Preface

Special Issue on Digital Transformation Environment for Education in the Space of CogInfoCom

This special issue brings together papers in the field of digital education and CogInfoCom based LearnAbility including education through online collaborative systems and virtual reality solutions, project- based education and investigating capabilities for learning through modern informatics based education. This is an interdisciplinary research field and fits well in the topic of Cognitive Infocommunication. The key concepts behind CogInfoCom and its application in digital education and learnability is that humans and ICT are becoming entangled at various levels, as a result of which new forms of blended cognitive learning capabilities are appearing. This special issue presents various new results on this scientific disciplina in the following papers:

1) Enhancing Higher Education Student Class Attendance through Gamification

This paper presents an electronic system for tracking students' attendance. "BeHere" was implemented at Subotica Tech – College of Applied Sciences, introducing gamification elements into class attendance tracking. Given that the first year of their studies in higher education is the most crucial time period, it is vital that students are motivated to attend classes regularly. Class attendance is frequently seen as the prime marker of students' persistence: lower attendance indicates a higher risk of dropout. The gamification module of the system is used to improve student engagement, motivation, attendance, and academic performance. Based on the research results, it is evident that the tested gamification module motivated students to attended classes more regularly during the 2018/19 school year as compared with the previous year.

2) Analyzing the spatial skills of university students with a virtual reality application using a desktop display and the Gear VR

This paper presents the analyzed results of a virtual reality application which allows to measure spatial skills of the users. The application contains mental rotation tests of three types and can be used on a computer with desktop displays and on Android with the Gear VR device. The authors measured the spatial ability of 61 students with the Gear VR and of 240 students with a desktop display. By investigating the correct answer ratios, comparisons were done between the age, the gender, the primary hand, what the studends are majoring in, moreover the display devices. Out of the two devices, the Gear VR significantly improved on

the performance of female students, left-handed students, older students and made the purdue spatial visualization test easier.

3) Evaluation of Eye-Movement Metrics in a Software Debbuging Task using GP3 Eye Tracker

Teaching different programming subjects is an increasing challenge nowadays as because of growing user demands, the latest paradigms and technologies must be taught. Students in higher education now are of the age who were born into the digital world; however, the success of fulfilling programming courses is lagging behind. Human-computer interface-based research has emerged in numerous fields of science recently, which could lead to the revolutionising of education. These interfaces could also help professors as a support system in transferring knowledge in a more efficient way besides supporting students acquiring adequate home learning methods. In this study, the applicability of eye movement tracking systems in respect of a programming task is examined, in which during the exploration and correction of the errors of an incorrectly functioning algorithm, the eye movement parameters are observed, recorded and evaluated. The test subjects participating in the research were divided into two groups according to some of their characteristic parameters, where the first group during debugging rather applied minor modifications and the more common technique of compile and run, which otherwise is also the most characteristic feature of students studying programming, while the members of the other group increased emphasis on analysing. In the statistic evaluation of the research, the parameters characteristic of the eye movement tracking of the two groups, as well as the efficiency of these groups were analysed. Based on the results, regarding the number of fixations, a significant difference could be shown between the two groups, while concerning the duration of fixation and the saccade length, the difference shown was infinitesimal.

4) Quantitative Analysis of Relationship Between Visual Attention and Eye-Hand Coordination

In perception and activity tasks, continuous visual tracking of the performed activity requires continuous eye motion. Besides writing and reading, the cooperative work of eyes and hands is a key factor when drawing and at certain motions (e.g. ball catching or throwing); during the exact execution of motions, eye-hand coordination has the utmost importance. The development of eye-hand coordination plays a key role in education too, regarding several subjects, i.e. writing, drawing, technique and lifestyle, and of course, at complex motion sequences. Modern ICT tools play an even more significant role in supporting education, where human-computer interfaces similar to the systems introduced in this paper are very significant. In this paper, by analysing certain features

describing computer mouse cursor motion, examined during the execution of the Trail Making Task, what correlation is there between visual attention and eye-hand coordination. Based on the statistical correlation analysis results of data, it was determined, that the fixation parameters of eye and hand motion are in negative correlation with visual attention, while the distance between the look and the mouse cursor's motion are not correlated to each other.

5) E-learning spaces to empower students collaborative work serving individual goals

Innovation has an impact on the modern society, so it appears as a demand of the learning society in the educational process. However, there are many other factors that need to be taken into account in supporting an individual's success in designing and implementing a learning process, not just technological change. As opportunities are multiplied, technological support for collaborative work is becoming increasingly demanding to effectively utilization these opportunities in everyday student work. The aim of higher education is to support student success. The continuous adaptation of educational environment to student needs is an important element of this need.

6) The correlations between health behaviors and the use of health-preserving mobile applications in young adults

Individuals' lifestyles manifest themselves in daily activities that can have effects that are a health preserving, preventive or risk-enhancing, in terms of health. Some of them are as simple everyday activities, as eating, exercising or smoking, which are closely related to health without being specifically viewed as health-related behaviors. In the case of university-age young people, a similar activity that affects health is the use of smart devices. Like any other factor, this can also have both positive and negative impacts on health.

In this study, we looked at the health status of university-age young people, as well as their habits in using smart applications. The results have shown that the health of university students studying in Serbia and Hungary is satisfactory in several respects. In addition, several correlations can be seen between their general well-being, their excercise and eating habits, as well as their use of smart devices, applications, more specifically, applications aimed at health-care.

