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Lucio Tommaso De Paolis · Patrick Bourdot
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Augmented Reality, Virtual Reality, and Computer Graphics

4th International Conference, AVR 2017
Ugento, Italy, June 12–15, 2017
Proceedings, Part II

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Preface

Virtual Reality (VR) is a simulation in which computer graphics is used to create a realistic-looking where the feeling of immersion and realistic presence is very high.

Augmented Reality (AR) technology allows for the real-time fusion of computer-generated digital contents with the real world with the aim of enhancing the users' perception and improve their interaction or assist them during the execution of specific tasks.

Human–Computer Interaction technology (HCI) is a research area concerned with the design, implementation, and evaluation of interactive systems that make more simple and intuitive the interaction between user and computer.

This book contains the contributions to the 4th International Conference on Augmented Reality, Virtual Reality and Computer Graphics (SALENTO AVR 2017) that has held in Ugento (Italy) during June 12–15, 2017. We cordially invite you to visit the SALENTO AVR website (<http://www.salentoavr.it>) where you can find all relevant information about this event.

SALENTO AVR 2017 intended to bring together researchers, scientists, and practitioners to discuss key issues, approaches, ideas, open problems, innovative applications, and trends on virtual and augmented reality, 3D visualization, and computer graphics in the areas of medicine, cultural heritage, arts, education, entertainment as well as industrial and military sectors.

We are very grateful to the Program Committee and local Organizing Committee members for their support and for the time spent to review and discuss the submitted papers and doing so in a timely and professional manner. We would like to sincerely thank the keynote and tutorial speakers who willingly accepted our invitation and shared their expertise through illuminating talks, helping us to fully meet the conference objectives.

In this edition of SALENTO AVR, we were honored to have the following keynote speakers:

- Mariano Alcañiz, Universitat Politècnica de València, Spain
- Vincenzo Ferrari, Università di Pisa, Italy
- Fabrizio Lamberti, Politecnico di Torino, Italy
- Roberto Scopigno, ISTI-CNR, Pisa, Italy
- Fabrizio Nunnari, German Research Center for Artificial Intelligence (DFKI), Germany

We extend our thanks to the University of Salento for the enthusiastic acceptance to sponsor the conference and to provide support in the organization of the event.

We would also like to thank the EuroVR Association, which has supported the conference since its first edition, by contributing each year to the design of the international Program Committee, proposing the invited keynote speakers, and spreading internationally the announcements of the event.

SALENTO AVR attracted high-quality paper submissions from many countries. We would like to thank the authors of all accepted papers for submitting and presenting their works at the conference and all the conference attendees for making SALENTO AVR an excellent forum on virtual and augmented reality, facilitating the exchange of ideas, fostering new collaborations, and shaping the future of this exciting research field.

For greater readability of the two volumes, the papers are classified into five main parts that include contributions on:

- Virtual Reality
- Augmented and Mixed Reality
- Computer Graphics
- Human–Computer Interaction
- Applications of VR/AR in Medicine
- Applications of VR/AR in Cultural Heritage

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

June 2017

Lucio Tommaso De Paolis
Patrick Bourdot
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An Introduction to Unity3D, a Game Engine with AR and VR Capabilities (Tutorial)

Paolo Sernani

Università Politecnica delle Marche, Ancona, Italy

Games, Augmented Reality, and Virtual Reality are capturing the attention of the research community as well as the industry in many application domains with purposes such as education, training, rehabilitation, awareness, visualization, and pure entertainment.

From a technical perspective, scientists, researchers, and practitioners need tools and integrated frameworks that allow them running a fast prototyping as well as an accurate development and production of applications and gaming experiences.

The tutorial presents the Unity3D game engine, describing its main features (cross-platforms applications, cloud build, the asset store, and the wide community of users). Moreover, the tutorial introduces the integration of Unity3D with AR and VR tools.

Keynote Abstracts

The Future Fabrics of Reality: Socio-psychological Aspects of Human Interaction in Advanced Mixed Reality Environments

