

Chapter 1

Common Terms to Start with Neural Network

1.1 Neural Network

A neural network is a massively parallel distributed processor made up of simple processing units, which has a natural propensity for storing experimental knowledge and making it available for use. It resembles the brain in two aspects:

1. Knowledge is acquired by the network from its environment through a learning process.
2. Inter-neuron connections strengths, known as synaptic weights, are used to store the acquired knowledge.

1.2 Stability for a Neural Network

Stability refers to such convergence that facilitates an end to the iterative process. For example, if any two consecutive cycles result in the same output for the network, then there may be no need to do more iterations. In this case, convergence has occurred, and the network has stabilized in its operation. If weights are being modified after each cycle, then convergence of weights would constitute stability for the network. In some situations, it takes many more iterations than you desire, to have output in two consecutive cycles to be the same. Then a tolerance level on the convergence

criterion can be used. With a tolerance level, you accomplish early but satisfactory termination of the operation of the network.

1.3 Plasticity for a Neural Network

Suppose a network is trained to learn some patterns, and in this process the weights are adjusted according to an algorithm. After learning these patterns and encountering a new pattern, the network may modify the weights in order to learn the new pattern. But what if the new weight structure is not responsive to the new pattern? Then the network does not possess plasticity—the ability to deal satisfactorily with new short-term memory (STM) while retaining long-term memory (LTM). Attempts to endow a network with plasticity may have some adverse effects on the stability of your network.

1.4 Short-Term Memory and Long-Term Memory

We alluded to short-term memory (STM) and long-term memory (LTM) in the previous paragraph. STM is basically the information that is currently and perhaps temporarily being processed. It is manifested in the patterns that the network encounters. LTM, on the other hand, is information that is already stored and is not being currently processed. In a neural network, STM is usually characterized by patterns and LTM is characterized by the connections weights. The weights determine how an input is processed in the network to yield output. During the cycles of operation of a network, the weights may change. After convergence, they represent LTM, as the weight levels achieved are stable.