

Learning artificial neural network

Yuan An

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Artificial neural networks [1] (ANNs) are computing systems vaguely inspired by the biological neural networks that constitute animal brains. An ANN is based on a collection of connected units or nodes named artificial neurons. Each connection between artificial neurons can transmit a signal from one to another.

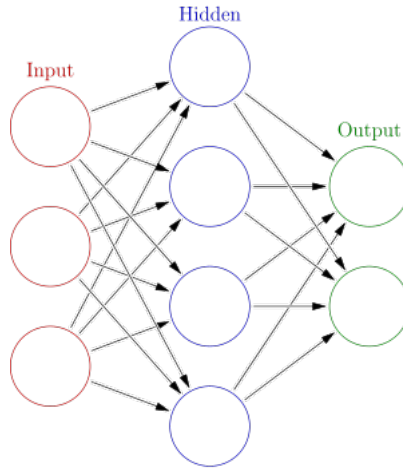


Figure 1: The model of ANN

As shown in the figure above, each circle represents an artificial neuron as an arrow represents a connection from the output of one artificial neuron to the input of another.

In Figure 1, we can see some visible components of an ANN: neurons and connections. There are other components behind representation.

Neurons: A neuron with label j receiving an input $p_j(t)$ from front neurons of the following components: an activation $a_j(t)$ depending on a discrete time parameter, a threshold θ_j staying fixed unless changed by a learning function, an activation function f that computes the new activation at a

given time $t + 1$ from $a_j(t)$, θ_j , and the net input $p_j(t)$ giving rise to the relation $a_j(t + 1) = f(a_j(t), p_j(t), \theta_j)$ and an output function f_{out} computing the output from the activation $o_j(t) = f_{out}(a_j(t))$.

Components	Expression
activation	$a_j(t)$
threshold	θ_j
activation function	$a_j(t + 1) = f(a_j(t), p_j(t), \theta_j)$
output function	$o_j(t) = f_{out}(a_j(t))$
weight	w_{ij}
propagation function	$p_j(t) = \sum_i o_i(t)w_{ij}$

Table 1: Components of ANN

Connections: each connection transferring the output of a neuron i to the input of a neuron j , and each connection is assigned a weight w_{ij} .

Propagation function: the propagation function computes the input $p_j(t)$ to the neuron j from the outputs $o_i(t)$ of front neurons and typically has the form $p_j(t) = \sum_i o_i(t)w_{ij}$.

Learning rule: the learning rule is a rule or an algorithm which modifies the parameters of the neural network, in order for a given input to the network to produce a favored output. This learning process typically amounts to modifying the weights and thresholds of the variables within the network.

References

- [1] Wikipedia.org. Artificial neural network. https://en.wikipedia.org/wiki/Artificial_neural_network#Components_of_an_artificial_neural_network/.