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Research Challenges in Information Science

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Preface

It is our great pleasure to welcome you to the proceedings of the 14th International Conference on Research Challenges in Information Science (RCIS 2020). RCIS brings together scientists, researchers, engineers, and practitioners from the whole spectrum of information science and provides opportunities for knowledge sharing and dissemination. The first edition of RCIS was held in 2007 in Ouarzazate, Morocco. Over the years, the various instances of RCIS were hosted in Morocco, France, Spain, the UK, Greece, and Belgium.

RCIS 2020 took place in Limassol, Cyprus, during September 23–25, 2020. The conference was originally scheduled for May 2020, but the Organizing Committee was forced to postpone the conference due to the outbreak of the COVID-19 pandemic. The scope of RCIS 2020 is summarized by the following eight thematic areas: (i) information Systems and their engineering, (ii) user-oriented approaches, (iii) data and information management, (iv) business process management, (v) domain-specific information systems engineering, (vi) data science, (vii) information infrastructures, and (viii) reflective research and practice.

Within the variety of information science areas and domains, we are assisting a dramatic boost in the role of artificial intelligence (AI) techniques. Clear examples of AI technologies that are applied to data and information are machine learning (including deep learning with neural networks), autonomous and self-adaptive systems (such as autonomous cars or the automation in Industry 4.0), and natural language processing. To emphasize this undeniable trend, the theme of RCIS 2020 was "Information Science in the Days of Artificial Intelligence."

Our two keynote speakers provided their perspectives on the role of AI in information science. Hajo Reijers (Utrecht University, The Netherlands) gave a keynote entitled "The Future of Work Automation," which focused on how human work can be analyzed and interpreted through AI techniques, in order to assess whether it makes sense to automate human work. Nana Tintarev (Delft University of Technology, The Netherlands), in her keynote entitled "Explainable AI is not yet understandable AI," investigated how advice-giving systems should be able to explain themselves, in order to avoid mismatches between the system representation of the advice and the representation that is assumed by the user. These interesting perspectives have been further elaborated in a plenary panel discussion.

We are pleased to present this volume comprising the RCIS 2020 proceedings. This is the first edition of RCIS that has proceedings published by Springer through their *Lecture Notes in Business Information Processing* (LNBIP) series. These proceedings include the papers in all the tracks of RCIS 2020, and therefore constitute a comprehensive account on the conference.

The main track received 136 abstracts, which materialized into 118 submissions. The program co-chairs desk rejected 12 papers which were out of scope, resulting in 106 papers that were peer reviewed. Each paper was reviewed by at least three Program Committee members; these reviews served to initiate an online discussion moderated by one Program Board member, who concluded the discussion by writing a meta-review and a suggestion for full acceptance, conditional acceptance with gatekeeping, invitation for poster track, or rejection. The program co-chairs discussed each paper and took the final decisions, largely in line with the Program Board advice, leading to 29 accepted papers in the main track. The breakdown by category is as follows:

- Technical solution: 15 accepted out of 58 reviewed
- Scientific evaluation: 5 out of 21
- Industrial experience: 6 out of 10
- Work in progress: 3 out of 17

The Posters & Demos track, chaired by Elena Kornyshova and Marcela Ruiz, attracted 8 submissions, 5 of which were accepted. Furthermore, 7 additional papers were accepted from those papers invited from the main conference track, leading to a total of 12 posters and demos. The Doctoral Consortium track, chaired by Raian Ali and Sergio España, attracted 5 submissions, 4 of which were accepted. The Tutorials track, chaired by Estefanía Serral and José Ignacio Panach, received 5 proposals, 3 of which were accepted.

To foster the discussion about innovative research projects in information science, we launched the Research Projects RCIS track, organized by the Posters & Demos co-chairs, aiming at short communications on projects such as those funded by the EU Commission via H2020 or ERC projects, or by national research councils. The track received 10 submissions, out of which 8 were accepted.

RCIS 2020 would not have been possible without the engagement and support of many individuals. As editors of this volume, we would like to thank the RCIS Steering Committee members for their availability and guidance. We are grateful to the members of the Program Board and of the Program Committee, and to the additional reviewers for their timely and thorough reviews of the submissions and for their efforts in the online discussions. A special thank you goes to those of them who acted as gatekeepers for the conditionally accepted papers. We would like to thank our social media chair Fatma Başak Aydemir, who guaranteed visibility through Twitter. We are deeply indebted to the George A. Papadopoulos, the general co-chair responsible for the local organization, for his continuous logistics and operation efforts, his extensive advertising activities, his decisive role in coping with the rescheduling, and his initial push regarding the Research Projects track. Finally, we would like to thank Christine Reiss, Ralf Gerstner, and Alfred Hofmann from Springer for welcoming RCIS to their LNBIP series and for assisting in the production of these proceedings.

We believe that this volume provides a comprehensive account on the conversations that took place at the RCIS 2020 conference. We hope you will find innovative and surprising research results and research challenges that can be used for the construction of better information systems that serve our society.

