Neural network

The simulation of the ants shows what the Digital Biological Neuron is capable of. However, it is the mathematical theory, which can tell us where are the opportunities and limits of the model of the neuron. First of all, the developed theory has brought to light new notions describing the interaction between neurons.

From a mathematical point of view the model is a multi-scale discrete model of a neuron. The dimension spans from sub-cellular level (such as synapses and receptors) to interconnected groups of neurons. The time span starts at microseconds (time needed for a signal to reach another neuron) and ends at hours, possibly days (time to learn a whole new area of inputs). The theory is inspired by real observations of neurons, however, not all of the observed features are modeled (such as electrical signaling), and opposite, not all of the modeled features can be observed (such as state of a neuron). The simulation of the model is strictly deterministic; therefore no statistic, probability or any other non-deterministic concepts are involved.

Since the theory makes a whole new approach to the subject, it would be useful to make clear that some assumptions from the incumbent theories are irrelevant. The most strikingly, the electrical signals are considered as a side effect of the neuron-cell behavior and the theory does not pay attention to it. The theory also omits a question where different functionalities and storage areas are located within the brain; the theory permits them anywhere. All cells other than neurons are omitted as well.

When compared to the classical mathematical neural networks (such as perceptron, back propagation networks, kohonen networks…) the most important differences are:

- the communication between neurons is multidimensional (mediators and their amount instead of an electrical potential)
- the amount of neurons in the simulation vary
- the fire time across the network is not synchronized
- periods of learning and execution are not divided

The theory describes how the network transmits signals and then the properties of the signals are compared to properties of mind and cognition. Beside the signal transmission, the theory uncovers how the network is modified, enlarged and adapted. All the parts have the same importance, depend on each other and one cannot be split apart from another. How the signals are transmitted depends on how the network has been created, and opposite, transmitting signals influence the network. Let’s make it clear: new neurons, connection between neurons and signals are results of a simulation, not a precondition of the theory. The theory is parameterized and tuned to work in the following areas:

- What transmitters are produced and in what quantity?
- What happens to the neurons and transmitters during signaling?
- What is the time scale of the processes involved?

You can download the beta version of presentation of the theory here.