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Intelligent Tutoring Systems

18th International Conference, ITS 2022
Bucharest, Romania, June 29 – July 1, 2022
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Preface

The 18th International Conference on Intelligent Tutoring Systems (ITS 2022) was held in Bucharest, Romania, from June 29 to July 1, 2022 in a hybrid format that allowed participants to attend online as needed considering the continuing COVID-19 pandemic. The Hosting Institution of ITS 2022 was the University Politehnica of Bucharest.

Adhering to the mission of ITS, the title of ITS 2022 was "New Challenges for ITS During and After COVID". Its objective was to present academic and research achievements in computer and cognitive Sciences, artificial intelligence, and, due to its recent emergence, specifically, deep learning in tutoring and education. The aim of ITS 2022 was to promote and improve learning technology systems, by combining novel and advanced technology with complex and nuanced research approaches. It offered a forum for exploring emerging and noteworthy progress in the field of artificial intelligence in education.

The call for scientific papers focused on a broad number of topics of interest in the area of ITS and beyond including the following:

- Intelligent Tutoring
- Learning Environments for Underrepresented Communities
- Artificial Intelligence in Education
- Human in the Loop, Understanding Human Learning on the Web in a Virtual (Digital) World
- Machine Behaviour (MB), Explainable AI, Bias in AI in Learning Environments
- Emotions, Modeling of Motivation, Metacognition and Affect Aspects of Learning, Affective Computing and ITS
- Extended Reality (XR), Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) in Learning Technologies
- Informal Learning Environments, Learning as a Side Effect of Interactions
- Collaborative and Group Learning, Communities of Practice and Social Networks
- Analytics and Deep Learning in Learning Systems, Educational Datamining, Educational Exploitation of Data Mining and Machine Learning Techniques
- Sentiment Analysis in Learning Environments
- Data Visualization in Learning Environments
- Privacy, Security, and Ethics in Learning Environments
- Gamification, Educational Games, Simulation-based Learning and Serious Games
- Brain-computer Interface Applications in Intelligent Tutoring Systems
- Dialogue and Discourse During Learning Interactions
- Ubiquitous, Mobile, and Cloud Learning Environments
- Virtual Pedagogical Agents and Learning Companions
- Multi-agent and Service-oriented Architectures for Learning and Tutoring Environments
- Single and Groupwise Action Modeling in Learning Environments
- Ontological Modeling, Semantic Web Technologies, and Standards for Learning

- Empirical Studies of Learning with Technologies
- Instructional Design Principles or Design Patterns for Educational Environments
- Authoring Tools and Development Methodologies for Advanced Learning Technologies
- Domain-specific Learning Technologies, e.g. Language, Mathematics, Reading, Science, Medicine, Military, and Industry
- Non-conventional Interactions Between Artificial Intelligence and Human Learning
- Personalized and Adaptive Learning Environments
- Adaptive Support for Learning, Models of Learners, Diagnosis and Feedback
- Recommender Systems for Learning
- Causal Modeling and Constraints-based Modeling in Intelligent Tutoring

The call for papers sought papers that presented significant new research findings in the use of advanced computing technology and interdisciplinary research to allow, promote, and enhance human learning. Full papers allowed for discussion of more mature and finalized research results, while short papers allowed discussions around brief novel findings. There was also a Poster Track, which included an excellent network for researchers to discuss research prototypes and work in progress with conference attendees.

The international Program Committee consisted of 65 leading members of the intelligent tutoring systems community (16 senior and 49 regular).

Scientific papers were reviewed by three to four reviewers through a double-blind process. Only 28% of submitted papers were published as full papers, 26% were published as short papers, and 16% were published as posters.

The full papers outlined important new developments and theory, the short papers explored new ideas and advances, and the posters discussed research in progress, all based on the ITS philosophy.

The main topics under which the accepted papers fall, on which basis we also structured this book, are as follows:

- Tools and methods for learning sciences and practices
- Algorithms for prediction, recommendation, and classification in learning systems
- Tutoring and learning systems: new approaches, frameworks, and theories

The quality of a conference is reflected by the work of its participants as well as their ability to push the boundaries, and the rigor with which they encourage the rest of the research field to move forward. The papers of ITS 2022 stretched the limits of intelligent tutoring, much as they had over the previous years. Virtual reality, reverse image searches, sequence models, cognitive maps, recommendation systems, and natural language processing were among the fields where authors had documented remarkable work. The ITS 2022 program was also reinforced by the successful organization of Intelligent Tutor Demonstrations by Mihai Dascalu and Philippe Dessus.

The successful preparation and implementation of the ITS 2022 conference was secured by the original work of all the authors, the devoted contribution of the various conference chairs, the members of the Program Committee, the Steering Committee Chair, Claude Frasson, and in particular the General Conference Chair,

Stefan Trausan-Matu. The organization, coordination, and online operation of the conference was achieved by the organizers, the Local Organization Chair, Mihai Dascalu, and the Organization Committee Chair, Kitty Panourgia. We would like to acknowledge the Politehnica University of Bucharest, where the conference was held. Last but not least, we would like to acknowledge the Institute of Intelligent Systems (IIS) for helping organize the conference.

Like previous conferences, the emphasis of ITS 2022 was to introduce new and established scholars to one another, continue to develop and innovate ideas, develop theoretical and business interests, and broaden areas and subgenres related to intelligent tutoring systems. We hope you enjoy reading the papers, building on the research reported, and continuing to develop theories and applications in intelligent tutoring systems.

June 2022

Scott Crossley
Elvira Popescu

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