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Lucio Tommaso De Paolis · Pasquale Arpaia ·
Marco Sacco (Eds.)

Extended Reality

First International Conference, XR Salento 2022
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Proceedings, Part II

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Editors
Lucio Tommaso De Paolis
University of Salento
Lecce, Italy

Pasquale Arpaia
Università di Napoli Federico II
Naples, Italy

Marco Sacco
CNR-STIIMA
Lecco, Italy

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Preface

In recent years, there has been a huge research interest in virtual reality (VR), augmented reality (AR), and mixed reality (MR) technologies that now play a very important role in various fields of application such as medicine, industry, cultural heritage, and education. The boundary between the virtual and real worlds continues to blur, and the constant and rapid spread of applications of these technologies makes it possible to create shortcuts that facilitate the interaction between humans and their environment and to encourage and facilitate the process of recognition and learning.

Virtual reality technology enables the creation of realistic looking worlds and enables users to completely isolate themselves from the reality around them, entering a new digitally created world. User inputs are used to modify the digital environment in real time and this interactivity contributes to the feeling of being part of the virtual world.

Augmented reality and mixed reality technologies, on the other hand, allow the real-time fusion of digital content into the real world to enhance perception by visualizing information that users cannot directly detect with their senses. AR and MR complement reality rather than replacing it completely and the user has the impression that virtual and real objects coexist in the same space.

Extended reality (XR) is an umbrella term encapsulating virtual reality, augmented reality, and mixed reality technologies.

Thanks to the increase in features that allow us to extend our real world and combine it with virtual elements, extended reality is progressively expanding the boundaries of how we live, work, and relate.

The potential of XR technology is amazing and can transform consumers' everyday experiences and generate benefits in many market sectors, from industrial manufacturing to healthcare, education, and retail.

This book contains the contributions to the 1st International Conference on eXtended Reality (XR SALENTO 2022) held during July 6–8, 2022, in Lecce (Italy) and organized by the Augmented and Virtual Reality Laboratory (AVR Lab) at the University of Salento (Italy). To accommodate many situations, XR SALENTO 2022 was scheduled as a hybrid conference, giving participants the opportunity to attend in person or remotely.

The goal of XR SALENTO 2022 was to create a friendly environment leading to the creation or strengthening of scientific collaborations and exchanges between participants and, therefore, to solicit the submission of high-quality original research papers on any aspect and application of virtual reality, augmented reality, or mixed reality.

We received 84 submissions, out of which 58 papers were accepted for publication, 16 of which are short papers. Each submission was reviewed by at least two reviewers. We used the OCS-Unisalento Conferences system for managing the submission and review process. The Scientific Program Committee, with the help of external reviewers, carefully evaluated the contributions considering originality, significance, technical soundness, and clarity of exposition.

We are very grateful to the members of the Scientific Program Committee for their support and time spent in reviewing and discussing the submitted papers and doing so in a timely and professional manner.

We would like to sincerely thank the keynote speakers who gladly accepted our invitation and shared their expertise through enlightening speeches, helping us to fully meet the conference objectives. We were honored to have the following invited speakers:

- Vincenzo Ferrari – University of di Pisa, Italy
- Nicola Masini – CNR, Institute of Cultural Heritage Sciences, Italy
- Christian Sandor – Paris-Saclay University, France

We cordially invite you to visit the XR SALENTO 2022 website (www.xrsalento.it) where you can find all relevant information about this event.

We hope the readers will find in these pages interesting material and fruitful ideas for their future work.

July 2022

Lucio Tommaso De Paolis
Pasquale Arpaia
Marco Sacco

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Keynote Abstracts

Extend Human Performances with Augmented Reality

Vincenzo Ferrari

Università di Pisa, Italy

AR allows the integration of spatial relation between visible and invisible information under a natural naked eye view. Furthermore, the augmented information could guide the user's hand during precision tasks improving human efficiency and accuracy. This improvement could bring human performance closer to that of the robot with a higher level of flexibility and humanization of the task. For tasks unfeasible with the sole hands, AR becomes particularly useful in robotics applications where the humans are engaged for remote controlling or cooperative working. In current AR displays, the augmentation lacks geometrical coherence along the three dimensions between real and virtual information that determine perceptual issues as wrong spatial, focus, and depth cues for both eyes. These issues will be detailed during the talk and possible solutions will be explained.

Past and Coming 20 Years with Augmented Reality

Christian Sandor

Paris-Saclay University, France

Augmented Reality embeds spatially-registered computer graphics into a user's view of the real world. During the last 20 years, AR has progressed enormously from a niche technology to a widely investigated one. This keynote consists of two parts. First, I speak about how major challenges for AR have been solved over the last 20 years. Second, I speculate about what the next 20 years are going to bring. The goal is to present a Birdseye view of the AR domain, including the balance of power between the major AR forces US and China. In my view, Europe has a very big, possibly almost impossible, challenge ahead to catch up. I hope that my talk will contribute to laying the seeds of a major European AR initiative.

Remote and Close Range Sensing, Imaging and eXtended Reality for the Interpretation and Conservation of Cultural Heritage

Nicola Masini

CNR, Institute of Cultural Heritage Sciences, Italy

Cultural heritage is not only the legacy of tangible and intangible heritage assets of a community inherited from past generations, to be maintained and transmitted to future generations, but it is also a domain of study and research where multidisciplinary skills compare, combine and contaminate each other, stimulating the development of new technologies and methods of analysis and study that can be re-applied in other domains. The reason is due to the heterogeneity of data to be analysed (from historical sources to imaging), phenomena to be observed (from chemical degradation to structural risks), objectives (from safeguarding to conservation). Effective tools to enrich knowledge of Cultural properties are remote and close range sensing, for diagnostic purposes, which provide a number of data on biophysical parameters without any contact with the object/artefact/site to be investigated. However, the heterogeneity of the data and the difficulty of transforming them into useful information for knowledge and conservation of CH, makes it necessary to use tools aimed at facilitating their interpretation. To this end, a useful tool for this purpose is the creation of combined real and virtual environments, i.e. extended reality capable to cover the entire spectrum from "completely real" to "completely virtual" in the concept of reality-virtuality continuum. This approach allows to interrelate data and results of the different diagnostic imaging techniques (from thermal infrared to high frequency georadar) with the spatial and architectural contexts of reference, in its constructive components and materials, facilitating their interpretation to improve the knowledge and to support decisions for restoration.

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