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## Neural Network Model of Multiple Object Tracking

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***Abstract.*** Psychological experiments show that humans are able to simultaneously track up to five randomly moving visual objects. The paper presents a neural network model of this phenomenon. The model operates with a set of identical visual objects located in the visual field. At the stage of exposition a subset of objects marked as targets is selected into the focus of attention. Other objects are used as attention distractors. At this stage objects are motionless. Later on at the stage of tracking the model aims to preserve initial separation between targets and distractors while objects are moving. It will be shown that multiple object tracking can be implemented by a proper interplay of synchronizing and desynchronizing interactions in a multilayer oscillatory neural network where each layer is responsible for tracking a single target. Computer simulations show that in the case of non-overlapping objects the performance of the model decreases as the number of targets increases. The same dependence has been observed in the experiments with humans. Also the functioning of the model in the case of temporally overlapping objects is presented.

# Evolutionary approach to design and training of artificial neural networks

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***Abstract.*** This paper concerns application of evolutionary algorithms to design and training of artificial neural networks (ANNs). We give general characteristics of the neuroevolutionary approach and state its advantages and disadvantages. Problems of neuroevolutionary algorithms development as well as possible ways of their solutions are described. Also the use of evolutionary training of ANNs for some “inexact evaluation” tasks solution is substantiated.

# Elastic neural networks as a robust approach

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***Abstract.*** After a brief survey of data handling methods for contemporary experiments of high energy physics, methods of elastic neural networks are expounded. Then they are considered as a particular case of a robust (stable to sample contaminations) approach to dependence estimations. A formalism of the robust approach is described with deriving optimal weights for the sample uniform contamination. An effective algorithm of the robust estimation is obtained on the basis of the joint estimate of position and scale parameters.

# From single-neuron models to models of neural populations

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***Abstract.*** We classify known neural population models and those single-neuron models used in the population models. The equations of typical one-dimensional population models are given, which describe neural continuums and distinguish states of the neurons between spikes by the means of a single parameter. The equations of such two models proposed by the authors of the present paper are given as well.

# On probability of finding local minima in the generalized Hopfield mode

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***Abstract.*** In this paper, we obtain expressions relating the depth of a local minimum of energy to the width of the domain of attraction. Using these expressions, we were able to represent the probability of finding a local minimum under a random initialization of the neural network as a function of the depth of this minimum. In practical applications, these expressions will make it possible to estimate the probability of determining a deeper minimum from a series of already found minima and make a decision on whether the run of a search program must be terminated or continued. The expressions are obtained by analyzing the generalized Hopfield model, namely, a neural network with Hebb correlation matrix. For matrices of this type, the analytical theory excellently agrees with the computer experiment.