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# Cognitive systems, concepts, processes, and techniques for the age of Industry 4.0

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## **EDITORIAL**

The aim of this Guest Edition of *Cybernetics and Systems* is to present a wide-ranging scale of concepts and processes being currently researched, developed, and evaluated in real life settings in anticipation of incoming Industry 4.0 era. With the fourth industrial revolution expectation, the broad spectrum of cognitive approaches have emerged as an attempt [to](#) mimic and augment, in some way, human intelligence. Intelligence, in cognitive systems and computing, can be defined as the ability to learn from experience and use [the](#) domain [of](#) experts' knowledge to adapt and act in contextually new situations. The communicated selection of

papers does not postulate ultimate answers to the aspects of Industry 4.0 and cognitive systems that are discussed. Rather, it poses ideas and provokes for additional exploration. It also makes the reader aware of immensely multifaceted and interdisciplinary character of such predicaments.

The selection of research contributions to this issue opens with the paper titled “*Experience-Based Product Inspection Planning for Industry 4.0*”. In this paper, the authors expand on the idea of Smart Virtual Product Development (SVPD) system showing how it can be used to enhance product inspection planning. Results of the comprehensive case study show that the proposed system is capable of supporting product inspection planning in smart manufacturing, and thus has a vital role to play in Industry 4.0.

The author of the following paper titled “*Smart Cities Concept - readiness of city halls as a measure of reaching a Smart City Perception*” presents the results of extensive two-year studies involving ten large city halls in Poland, which are on their way to becoming a Smart City. The performed research focused on elaborating a new approach to the assessment of Smart Cities: testing the readiness of city halls to a Smart City concept implementation. This readiness is compared with the previously used Smart City assessment methods: dedicated rankings and ISO standards.

The paper that follows is titled “*A novel approach for mining closed clickstream patterns*”. This paper contributes to the very current topic of closed sequential pattern mining. The authors propose a novel approach for Closed Clickstream Pattern mining using C-List (CCPC) data structure. Experimental results conducted on several datasets show that the proposed method is better than the currently used techniques, improves the runtime and memory usage in most cases, especially when using low minimum support thresholds on the huge databases.

In the following paper titled “*Evaluating Industry 4.0 Implementation Challenges Using Interpretive Structural Modelling and Fuzzy-Analytic Hierarchy Process*” the authors contribute

to the Industry 4.0 related works by identifying, modelling, analyzing and prioritizing the challenges in implementing Industry 4.0 in manufacturing industries. The presented research identifies the main challenges and proposes the way they can be addressed in an efficient way.

The next paper is titled “*Decision support system for solving reviewer assignment problem*”. The paper introduces a smart support system for selecting a group of reviewers to evaluate a particular problem, such as a research proposal or a research paper. The presented support system consists of three main modules: data collection, reviewer identification, and group prediction of reviewers. Experiments using o the DBLP computer science bibliography dataset showed that the proposed system achieves better results in terms of accuracy in assigning reviewers than the currently used approaches.

In the following paper titled “*Centralisation Measures for Social Networks*”, the authors propose centralization evaluates which enforce intuition behind centralization. Centrality indicates the most central node or most influential node within a social network, which is crucial in developing marketing strategies that use the enormous promotion potential within online social networks.

The next paper is titled “*Towards Intelligent Recommendations Using the Neural Knowledge DNA*”. It introduces a recommendation approach using past news click data and the Neural Knowledge DNA (NK-DNA). The Neural Knowledge DNA is a novel knowledge representation methodology designed to support discovering, storing, reusing, improving, and sharing knowledge among machines and computing systems. The proposed approach is tested for news recommendation tasks on the MIND benchmark dataset. By taking advantages of NK-DNA, deep learning, and the Set of Experience technologies, the approach can learn from users’

past behaviours to form reading preference, and reuse learned knowledge for improving the recommendation performance.

The paper that follows is titled “*Polarization and Persuasion as Opposite Integration Strategies in Collective Models*”. The research presented in this paper builds on previous works of the authors aiming at the development of a comprehensive and universal integration model of unsupervised group with asynchronous communication. The paper represents an important step towards understanding the behavior of collectives, influencing and enhancing the whole field of computational collective intelligence.

The next paper relates to some of the medical imaging domain challenges. The paper is titled “*Smart approach for glioma segmentation in Magnetic Resonance Imaging using modified convolutional network architecture (U-NET)*” and it introduces a novel architecture for semantic segmentation. The proposed architecture is tested and evaluated on BraTS-2019 dataset achieving an average dice score of 0.782 for the whole tumor region, and has the potential to play a vital role in medical imaging interpretation.

This Special Issue is concluded with a brief communication of an interesting survey titled “Where did Knowledge Management Go?” This study is the first promising step in developing much needed for cognitive systems advance Knowledge Management (KM) ontology.

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