

## STANDPOINT

regarding a dissertation for obtaining an educational and scientific degree "Doctor" in the doctoral program "Computer Systems, Complexes and Networks" prof. direction 5.3 "Communication and computer technology"

The work was presented by Ivan Torlakov  
Dissertation topic: „ Application of high-performance systems for modeling persistent processes in Cohen-Grosberg type neural networks”

Presented the opinion: Assoc. Prof. Hristo Georgiev Valchanov, PhD

### **1. Relevance of the problem developed in the dissertation work**

The topic of the dissertation work is in the field of application of neural networks in various spheres. The analysis of the dynamic behavior of neural networks is extremely important in terms of their correct implementation. Based on them, systems with intelligent behavior allow the processing of huge volumes of data. From this point of view, the research of stable processes in neural networks by using high-performance systems is of great interest.

The aim of the dissertation work is to model stable processes in Cohen-Grosberg neural networks with bidirectional associative memory with time-varying delays and variable impulse disturbances. The tasks set by the doctoral student correspond to a defined goal of the dissertation work.

### **2. Degree of knowledge of the state of the problem and creative interpretation of the literary material.**

A comprehensive literature review was made on the subject of the dissertation. The citations of both quite classical and modern sources show the broad aspect of the problem addressed in the dissertation. It can be seen that the doctoral student has acquired in-depth knowledge in the field under consideration and possesses the necessary theoretical basis for the successful development of the dissertation

### **3. Correspondence of the chosen research methodology and the set goal and tasks of the dissertation with the contributions achieved.**

I believe that there is a compliance of the chosen research methodology with the goals and objectives of the dissertation work. The results of the theoretical studies, as well as the logic of these studies, determine the credibility of the material on which the doctoral student's contributions are based.

### **4. Scientific and applied contributions of the dissertation work**

In my opinion, the stated contributions can be formulated as follows:

Scientific contributions:

1. A mathematical model is proposed for the study of qualitative properties of impulse neural networks of the Cohen-Grosberg type.

**Scientific and applied contributions:**

1. A classical algorithm for the implementation of neural networks is proposed, based on the presented model.
2. Parallel algorithms for stability conditions of an existing configuration are proposed.

**Applied Contributions:**

1. A parallel algorithm based on CUDA is implemented and studied.
2. A parallel algorithm based on OpenMPI was implemented and studied.

**5. Assessment of dissertation publications**

The PhD student defends his work with 4 publications, 3 of which are visible in the international database Scopus. One of the publications has 3 citations by foreign authors in Scopus (excluding self-citations by co-authors). The publications describe various aspects of the dissertation work and I believe that they have given the scientific community an opportunity to become familiar with it. They cover the subject of the dissertation work.

**6. Critical notes on the presented work**

1. It is recommended that conclusions be presented after each chapter, which will subsequently be summarized in contributions to the dissertation work.
2. At the end of the dissertation work, the claimed contributions of the doctoral student should have been presented. At the time of drafting the opinion, they are presented only in the abstract.
3. Much of the references used is from 5 years ago.

**7. Reasons and a clearly formulated conclusion.**

I propose to the scientific jury to accept the results and contributions in the dissertation work and award the doctoral student Ivan Torlakov the educational and scientific degree "Doctor of Philosophy" in professional direction 5.3 "Communication and computer technology" under the doctoral program "Computer systems, complexes and networks".

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Author of the standpoint:  
(Assoc.Prof. Hristo Valchanov, PhD)

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