Mariano Alcañiz

Universitat Politècnica de València, Valencia, Spain

In the last two years, technological tools known as Mixed Reality Interfaces (MRIs) have appeared on the market, which not only allow user interaction with a virtual environment, but also allow the physical objects of the user's immediate real environment to serve as elements of interaction with the virtual environment. That is, MRIs are perfect tools to introduce into our reality new virtual elements (objects and virtual humans) that will generate a new reality in our brain. Today, MRIs are the most technologically advanced tools that human beings have used to date to improve their reality and generate artificial realities that improve the reality they live. In the last year, there is an unusual interest in MRI in the ICT industry. That means that MRI will be a revolution in human communication mediated by new technologies, as in the moment was the irruption of the mobile phone. Therefore, the central question that motivates the present talk is: what capacity will MRIs have to alter the reality that we are going to live in a few years and hence alter the social communication between humans? To date, only a very basic aspect of MRIs is being investigated, its ability to simulate our current reality. However, the above question calls for a paradigm shift in current MRI research. It is necessary to advance towards this new paradigm by proposing a basic research scheme that will allow to analyse the influence of individual personnel variables and MRI interaction aspects will have on basic aspects of human behaviour, like decision making. In this talk, we present several examples of how MRI can be used for human behaviour tracking and modification, we describe different research projects results and we conclude with a discussion of potential future implications.

Potentialities of AR in Medicine and Surgery

Vincenzo Ferrari

Università di Pisa, Pisa, Italy

Patient safety and the surgical accuracy can be nowadays significantly improved thanks to the availability of patient specific information contained in particular in medical images. AR is considered an ergonomic way to show the patient related information during the procedure, as demonstrated by the hundreds of works published in the last years. To develop useful AR systems for surgery there are many aspects to take into account from a technical, clinical and perceptual point of view. During the talk particular attention will be posed to the using of HMD for surgical navigation describing also current doubts related to the using of this kind of technologies to perform manual tasks under direct view.

AR offers also the possibility to improve surgical training outside the surgical room. Surgical simulation based on AR, mixing the benefits of physical and virtual simulation, represents a step forward in surgical training. In this talk the last advancements in visual and tactile AR for surgical simulation will be showed.

Phygital Play: Where Gaming Intersects Mixed Reality, Robotics and Human-Machine Interaction

Fabrizio Lamberti

Politecnico di Torino, Turin, Italy

Developments in Virtual Reality (VR) and Augmented Reality (AR) technologies are dramatically changing the way we perform many of our everyday activities. One of the fields that is expected to be more profoundly influenced by this technological revolution is entertainment and, especially, gaming. With VR and AR, players will be able to fully immerse in computer-generated environments and become part of them, while gaming elements will be allowed to enter the real world and interact with it in a playful way. The physicality ensured by the possibility to move in open spaces as well as to touch, move and, in a word, feel both real and virtual objects will make gaming more engaging, as it will bring players' experience to a more primordial level. The "physicalization" of gaming is a process that will encompass a number of other fields. For instance, ways to make players interaction with computers and computer-generated contents ever more concrete, e.g., by exploiting haptic, tangible or hand and body tracking-based interfaces will have to be experimented. Similarly, the contribution of non-technical research fields will have to be taken into account. As a matter of example, according to behavioural studies, robotic elements could be introduced in the playing area, e.g., as players' avatars, artificial companions, etc. to strengthen the relation between the digital and physical worlds. By leveraging the above considerations, the aim of this talk is to present the activities that are being carried out to create a cloud-based platform supporting a systematic use of VR/AR technologies, robotic components and human-machine interaction paradigms with the aim to further push the transformation of real-world settings in ever more amazing gaming environments.

VR/AR: Success Stories and Opportunities in Cultural Heritage and Digital Humanities

Roberto Scopigno

ISTI-CNR, Pisa, Italy

Virtual and Augmented Reality have already a quite long story and a consolidated status. There are a number of projects and installations specifically developed for presenting or navigating Cultural Heritage (CH) data. But CH or, more broadly, Digital Humanities are domains with specific needs and constraints. Previous projects have selected these domains either to assess new technologies or to provide new tools and navigation experiences. The users in this domain belong to two well differentiated classes: ordinary public (museum visitors, web surfers) or experts (scholars, archaeologists, restorers). The talk will present in a comparative manner some selected previous experiences, aiming at deriving a critical assessment and suggest issues and open questions.

Populating Virtual Worlds: Practical Solutions for the Generation of Interactive Virtual Characters

Fabrizio Nunnari

German Research Center for Artificial Intelligence (DFKI),
Saarbrücken, Germany

Creating a state-of-the-art virtual character is a job which requires the employment of many professionals—dedicated artists do modeling, texturing, and rigging. However, since few years it is possible to find some software tools allowing nonskilled users to generate fully functional virtual characters quickly. The characters, which feature a compromise between quality and creation speed, are ready to be employed for either movie production or in real-time applications. In this tutorial, I will give an overview of some modern virtual character generators, and I will show how to use them to populate with characters real-time interactive applications.

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