Associative Broadcast Neural Network

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2016.10.04

Abstract

Associative broadcast neural network (ABNN) is an artificial neural network inspired by a hypothesis of broadcasting of neuron's output pattern in a biological neural network. Neuron has wire connections and ether connections. Ether connections are electrical. Wire connections provide a recognition functionality. Ether connections provide an association functionality.

Electrically Conductive Network

ABNN contains an aggregate electrically conductive network (ECN). ECN represents electrically conductive medium around neurons in a biological neural network. ECN provides a broadcasting of electrical impulses. Electrical impulses propagate via ECN at a speed close to the speed of light. ECN provides a summation of impulses from different sources. Group of impulses composes a pattern.

Neuron

Neuron of ABNN has multiple input cable and one output cable. Neuron scheme is shown in figure 1. Input cable represents a dendritic branch. Output cable represents an axon. Each cable is electrically isolated from the ECN. Each input cable comprises a transmitter of electrical impulse to the ECN, and a receiver of electrical impulse from the ECN. Electrical impulse in an input cable represents a dendritic spike. Each transmitter and each receiver has an electrically conductive connection to the ECN. Input cable signal is a linear combination of wire signal and ether signal. Neuron signal is an activation function of a linear combination of signals from input cables. Neuron signal is supplied to the output cable.

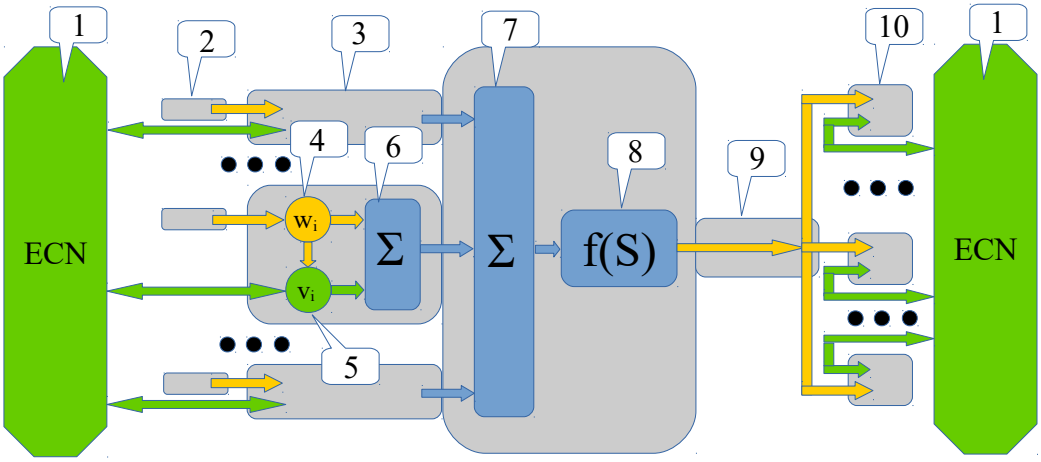

Figure 1. Scheme of a neuron of an associative broadcast neural network.

Figure 1 numerals designate the following elements.

1. Electrically conductive network (ECN).
2. Neurons, whose output cables are connected to the input cables of the neuron.
3. Input cables of the neuron.
4. w_i — weight of an input wire signal.
5. v_i — weight of an input and output ether signal.
6. Adder of an input wire signal and an input ether signal.
7. Adder of input cable signals.
8. Transfer function.
9. Output cable of the neuron.
10. Neurons, whose input cables are connected to the output cable of the neuron.

Neural Network

The input cable of one neuron can have wire connection with the output cable of other neuron. Wire connection of two cables represents a synapse in a biological neural network. The output cable of neuron can have several wire connections with other neurons. Group of neurons forms a neural network. The input cable of neuron can provide wire incoming connection of a neural network. The output cable of neuron can provide the wire outgoing connection of a neural network. Each wire connection in ABNN is characterized by a weight.

Input Tree of Cables of a Neuron

The input tree of cables of neuron consists of input cables of the neuron. The input tree of cables is a part of one neuron.

Output Tree of Cables of a Neuron

The output tree of cables of neuron consists of input cables of other neurons, whose cables are connected to the output cable of this neuron. The output tree of cables of neuron isn't a part of this neuron.

Output Ether Pattern of a Neuron

The output ether pattern of a neuron is defined by geometry of an output tree of cables of the neuron. The output wire electrical impulse of neuron on the output cable arrives on the associated input cables of other neurons. The transmitter of each of these input cables gives out electrical impulse to an electroconductive network. Electrical connection of the transmitter to ECN forms the output ether connection. Each output ether connection in ABNN is characterized by a weight. Impulses can come to ECN not at the same time. This group of impulses defines an output ether pattern of neuron. In ABNN the output ether pattern of a neuron is defined by a set of weights of ether connections of input cables of neurons connected to the output cable of neuron.

Input Ether Pattern of a Neuron

The input ether pattern of a neuron is defined by geometry of an input tree of cables of the neuron. Electrical impulses from an electroconductive network come to receivers on input cables of neuron. Impulses from ECN can come to receivers not at the same time. Electrical connection of the receiver to

ECN forms an input ether connection. Each input ether connection in ABNN is characterized by a weight. In a simple ABNN the output ether connection and the input ether connection can be characterized by same weight. Group of impulses from ECN can cause activation of a neuron even in the absence of signals from wire connections. Such group of impulses defines an input ether pattern of the neuron. Neuron can have some set of input ether patterns.

Broadcasting of Output Ether Pattern of a Neuron

The output ether pattern of an active neuron broadcasts via electroconductive network and reaches each neuron. Broadcast of patterns of neurons provides ether functionality of a neuron. The ether pattern arrives from ECN to ether inputs of a neuron and can cause activation of this neuron.

Ether Multipattern

Several active neurons can send their output ether patterns to the electroconductive network at the same time. Superposition of several patterns forms an ether multipattern.

Ether Association

Neurons have an ether association if one or several active neurons cause activity of one or several other neurons by transmission to their ether inputs the output ether patterns through the electroconductive network. Ether association has a direction. In the simplest case the active neuron can cause activity of other neuron, having transmitted to it his output ether pattern through ECN. Ether multiassociation is an ether association of several neurons.

Ether Stream of Consciousness

Flow of patterns in the electroconductive network forms an ether stream of consciousness. In a combination with wire transfer of signals between neurons the ether stream of consciousness forms a basis for a distributed multi-level multiassociation of neurons.

Testable Predictions

It is necessary to isolate input wire connections in some part of a functioning biological neural network. At the same time it is necessary to save the electroconductive network in full neural network. If the neurons in the isolated part have spikes, then the hypothesis of broadcasting of neuron's output pattern in a biological neural network is correct.

Popularization of Hypothesis

In order to ensure convenience for the study, experimentation and creation the idea of ether stream of consciousness is available to all, without exception, free of charge and without restrictions immediately after the occurrence.