

Abstract

For Master's Certification of on the topic:

"Pattern recognition using artificial neural networks"

By Vadim S. Pidoplichko

The Relevance

The growing interest in problems of pattern recognition by the need to automate both the control and management of complex dynamic objects in real time, and shaped the processes of communication intelligence systems. Therefore, so far, the search for and implementation of effective principles of the transfer recognizable human functions computerized systems. One promising solution to this problem based on the application of artificial neural networks and neuro-computers, as the most appropriate in relation to the class of pattern recognition. In our time suggested a large number of neural network paradigms for solving problems of pattern recognition. Significant difficulty in recognizing evoke that were tucked in some distortion (noise, shift, rotation, scaling). This problem is solved by choosing the appropriate architecture and method of training. Analysis of the work shows that so far there is no such model, which would not have been sensitive to all kinds of distortions. The problem is well resolved on the displaced and noisy images of neural networks back-propagation errors. However, continue to cause difficulties in these types of distortions as a change in image size and rotation. The prospect of overcoming these difficulties, see a new neural network paradigm - neocognitron, thst uses qualitatively new architecture and uncontrolled studies. At the core architecture is neocognitron organization of human visual system.

The Purpose

The aim of this work is research, development, design and testing of improved neural network to facilitate the recognition, in particular characters.

Problems that are solved

In this paper various approaches to solving the problem of pattern recognition. The focus is on approach to pattern recognition using artificial neural networks and their methods of training. In particular, discussed in detail such as a neural network neocognitron, given the advantages and disadvantages of the neural network.

In the final part of the developed and offered an improved model of neocognitron, after which the results of testing the developed neural networks for pattern recognition of images, made a comparison with the prototype and the associated advantages and disadvantages of the modified neural network.

Results Achieved

The result of the research is theoretical and practical consideration of improving neocognitron. The results of the proposed approach to pattern recognition have shown that the developed modification is easy to understand, design and configuration, and has fewer neurons and connections between neurons, compared with the prototype. The speed of work and training of the proposed model shows its advantage over the original version.

Testing the proposed model showed quite good results for image recognition of characters.

Scientific novelty

In this paper we proposed an improved model of neocognitron focused on reducing the amount of memory and the cost of computation, analysis of the learning process and recognition of graphic images. The simulation results showed that the feature of neural networks of this type is their high rate of learning and pattern recognition as well as the stability of a pattern recognition is prone to all kinds of distortions.

The practical value

The practical value of the work lies in the possibility of applying the results obtained for the effective use of neural networks for pattern recognition tasks. Also, it should be noted that the proposed model can be modified to achieve better recognition results.

Findings

Modeling learning and pattern recognition software model of neocognitron Perspectives recognition of graphic images in a distortion of various kinds. This is due to the special structure of this type of neural networks, which to some extent, emulate the human visual system. Neocognitron can be viewed as a multi-level neural network system for induction of knowledge training set image data by extracting the typical characters and their generalizations to the next level. Summarizing the results of a study of recognition by neocognitron of images that have been distorted by various types of transformations, one can identify a number of advantages that make neocognitron superior to other neural networks designed for pattern recognition:

- poor sensitivity to distortions of images;
- reasonable amount of time learning and pattern recognition;
- self-organization;
- the possibility of training with a teacher and no teacher;
- availability of a sufficient number of parameters to tune the pattern recognition of various types.

A large number of neurons and interneuronal connections is the main drawback of neocognitron, which was partially eliminated in the course of research conducted within this work. Another disadvantage - a relatively long time operation, which can be eliminated by the hardware implementation and parallelization model of neocognitron, since in both cases, the calculation of outputs of all neurons at each level takes place in parallel. This is confirmed by tests in parallel modification of the neural network.

Neocognitron and its modification developed for modeling the visual system. However, this does not mean that they are applicable only for recognition of graphic

images. This neural network requires additional studies and can be used in other industries.

Testing results

The main provisions and the results of master's theses were reported at an international scientific conference "System analysis and information technology. Topic: Pattern recognition using artificial neural networks.

Publications

- E-book «SYSTEM SCIENCE AND CYBERNETICS»: article «Pattern recognition using artificial neural networks».

Diploma contains 79 pages, 2 tables is the 29 illustrations. In the preparation of used books from 26 different sources.

Keywords: Neural network training, neocognitron, pattern recognition.