Al-Hamdaniya University

College of Education

Computer Science

Stage: 3rd

Artificial Neural Networks ANNs

Brains vs. Computers

Processing elements: There are 1014 synapses in the brain, compared with 108 transistors in the computer.

Processing speed: 100 Hz for the brain compared to 109 Hz for the computer.

Style of computation: The brain computes in parallel and distributed mode, whereas the computer mostly serially and centralized.

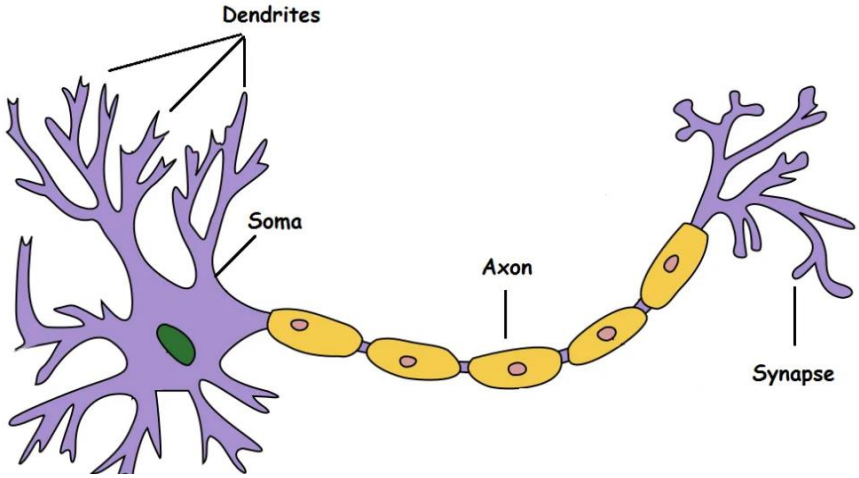
Fault tolerant: The brain is fault tolerant, whereas the computer is not.

Adaptive: The brain learns fast, whereas the computer doesn't even compare with an infant's learning capabilities.

Intelligence and consciousness: The brain is highly intelligent and conscious, whereas the computer shows lack of intelligence.

Evolution: The brains have been evolving for tens of millions of years, computers have been evolving for decades.

Biological Neurons: An Overly Simplified Illustration



Basic Components of Biological Neurons

Dendrite: Receives signals from other neurons

Soma: Processes the information

Axon: Transmits the output of this neuron

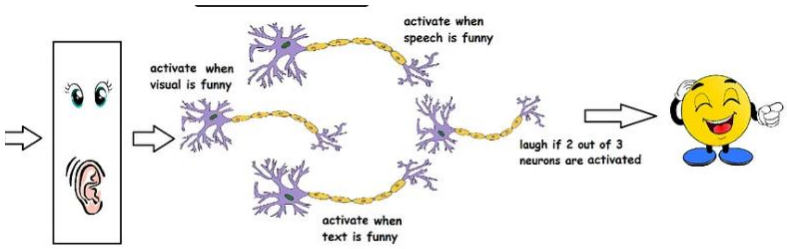
Synapse: Point of connection to other neurons

Basically, a neuron takes an input signal (dendrite), processes it like the CPU (soma), passes the output through a cable like structure to other connected neurons (axon to synapse to other neuron's dendrite). Now, this might be biologically inaccurate as there is a lot more going on out there but on a higher level, this is what is going on with a neuron in our brain — takes an input, processes it, throws out an output.

Our sense organs interact with the outer world and send the visual and sound information to the neurons. Let's say you are watching comedian show. Now the information your brain receives is taken in by the “laugh or not” set of neurons that will help you make a decision on whether to laugh or not.

Comedian Show

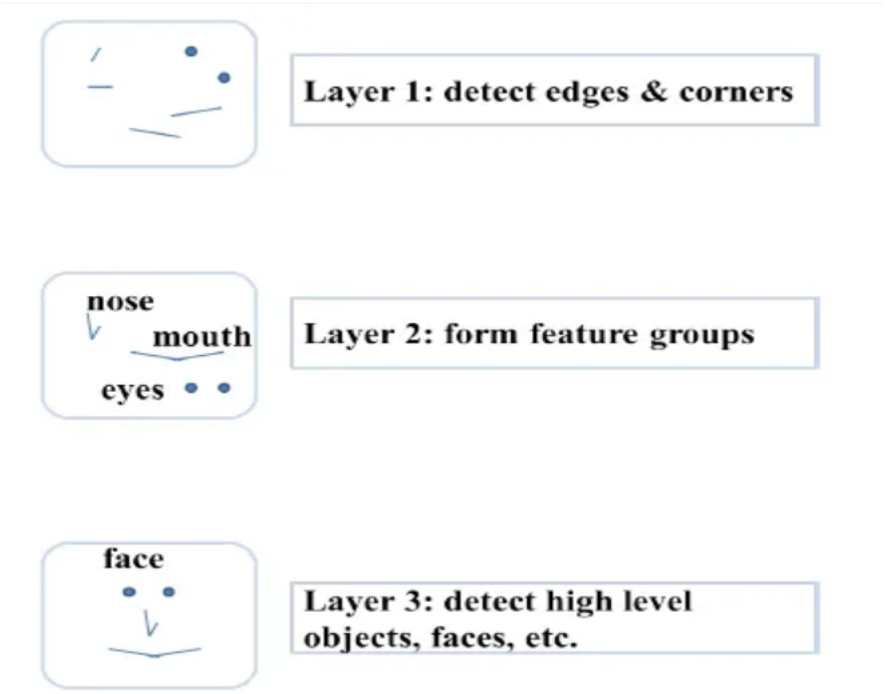
This massively parallel network also ensures that there is a division of work. Each neuron only fires when its intended criteria is met i.e., a neuron may perform a certain role to a certain stimulus, as shown below.



Comedian Show

Division of work

It is believed that neurons are arranged in a hierarchical fashion (however, many credible alternatives with experimental support are proposed by the scientists) and each layer has its own role and responsibility. To detect a face, the brain could be relying on the entire network and not on a single layer.



Brain Neurron VS artificial Neuron