7) Educational tool for testing emotions recognition abilities in adolescents

Recognition of facial expressions is one of the basic skills used to understand the feelings and intentions of others and it represent a crucial ability for establishing interpersonal connections in life. Previous studies have shown that the ability to

recognize emotions, the speed and accuracy, with which individuals process emotions, appears to develop through adolescence before reaching its peak in adulthood. Individuals with autism spectrum disorder (ASD) show reduced attention to faces and facial expressions and they have difficulties in identifying emotions. Our goal was to investigate the effectiveness of a technology based educational tool for assessing emotion recognition skills in individuals with ASD and typical developing children. 51 children aged between 12 and 14 year were enrolled in our study, out of which 11 have a diagnosis of ASD. The results of our study show that adolescents perceive differently emotions depending on the type of stimuli that we use and on their ages.

8) Mathability and Creative Problem Solving in the MaTech Math Competition

The Klebelsberg Center and the University of Dunaújváros as a professional partner organized the national MaTech math competition for the second time in 2019,. The main goal of this competition is to develop creativity, creative problem solving, teamwork, and apply of digital knowledge in real mathematical problems when the mathematical capabilities co-evolving with human-ICT systems. The article presents an analysis to identify the characteristics of the mathematical knowledge, and its relationship with skills of creative presentation and performance.

9) Advanced assistive technologies for elderly people: A psychological perspective on seniors' needs and preferences (part A.)

This paper provides an overview of the literature about seniors' psychological perspective in exploiting assistive robots and embodied conversational agents. The main theoretical models devoted to assess user's technology acceptance are briefly reviewed along with a description of the main factors empirically found to be positively/negatively associated with seniors' acceptance of them. Special attention is reserved to barriers generated by seniors' representations of social assistive technologies such as a stigma and threat to their autonomy, infantilization, privacy interferences, fear of dehumanization, and isolation.

10) Putting the Human Back in the Loop: A Study in Human-Machine Cooperative Learning

This paper introduces a novel approach to human-machine collaborative learning that allows for the chronically missing human learnability in the context of supervised machine learning. The basic tenet of this approach is the refinement of a human designed software model through the iterative learning loop. Each iteration of the loop consists of two phases: (i) automatic data-driven parameter adjustment, performed by means of stochastic greedy local search, and (ii) human-

driven model adjustment based on insights gained in the previous phase. The proposed approach is demonstrated through a real-life study of automatic electricity meter reading in the presence of noise. Thus, a cognitively-inspired non-connectionist approach to digit detection and recognition is introduced, which is subject to refinement through the iterative process of human-machine cooperation. The evaluation of the prototype system is reported.

11) Movement pattern recognition in physical rehabilitation - cognitive motivation based IT method and algorithms

In this paper, a solution is presented to support both existing and future movement rehabilitation applications. The presented method combines the advantages of human computer interaction based movement therapy with the cognitive property of intelligent decision making systems. With this solution, therapy could be fully adapted to the needs of the patients and conditions while maintaining a sense of success in them, thereby motivating them. In our modern digital age, the development of HCI interfaces walk together with the growing of user needs for them. The available technologies have limitations, which can reduce the effectiveness of modern input devices, such as the Kinect sensor or any other similar sensors. In this article, multiple newly developed and modified methods are introduced with the aim to overcome these limitations. This methods can fully adapt the movement pattern recognition to the users' skills. The main goals are to apply this method in movement rehabilitation, where the supervisor, therapist can personalize the rehabilitation exercises due to the Distance Vector Based Gesture Recognition (DVGR), Reference Distance Based Synchronous/Asynchronous Movement Recognition (RDSMR/RDAMR) and the Real-Time Adaptive Movement Pattern Classification (RAMPC) methods.

12) An architectural approach to Cognitive Information System

The fast changes in information technology and business needs led to the evolution and development of Cognitive Information Systems (CIS). There have been few pieces of research on the general model for the analysis and design of CIS. This paper attempts to create a design scheme for incorporating the various model for CISs and Understanding-based management systems (UBMSS). The components that have been examined create elements of CIS analysis and design, however there were not described as modeling element and not described as an enabling tool to create a consistent and integrated system The most significant components for modeling are: semi-structured documents, business processes, constituents of knowledge management, the enterprise and, the information architecture including self-directing software components – Artificial Intelligence (AI) – that yield function. For CIS modeling the above-mentioned elements were combined into a unified framework that follows the object-oriented paradigm and

architecture approaches. The aim of the research to describe a framework that presents an overarching model and assists our understanding of properties of CIS and UBMSS for being able to formulate a practical development method for CIS and cognitive management systems.

13) Experiencing the Sense of Presence in an Educational Desktop Virtual Reality

This study examines the sense of presence in MaxWhere desktop virtual reality. Thirty-one people participated in the research. The participants spend about fifteen minutes in the virtual environment. For measuring presence, the Igroup Presence Questionnaire (IPQ) was used. The results showed that more automatic navigation positively relates to spatial presence. This research also measured the participants' level of experience with the VR software. A significant difference was found in the spatial presence and experienced realism: the more experienced users gave higher ratings on both subscales. At the same time, the involvement and the general presence scores were similar in the two groups, which is advantageous in education as the presence is positively related to the learning outcome.

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Guest Editor