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Smart Applications and Data Analysis

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Preface

With a track record of three editions, the International Conference on Smart Applications and Data Analysis for Smart Cyber-Physical Systems (SADASC 2020) has established itself as a high-quality forum for researchers, practitioners, and developers in the field of Cyber-Physical Systems. SADASC 2020 topics cover the main layers of data-enabled systems/applications: source layer, network layer, data layer, learning layer, and reporting layers. This year's conference (SADASC 2020) builds on this tradition, facilitating the interdisciplinary exchange of ideas, theory, techniques, experiences, and future research directions.

Our call for papers attracted 44 papers, from which the Program Committee finally selected 17 full papers and 8 short papers, yielding an acceptance rate of 39%. Each paper was reviewed by an average of three reviewers and in some cases up to four. Accepted papers cover a number of broad research areas on both theoretical and practical aspects. Some trends found in accepted papers include the following: Ontologies, Modeling, and Meta Modeling; Cyber-Physical Systems and Block-Chains, Machine Learning, Recommender Systems, Combinatorial Optimization, and Simulations and Deep Learning.

One workshop was associated with SADASC 2020 on Data Enrichment in Smart Applications (DESA 2020), co-chaired by Imane Hilal and Najima Daoudi, both from ESI, Morocco. This workshop received six papers and its Program Committee finally selected two papers that are included in the SADASC 2020 proceedings as short papers. Each paper was reviewed by three reviewers.

Due to the reputation and topics, novelty of SADASC 2020, editors of well-known journals have agreed to receive extended versions of best papers selected from our program. This year, we are pleased to have a special issue in: the *IEEE/CAA Journal of Automatica Sinica*, the *International Journal of Reasoning-based Intelligent Systems* (IJRIS, Scopus indexed journal), and the *Journal of Systems Architecture* (Scopus indexed journal).

We would like to thank all authors for submitting their papers to SADASC 2020 and we hope they submit again in the future. On the other hand, we express our gratitude to all the Program Committee members who provided high-quality reviews. We want to acknowledge the ease of use and flexibility of the EasyChair system to manage papers. Finally, we would like to thank the support of local organizers.

For conference attendants, we hope the technical program, informal meetings, and interaction with colleagues from all over the world was most enjoyable. For readers of these proceedings, we hope these papers are interesting and they give you ideas for future research.

SADASC 2020 was postponed to June due to the COVID-19 pandemic. The committee and local organizers have done a great job managing the review process and the conference, despite this pandemic.

February 2020

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Abstracts of Keynotes

Recommending POIs in LBSNs with Deep Learning

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Abstract. In recent years, the representation of real-life problems into k -partite graphs introduced a new era in Machine Learning. The combination of virtual and physical layers through Location Based Social Networks (LBSNs) offered a different meaning to the constructed graphs. As a consequence, multiple diverse models have been introduced in the literature that aim to support users with personalized recommendations. These approaches represent the mathematical models that aim to understand users' behavior by detecting patterns in users' check-ins, reviews, ratings, and friendships. In this talk, we will discuss state-of-the-art methods for POI recommendations based on deep learning techniques. First, we categorize these methods based on data factors or features they use, the data representation, the methodologies applied, and the recommendation types they support. By briefly representing recent key approaches, we highlight the limitations and trends. The future of the area is illustrated.

Keywords: Recommenders · Points of interest · Location based services · Deep learning

Natural Language Based Augmentation of Information, Conversations and Software: Issues, Applications and Directions

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As economies undergo significant structural change, digital strategies and innovation must provide industries across the spectrum with tools to create a competitive edge and build more value into their services. With the advent of widely available data capture and management technologies, coupled with intensifying global competition, fluid business, and social requirements, organizations are rapidly shifting to data-fication of their processes. Accordingly, they are embracing the radical changes necessary for increased productivity, added value, and insights.

However, while advances in big data analytics and AI enable tremendous automation and scalability opportunities, new productivity and usability challenges have also emerged. A commonly overlooked limitation of current systems is that they do not provide effective integration of analytics, AI enablement, and end user workspace environments (e.g., investigators, analysts user productivity tools). We discuss critical challenges in the effective integration of data and AI driven insights and end user- oriented case management technologies. We will discuss synergies between machine reading, data curation, digital augmentation, and assistance as a step forward to empower end users to effectively use data and AI technologies, while share and collaborate on the fly, in order to generate and evolve insights.

We will also discuss cognitive services and conversational AI to augment and improve productivity and effectiveness of their customers, workers, and stake-holders, automate business processes, and deliver data-driven insights. However, there are significant gaps in the cognitive service-enabled endeavor. We will discuss how integration of cognitive services APIs are unlocking application, data source, and device silos through standardized interaction protocols and access interfaces. To leverage the opportunities that APIs bring, we need cognitive service development to 'scale' in terms of how efficiently and effectively they can integrate with potentially large numbers of evolving APIs. We will discuss some critical challenges to achieve this objective. First, a core challenge is the lack of latent and rich intent and APIs knowledge to effectively and efficiently support dynamic mapping of complex and context-specific user intents to API calls. Second, user intent may be complex and its realization requires composition of multiple APIs (e.g., triggering multiple APIs to control IoT devices using one user utterance). Existing intent composition techniques typically rely on inflexible and costly methods including extensive intent training or development of complex and hard-coded intent recognition rules. We will discuss challenges in API aware training of cognitive services. We will discuss novel latent

knowledge-powered middleware techniques and services to accelerate bot development pipelines by: (i) devising novel intent and API element embeddings and matching techniques; (ii) declaratively specifying reusable and configurable conversation models to support complex user intent provisioning; and (iii) dynamically synthesizing API calls instead of the ad hoc, rule-based, and costly development of intent-to-executable-code mappings.

Data Mining in Predictive Maintenance: Overview and Applications

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Abstract. Maintenance costs are a significant part of the total operating costs of all manufacturing or production plants. Depending on the specific industry, they can represent between 15 and 60 percent of the cost of goods produced. Recent surveys of maintenance management effectiveness indicate that one-third of all maintenance costs is wasted as the result of unnecessary or improperly carried out maintenance. It is then clear the enormous impact the maintenance operation plays in productivity.

Modern manufacturing systems use thousands of sensors retrieving information at hundreds to thousands of samples per second. Predictive maintenance makes use of this massive amount of data to predict malfunctioning or failures in the system and recommend a maintenance operation just before the failure happens. The objective of this presentation to show the role that machine learning and big data mining algorithms play in the development of predictive maintenance strategies, illustrating with several successful examples described in the literature. We will finish the speech by illustrating a case study: the predictive maintenance of trucks belonging to the Spanish land army.

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