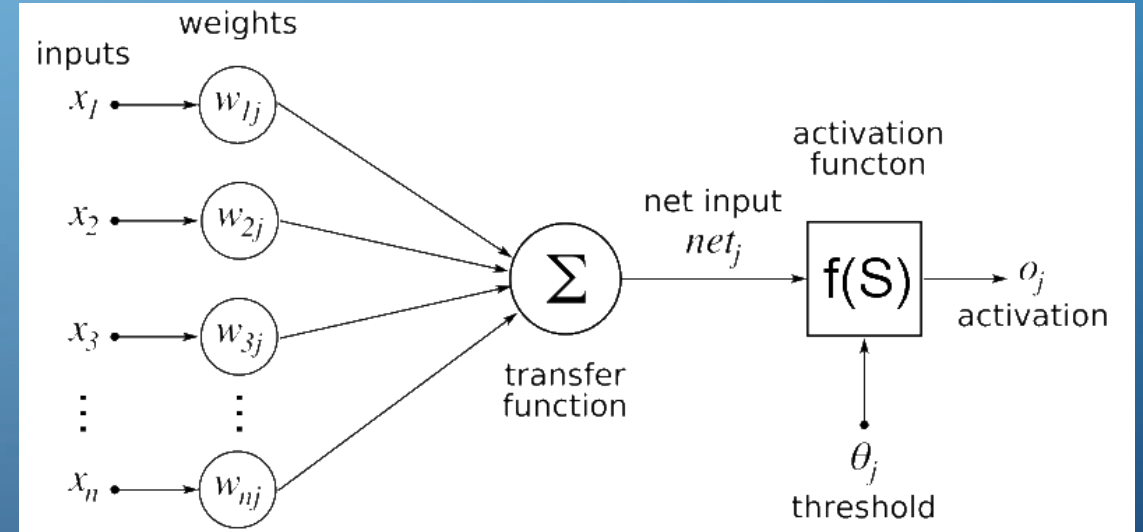


ARTIFICIAL NEURON MODEL

- Inputs to the network are represented by the x_1 mathematical symbol, x_n
- Each of these inputs are multiplied by a connection weight, w_n

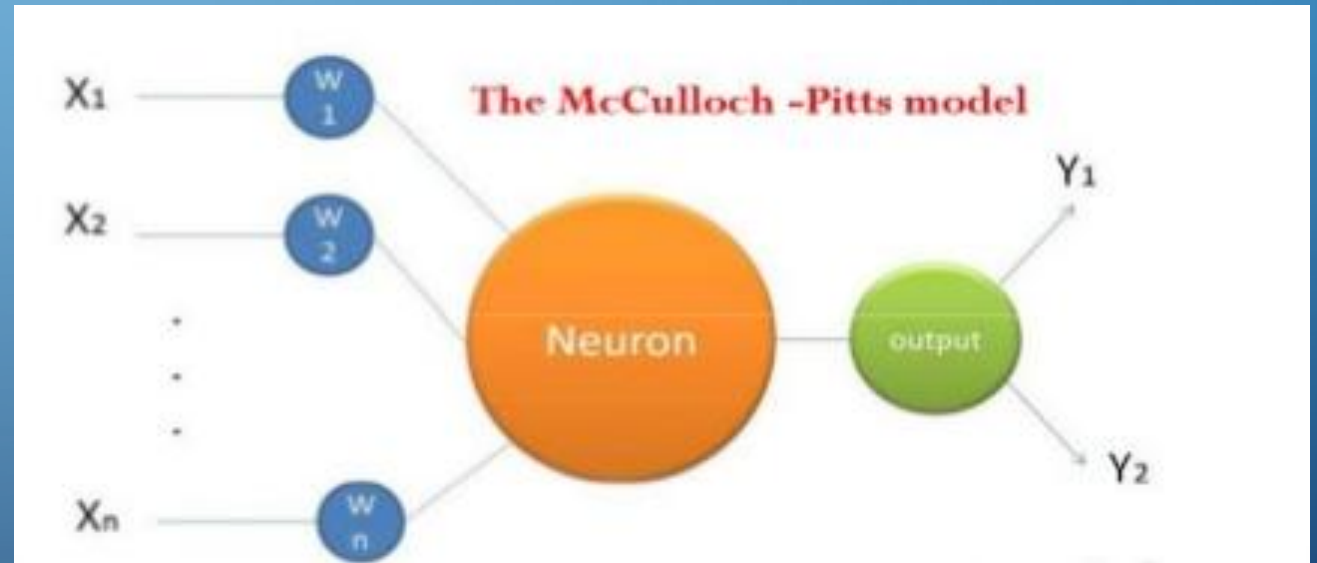
$$\text{sum} = w_1 x_1 + \dots + w_n x_n$$

- These products are simply summed, fed through the transfer function, $f()$ to generate a result and then output.



NEURON MODEL

- Neuron Consist of:
 - Inputs (Synapses): input signal.
 - Weights (Dendrites): determines the importance of incoming value.
 - Output (Axon): output to other neuron or of NN.



NEURAL NETWORKS VS COMPUTERS

Digital Computers

- Deductive Reasoning. We apply known rules to input data to produce output.
- Computation is centralized, synchronous, and serial.
- Memory is packetted, literally stored, and location addressable.
- Not fault tolerant. One transistor goes and it no longer works.
- Exact.
- Static connectivity.
- Applicable if well defined rules with precise input data.

Neural Networks

- Inductive Reasoning. Given input and output data (training examples), we construct the rules.
- Computation is collective, asynchronous, and parallel.
- Memory is distributed, internalized, short term and content addressable.
- Fault tolerant, redundancy, and sharing of responsibilities.
- Inexact.
- Dynamic connectivity.
- Applicable if rules are unknown or complicated, or if data are noisy or partial.

TERMINOLOGY

Biological Terminology	Artificial Neural Network Terminology
Neuron	Node/Unit/Cell/Neurode
Synapse	Connection/Edge/Link
Synaptic Efficiency	Connection Strength/Weight
Firing frequency	Node output

ADVANTAGES

- It involves human like thinking.
- They handle noisy or missing data.
- They can work with large number of variables or parameters.
- They provide general solutions with good predictive accuracy.
- System has got property of continuous learning.
- They deal with the non-linearity in the world in which we live.

APPLICATIONS OF NEURAL NETWORKS

- **classification**

in marketing: consumer spending pattern classification

In defence: radar and sonar image classification

In agriculture & fishing: fruit and catch grading

In medicine: ultrasound and electrocardiogram image classification, EEGs, medical diagnosis

- **recognition and identification**

In general computing and telecommunications: speech, vision and handwriting recognition

In finance: signature verification and bank note verification

- **assessment**

In engineering: product inspection monitoring and control

In defence: target tracking

In security: motion detection, surveillance image analysis and fingerprint matching

- **forecasting and prediction**

In finance: foreign exchange rate and stock market forecasting


In agriculture: crop yield forecasting

In marketing: sales forecasting

In meteorology: weather prediction



INTELLIGENCE SYSTEMS IN YOUR EVERYDAY LIFE

- Post Office
 - automatic address recognition and sorting of mail
 - Banks
 - automatic check readers, signature verification systems automated loan application classification
 - Customer Service
 - automatic voice recognition
 - Digital Cameras
 - Automated face detection and focusing
 - Computer Games
 - Intelligent characters/agents
- 

The image features a blue gradient background with white circuit-like lines in the corners. These lines consist of straight segments and small circles, resembling a stylized electronic circuit or data flow diagram. The lines are positioned in the top-left, top-right, bottom-left, and bottom-right corners, framing the central text.

THE END