AIoT Data Management, Analytics and Decision Making (Artificial Intelligence of Things Data Management, Analytics and Decision Making)

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EDITORIAL

AIoT Data Management, Analytics and Decision Making (Artificial Intelligence of Things Data Management, Analytics and Decision Making)

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Abstract: Nowadays, the fast development of hardware for IoT-based systems creates appropriate conditions for the development of services for different application areas. As we know, the large number of multifunctional devices, which are connected to the Internet is constantly increasing. Today, most of the IoT devices just only collect and transmit data. The huge amount of data produced by these devices requires efficient and fast approaches to its analysis. This task can be solved by combining Artificial Intelligence and IoT tools. Essentially, AI accelerators can be used as a universal sensor in IoT systems, that is, we can create Artificial Intelligence of Things (AIoT). AIoT can be considered like a movement from data collection to knowledge aggregation. AIoT-based systems are being widely implemented in many high-tech industrial and infrastructure systems. Such systems are capable of providing not only the ability to collect but also analyse various aspects of data for identification, planning, diagnostics, evaluation, monitoring, optimization, *etc*., at the lower level in the entire system's hierarchy. That is, they are able to work more efficiently and effectively by generating the knowledge that is needed for real-time analytics and decision-making in some application areas.

Keywords: AIoT, data management, analytics, decision making, hypercubes, geometric transformation model,technical parameters.

1. INTRODUCTION

This special issue is dedicated to cover the up-to-date methodology for creating components of the AI-driven IoT systems to address a variety of information processing issues in different application systems.

In totally, nine submissions by scientists from the Czech Republic and Ukraine were received. After the review process, only five papers were accepted for publication, which are related to current developments in this area of research.

2. OVERVIEW OF SUBMISSIONS

The paper “Recover missing sensor data with GRNN-based cascade scheme” [1] is dedicated to solving the urgent problem of missing data recovery collected by various Internet of Things devices. Professor R. Tkachenko and his research team have developed a new ensemble model. It is built based on two series-connected general regression neural networks. The first member of the ensemble is designed to approximate the value of the required variable, while the second is used to predict the errors of the first member of the ensemble. The result of the designed model is formed by adding the outputs of both networks of the ensemble. The authors confirmed the high accuracy of the proposed model in comparison with other modern methods designed to solve this task. The proposed approach can be used in various applied areas.

The paper “Formation of hypercubes based on data obtained from systems of IoT devices of urban resource networks” [2] discusses the problems of storing a huge amount of diverse information collected by Internet of Things devices. A large number of different ICTs based on these data greatly affect the efficiency of the internal infrastructure systems of a Smart City. Dr. O. Duda and co-authors proposed approaches to improving the processes of formation of data hypercubes, which are an informational model of the processes of functioning of urban resource networks. Designed methods for constructing data hypercubes for systems of large Smart Cities provide the ability to carry out fast and precise monitoring of the status and trends of resources in urban resource networks, which is an important element of the effective operation of such systems.

Professor M. Nazarkevych and co-authors performed research in the direction of biometric security systems based on fingerprint recognition. An important task within this area is the speed and accuracy of biometric identification of fingerprint images. In the paper [3], "Evaluation of the effectiveness of different image skeletonization methods in biometric security systems”, the authors conducted theoretical and experimental analysis and comparison of the effectiveness of different skeletonization methods for biometric fingerprint images, which greatly affect the above characteristics. Based on this, the paper describes the advantages and disadvantages of using the Zhang-Suen method, Hilditch method and thinning algorithm based on Ateb-

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Gabor filtration. In particular, the latter method was developed based on the original theory of the first author of the article. High efficiency of its work for the solving the stated task has been established experimentally.

The study "The method and simulation model of element base selection for protection system synthesis and data transmission" [4], presented a new model and software tool for the synthesis of neural-like structures of symmetric encryption-decryption of data as well as tools of encoding-decoding for data transmitting using noise-like codes. It is based on the use of a non-iterative high-speed neural-like structure based on the Successive Geometric Transformations Model. The authors conducted a series of model experiments for the selection of basic elements and synthesis of DPTS with different technical parameters. The results show the high efficiency of real-time DPTS implementation using noise-like codes combining different modes of operation of the processor core. This approach provides fast and crypto-resistant data transmission, which can be the basis for future Smart City subsystems that require a high degree of data protection from unauthorized access.

The article [5], "Mathematical modeling of the availability of the information system for critical use to optimize control of its communication capabilities" is devoted to solving the local task of modeling the process of controlling the access of authorized person-user to the resources of an information system for critical use. It should be noted that the decision to grant access is made by the service of the registration center server in conditions of limited resources. At the same time, the provision of access implies a one-time provision to the person-user of a portion of different types of resources, generalized into the concept of a virtual machine. Taking into account the complexity of the modeled process, the mathematical apparatus of Markov chains was chosen to describe it. The resulting model made it possible to set a nonlinear integer-programming task for optimal control of the communication capabilities of an information system for critical use. The article provides a descriptive algorithm for solving such an optimization task, presents the results of its practical application, and analyzes the obtained experiments.

In general, all the presented works significantly complement the existing field of research with scientific novelty and practical value of the presented developments in the field of IoT. The proposed methods and models, which are based on the use of artificial intelligence, set the direction of original solutions to more complex problems in this area, which arise in particular in the systems of Smart City, Smart Enterprise or Smart House.

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