Human Brain and Artificial Neural Network

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Abstract

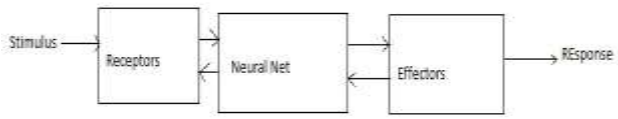
Human brain has a very complex structure. From birth it can make its own rules by means of experience. Experience is build up over time during the first two years it make very dramatic changes. Developing neuron follow a property named as plasticity. It permits the neuron to adopt the surrounding environment.

Neural network is designed to model the human brain. Network is implemented by the electronic component or is simulated in software on a digital computer.

Keywords: *Human Brain, Neural network, AI*

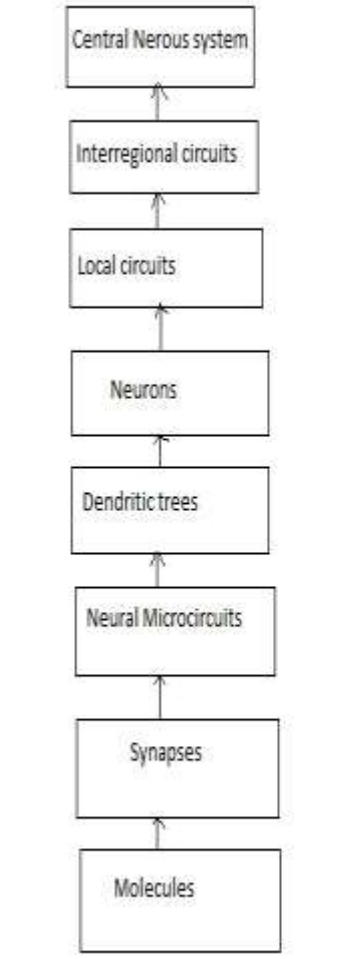
Human Brain

Human nervous system may be viewed as 3-stage system receptor takes the inputs from external environment and give it to the neural network (Human brain) , neural net process it according to the knowledge it have and give it to the effectors, effectors convert the processed inputs into the output that is adopted by the external environment.



The feedback links are there which are used to back propagate the output to the brain so that if any error in the output that can be minimized with the help of algorithm.

Neurons are five to six order of magnitude slower than silicon logic gates, event in silicon chip happen in nano seconds range, where as neural events happen in milliseconds. however the brain makes up for the relatively slow rate of operation of a neuron by having a truly staggering number of neurons with massive interconnection between them. It is estimated that there are approximate 10 billion neuron in the human cortex and 60 trillion synapses or connections(Shephered and Koch, 1990).



Structural organization of levels in the brain

Synapses are the link between the neurons , it mediate the interaction between neurons. The majority of neuron encode their outputs as a series of brief voltage pulses. These pulses commonly known as action potential or spikes, originate ate or close to the cell body of neurons and then propagate across the individual neurons at constant velocity and amplitude. Basically synapses is depend on molecule and ion as their action. Group of synapses make a neural microcircuits organized into patterns . The neural microcircuits are grouped to form dendritic subunits with in dendritic trees of individual neurons. Next level of complexity we have local circuits, made up of neurons with similar or different properties.

There neural assemblies perform operation characteristic of a localized region in the brain.
This is followed by interregional circuits made up of pathways, columns and topographic maps, which involve multiple region located in different part of the brain.

Artificial Neural Network

A neuron is a fundamental unit of neural network which process the information. There are three basic element of neuronal model:
1. Synaptic weights.
2. Summing junction.
3. Activation Function.

Synapses of one neuron is connected with other neurons, there are more than one synapses in the neuron. These synapses are called connected links in the neuronal model. Each link has some weight.
Adder or summing junction combines all weights of a neuron which are connected to it.
Activation function is used to limit the output of the neuron it also called as squashing function.
Types of activation function
1. Threshold function.
2. Piecewise linear function.
3. Sigmoid function.

Feedback

As our brain works i.e. we learn when do some mistake, means after mistake we avoid the cause of mistake in next time. In the same fashion, the neural network work, therte is a feedback system with the network. The input is given to the network, after processing the network gives the output, then we compare the actual output with the desired output and find the error, then that error is propagated back to the network.
According to the error the parameters are manipulated , this is done number of times till the error between actual output and desired output is minimized.

Network architecture

1. Single layer feedforward network.
2. Multilayer feedforward network.
3. Recurrent network.

Knowledge representation

Knowledge refers to stored information or models used by a person or machine to interpret, predict and appropriately respond to the outside word.
The primary characteristics of knowledge representation are:
1. What information is actually made explicit.
2. How the information is physically encoded for subsequent use.

Benefits of Neural Network

1. Nonlinearity.
2. Input output mapping.
3. Adaptivity.
4. Evidental response.
5. Fault tolerance.

Artificial Intelligence and neural network

AI is the devolpment of algorithms that require machine to perform cognitive task in which humans are better.
AI system must capable of doing three things:
1. Store knowledge.
2. Apply the knowledge stored to solve problem.
3. Acquire new knowledge through experience.

Artificial Intelligence has three components:
1. Representation.
2. Reasoning.
3. Learning.

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