September 2020

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Abstracts of Invited Talks

Explainable AI is Not Yet Understandable AI

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Some computer systems operate as artificial advice givers: they propose and evaluate options while involving their human users in the decision making process [8]. For example, a regulator of waterways may use a decision support system to decide which boats to check for legal infringements, a concerned citizen might used a system to find reliable information about a new virus, or an employer might be use an artificial advice giver to chose between potential candidates. This keynote focuses specifically on explanations for *recommender systems*. Recommender systems such as Amazon, offer users recommendations, or suggestions of items to try or buy. Recommender systems can be categorized as filtering and ranking algorithms, which result in the increase in the prominence of some information, and other information (e.g., low rank or low confidence recommendations) not being shown to people.

For explanations of recommender systems to be useful, they need to be able to justify the recommendations in a *human-understandable* way. This creates a necessity for techniques for automatic generation of satisfactory explanations that are *intelligible* for users interacting with the system[1].

"*Interpretability*" has been qualified as the degree to which a human can understand the cause of a decision [4]. However, understanding is rarely an end-goal in itself. Pragmatically, it is more useful to operationalize the effectiveness of explanations in terms of a specific notion of usefulness or **explanatory goals** such as improved decision support or user trust [7]. One aspect of intelligibility of an explainable system (often cited for domains such as health) is the ability for users to accurately identify, or correct, an error made by the system. In that case it may be preferable to generate explanations that induce appropriate levels of reliance (in contrast to over- or under-reliance) [9], supporting the user in discarding recommendations when the system is incorrect, but also accepting correct recommendations. The domain affects not only the overall cost of an error, but the cost of a specific type of error (e.g., a false negative might be more harmful than a false positive for a terminal illness). In a domain such as news, a different goal might be more suitable, such as explanations that facilitate users' epistemic goals (e.g., broadening their knowledge within a topic) [6].

It is sometimes erroneously assumed that explanations need to be completely transparent with regard to the underlying algorithmic mechanisms. However, a transparent explanation is not necessary understandable to an end-user. [1] distinguishes

[1] NWO Artificial Intelligence Research Agenda for the Netherlands (AIREA-NL), https://www.nwo.nl/en/news-and-events/news/2019/11/first-national-research-agenda-for-artificial-intelligence.html, released in November 2019.

between explanation and justification in the following way: "*a justification explains why a decision is a good one, without explaining exactly how it was made.*" That is, a user-centered explanation may not be fully transparent, but still useful if it fulfills an explanatory goal.

Assessing the effect of explanations on given explanatory goals requires systematic user-centered evaluation. To understand which explanation (e.g., with regard to modality, degree of interactivity, level of detail, and concrete presentational choices) for explanations, it is vital to identify which requirements are placed by *individual characteristics*, the *domain*, as well as the *context* in which the explanations are given. For example, in the music recommender domain, personal characteristics such as domain expertise and visual memory have been found to influence explanation effectiveness [3]. Further, having additional transparency and control for context such as location, activity, weather, and mood has been found to lead to higher perceived quality and did not increase cognitive load for music recommendations [2]. Other contextual factors, such as group dynamics, create additional requirements on explanations, such as balancing privacy and transparency [5].

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The Future of Work Automation

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Due to the advent of Information Technology (IT), our perception of what "work" is evolves. Tasks that were until recently considered to be the exclusive domain of humans are now carried out by robots or algorithms. Examples are plentiful: algorithms are more accurate for some medical diagnosis tasks than medical specialists, simple journalistic texts can be automatically generated, and personal financial advice can be provided by robots to a certain extent [1].

There is a rich debate on the question whether humans will become obsolete in the working place. To some, the real question is *when* this will happen [2]. Others emphasize that what we see happening is a long process of the automation of human *tasks*, while there is still an ongoing growth of human *jobs* [3].

There is another perspective on the relationship between IT and work. IT is not only a means to automate work; it can also be an enabler to better *understand* human work itself.

This can be seen in the following way. Increasingly, human work is less about physical labor and more about cognitive action. Cognition centers around the processing of data. Workers receive, retrieve, interpret, enrich, create, send, and store data. The occurrence of such data actions manifest themselves as *human event data* in logs in all types of records. Very often, it is even possible to determine the exact data that was retrieved or stored during such events.

The capabilities of IT to process large amounts of data and the development of a range of data analysis algorithms all of a sudden make human event data of much interest. Through approaches such a process mining [4] and task mining [5], we are able to find out all kinds of properties of human work, such as their volume, timing aspects, repetitive patterns, etc.

A new step, which now lies ahead of us, is to use our understanding of human work to rethink it. Can we identify the parts of human work that are simple and perhaps boring, so that we can automate these to relieve human workers from it? Can we also identify the demanding parts of human work, so that we can think of better ways to enable workers carrying out those parts, for example by providing them with better data? Could we even do this all automatically, so that we embark on a continuous process of work improvement?

Far-fetched as these questions may seem now, signs can be observed that it becomes feasible to start answering them. Those signs can be observed in new technologies, such as Robotic Process Automation [6], and during running research projects that aim at understanding human work. We may very well be entering a new era for work automation where the focus shifts from replacing humans by computers to design work that gracefully combines the skills of humans and computers.

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