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International Master's degree program "High-Performance and distributed information processing systems"

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Abstract

This paper presents information on the content and resources of the internationally certified Master's program "High-Performance and Distributed Information Processing Systems" in the field of Applied Mathematics and Computer Science. The paper studies scientific achievements of the academic staff, peculiarities of courses currently held, characteristics of available facilities and resources, prospects for the Master's worldwide research activities at a high scientific level, and opportunities to pursue postgraduate studies and to defend a PhD thesis.

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Keywords: Master's Program; curriculum; core courses description; parallel and distributed programming; high-performance computing; data mining

1. Introduction

In accordance with the Development Strategy of the Information Technology Industry of the Russian Federation in 2014-2020 projected for the year of 2025 (hereinafter referred to as the Strategy) approved by the Russian Federation Government Executive Order No. 2036-r dated November 1, 2013, the Priority Research and Development Areas in the field of Information Technology include the following:

- Big Data analysis and data mining including new methods and algorithms for Big Data collecting, storing and mining, new methods and software for distributed Big Data processing, as well as new methods and software for predictive modeling of complex engineering solutions;

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- development of new high-performance computing and data storing systems including new algorithms for parallel computing, new supercomputing technologies and applications, new communication technologies and communication protocols for increasing energy efficiency and fail safety, and for lowering the time of exchange between system elements, as well as new software for high-performance and reliable data storage systems;
- ubiquitous and cloud computing including new intercommunication algorithms for off-line devices (such as mobile and transport), new algorithms for interaction between robot systems and human beings, new engineering elements of a network data transfer infrastructure, new integrated sensors and sensor networks, as well as new infrastructure and software elements for implementation of various patterns of cloud service delivery.

The key issue of modern Information Technology is Big Data mining – a processing technology for large amounts of data of various composition (being very often updated and located in different sources) providing transfer from the common use of data assets to their capitalization: identification of future needs, creation of new products and services, improving competitiveness, development of completely new approaches to solve complex interdisciplinary basic and applied problems almost in all areas of human activities. International Data Corporation (www.idc.com, www.idcrussia.com) indicates that operation with Big Data will be one more 'must-have' competence in the world of today.

The IT industry is one of the most dynamically developing industries throughout the world and in Russia. The global IT market is estimated at 1.7 US dollars trillion. According to forecasts, the global IT market will continue to grow in the coming years averagely by at least 5 percent per year. Furthermore, the Russian IT industry has the potential for significantly faster growth of 10 percent or even more per year.

The Strategy's measures include increasing by 2020 the number of high-tech jobs in the Russian IT industry up to 700 thousand (about 60 thousand annually) workplaces, as well as the annual increase in domestic IT production and services of not less than 1 billion US dollars.

In order to provide rates of growth of priority research and development areas in the IT industry with high-qualified personnel, Samara National Research University (Samara University, before 2016 – Samara State Aerospace University) together with the Image Processing Systems Institute of the Russian Academy of Sciences (IPSI RAS) – the Branch of the "Crystallography and Photonics" Federal Research and Development Center of the RAS [1] have developed the Master's degree program "High-Performance and Distributed Information Processing Systems" (hereinafter referred to as the Master's program).

The Master's program was developed within a framework of the National Education and Training System in the field of Supercomputer Technologies and High-Performance Computing (HPC) being implemented by the Supercomputer Consortium of Russian Universities (www.hpc-russia.ru, www.parallel.ru) whose permanent member from 2012 has been Samara University (The Consortium President – Rector of M.V. Lomonosov Moscow State University V.A. Sadovnichy).

The advantage of the Master's program is that it is based on scientific achievements of the Russian leading scientific school "Diffractive Nanophotonics and Computer Optics" under the leadership of the Academician of the RAS V.A. Soifer [2-11]. Beginning with the first course of scientific schools (1996), the projects headed by V.A. Soifer frequently obtained the state support. In particularly, in 2016 the Project "Theory Development and Creation of Photonics Elements for All-Optical Information Processing" was supported by a two-year grant of the President of the Russian Federation in Information and Telecommunication Systems and Technology.

From 2012, the Master's program has been implemented at the Faculty of Information Technology of Samara University in the field Applied Mathematics and Computer Science. In 2015 the Master's program was internationally accredited by the Accreditation Center of Association for Engineering Education of Russia (AEER) with releasing the AEER Certificate and the Certificate of the European Network for Accreditation in Engineering Education (ENAEE) on rewarding this program with the European Quality Label (EUR-ACE® Label). The Master's program has been recorded in the register of AEER accredited programs and listed on the ENAEE database (www.ac-raee.ru, www.eur-ace.eu).