Challenges for Smart Environments – Human-Centered Computing, Data Science, and Ambient Intelligence II

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Handy mobile systems with access to the cloud from anywhere expand the possibilities for designers and users in many areas of work and leisure. However, a number of requirements must be met and complex problems solved before such systems can provide reliable, accurate, and timely information that users can handle, understand, process, and trust. The most important source and asset for the development of intelligent systems is data, which our information age has made more readily available, although access via appropriate interfaces and intuitive query techniques are still limited and, in most cases, require expert knowledge and digital rights to be complied with. Thus, we face the challenge of enabling effective and efficient extraction of knowledge from vast amounts of data and heterogeneous sources while maintaining quality standards to build smart applications for Smart Environments (SmE) supporting collaboration of the stakeholders in virtual and mixed reality settings, multimodal interaction and reliable visual analytics for knowledge extraction and creation.

Research in Ambient Intelligence (AmI) and SmE in Urban and Rural Areas presents great challenges: AmI depends on advances in sensor networks, artificial intelligence, ubiquitous and persuasive computing, knowledge representation, spatial and temporal reasoning. SmE builds upon embedded systems, smart integration, and an increasing fusion of real and virtual objects in the IoT. Customized sensor networks are used to detect human behavior and activities, evaluation logic and process mining are needed to replace people's cognitive abilities in Ambient Assisted Living (AAL) applications, detecting recurring activities without being noticed and hurting their privacy. Validated counseling services, recommender tools, for all areas of daily life, robots and chatbots in public institutions facilitate or relieve citizens of decisions, support them in mobility, learning activities and teamwork, must therefore be subjected to a standardized requirements and evaluation management over the whole lifecycle.

The first volume of the current issue of J.UCS contains articles which treat machine learning and information processing problems in various applications and theory mainly focused on building autonomous systems with intelligence. It is also dealing with the explainability aspect of machine learning models which is a fundamental challenge nowadays, when with the advent of deep learning, models with high predictive power can consist of millions of parameters with human interpretability lost in such a complexity. Building smart systems that aimed at helping people in various ways imply more specific challenges for researchers and practitioners besides efficiently leveraging data science methodologies. It requires novel theoretical frameworks and collaboration platforms for human-human and human- computer scenarios with data security and privacy constraints. Typical examples in which data science has been used for human-centric computing are: learning analytics for education (e.g., construct models for student performance forecasting), using convolutional neural networks to reconstruct 3D models of cultural heritage objects for digital museums, analyzing the structure and dynamic of social networks, developing explainable models for predicting health risks of the population, etc.

Based on a successful funded collaboration between the American University of Armenia, the University of Duisburg-Essen and the University of Chile, in previous years a network was built, and in September 2020 a group of researchers gathered (although virtually) for the 2nd CODASSCA workshop on "Collaborative Technologies and Data Science in Smart City Applications". This event has attracted 25 paper submissions which deal with the problems and challenges mentioned above. The studies are in specialized areas and disclose novel solutions and approaches based on existing theories suitably applied.

The authors of the best papers published in the conference proceedings on Collaborative Technologies and Data Science in Artificial Intelligence Applications by Logos edition Berlin were invited to submit significantly extended and improved versions of their contributions to be considered for a journal special issue of J.UCS. There was also a J.UCS open call so that any author could submit papers on the highlighted subject. For this volume, we selected those devoted mainly to human-computer interaction problematics, which were rigorously reviewed in three rounds and 6 papers nominated to be published.

The editors would like to express their gratitude to J.UCS foundation for accepting the special issues in their journal, to the German Research Foundation (DFG), the German Academic Exchange Service (DAAD) and the universities and sponsors involved for funding the common activities and thank the editors of the CODASSCA2020 proceedings for their ongoing encouragement and support, the authors for their contributions, and the anonymous reviewers for their invaluable support. Guest editors are especially grateful to Prof. Luther for his invaluable help during the preparation of this special issue.

The paper "Designing, realizing, running, and evaluating virtual museums – a survey on innovative concepts and technologies" by Nelson Baloian, Daniel Biella, Wolfram Luther, Jose A. Pino, and Daniel Sacher represents a state-of-the-art survey of virtual museums emphasizing the role of their different dimensions in the context of modern technologies and requirements. It demonstrates an extensive literature review outlining all aspects of virtual museums infrastructures including management, design, maintenance, and application of new technologies.

The paper "Big Data between Quality and Security: Dynamic Access Control for Collaborative Platforms" by Mohamed Talha and Anas Abou El Kalam proposes a framework for secure data collection in collaborative platforms. It relies on two existing frameworks (PolyOrBAC and SLA-Framework). The extended framework incorporated into a data quality assessment system creates a secure and dynamic collaborative activity in the Big Data context.

The paper "An Integration of Health Monitoring System in Public Transport Using the Semantic Web of Things" by Abdelhalim Hadjadj and Khaled Halimi makes a design proposal to integrate a health monitoring system with a public transportation system using the semantic web technologies. In other words, authors contribution is about using IoT to support ad hoc health services to patients during transportation.

The paper "Uncertainty Handling in Genetic Risk Assessment and Counseling" by Ekaterina Auer and Wolfram Luther demonstrates a novel method that combines Dempster-Shafer theory, interval analysis, and decision trees to provide a framework for risk assessment in scenarios where uncertainty is high such as counseling sessions. Authors test the method in breast cancer risk assessment using prior prevalence information.

The paper "Combined Use of Virtual Reality and a Chatbot Reduces Stress More Than Using Them Separately" by Atsuko Matsumoto, Takeshi Kamita, Tomoo Inoue, Yukari Tawaratsumida, Ayako Nakamura, Harumi Fukuchimoto, Yuko Mitamura, Hiroko Suzuki, and Tsunetsugu Munakata presents an extension to the structured association technique (SAT) for assessing mental health, by addressing virtual reality and chatbot technology. A thorough and localized user study was conducted, with a particular interest in measuring the effectiveness of the VR app, the chatbot app, and the interaction between these two applications. The reported results show that the interaction between VR and chatbot apps serves as an effective output for practicing self-care with a higher stress reduction.

The paper "Deep Semi-Supervised Image Classification Algorithms: A Survey" by Ani Vanyan and Hrant Khachatrian focuses on the current state of the art of deep semi-supervised image classification algorithms. It presents the shortcomings of current algorithms, starting with basic definitions and building up to the current techniques used for this problem.

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