GLOBAL HEALTH 2013, The Second International Conference on Global Health Challenges

November 17 - 22, 2013 - Lisbon, Portugal

Tutorial Proposal:

New Trends in Virtual and Augmented Reality Applications

Lucio Tommaso De Paolis
Department of Engineering for Innovation, University of Salento, Italy

Our definition of reality depends largely on our senses and how we perceive things around us. Virtual Reality (VR) aims at stimulating the senses to create a virtual world that is indistinguishable from the "real" world. We can then go one step further and provide a greater ranges of the various senses than what humans usually have.
The synthetic world is not static, but responds to the user inputs and it can be modified in real time. Interactivity and captivating power contribute to the feeling of immersion in the virtual world, of being part of the action that the user experiences. It is not only possible to see and manipulate the virtual objects, but also to feel and touch them using specific haptic devices.
The last few years have witnessed scientific advances in Virtual Reality, allowing virtual training environments to get closer and closer to reality. Interesting learning situations can emerge with free interaction in these simulated realities.
In addition, the integration of pedagogical functions and motivational aspects as in serious gaming and interactive storytelling, offers new possibilities for training and allows the creation of relevant situations on the learning level.

Mixed Reality (MR) and Augmented Reality (AR) technologies permit the real-time fusion of computer-generated digital content with the real world and allow the creation of fascinating new types of user interfaces. Augmented Reality enhances the users' perception and improves their interaction in the real environment. The virtual objects, displaying information that they cannot directly detect with their own senses, help them to perform real-world tasks better.
Unlike the Virtual Reality technology that completely immerses users inside a synthetic environment where they cannot see the real world around them, Augmented Reality technology allows to see 3-dimensional virtual objects superimposed upon the real environment. Therefore, AR supplements reality rather than completely replacing it; the user is under the impression that the virtual and real objects coexist in the same space.

VR/AR concepts are applicable to a wide range of applications (medical, entertainment, military, design, manufacture, maintenance, arts and cultural heritage) moving from pure academic research into industrial and potential consumer areas.
In particular, these technological innovations have provided medicine and surgery with new tools for diagnosis and therapy definition and allow surgeons to practice and rehearse the surgical procedures on virtual patients, who are realistic replicas of living patients. A new form of medical education has then become possible by translating the information contained in medical images into a set of 3D models in order to obtain a kind of digital clone of the real patient and to experiment various scenarios without risks for the patients. In addition, advances in Augmented Reality technology are making it possible to develop systems that can help surgeons to perform their tasks in ways that are both faster and safer. This technology in surgery has the potential to bring the advantages of open-surgery visualization also in minimally invasive surgery.

Recently, new concepts such as Natural User Interfaces and Mobile Immersion have emerged and permit to combine AR/MR technologies with new mobile human machine interfaces. Consequently, mobile immersion will allow users to move away from purely physical communication mode to a mixed/augmented reality communication, interaction and collaboration mode. Interactions will be natural and augmentations will become ubiquitous.

This tutorial is intended to bring together researchers from academia and industry in computer science, electrical engineering, physics, and clinical and to share points of views and emerging impressions on the future of Virtual Reality and Augmented Reality technologies and on the developing of advanced human-computer interfaces.

Tutorial Topics:

Virtual and Augmented Reality Technologies

- Introduction to Virtual Reality and Augmented Reality technologies
- Visualization devices (HMD, cave and 3D display)
- Building of the virtual environments
- Interactions in the virtual environments
- Physical modelling
- Force feedback and haptic interfaces
- New AR/MR devices
- Building an Augmented Reality application
- New trends in Virtual and Augmented Reality

Virtual and Augmented Reality in Medicine and Surgery

- Introduction to Virtual and Augmented Reality in medicine and surgery
- Medical imaging and image processing in medicine and surgery
- Applications of Virtual Reality in pre-operative surgical planning
- Applications of Virtual Reality in surgical training
- Image-guided surgery
- Augmented Reality in medicine and surgery
- Serious games in medicine

Virtual and Augmented Reality in Cultural Heritage

- Introduction to Virtual Reality and Augmented Reality in Cultural Heritage
- Edutainment in Cultural Heritage
- Augmented Reality on mobile
- New challenges in augmented visualization on mobile

Virtual and Augmented Reality in Education

- Virtual environment for learning
- Augmented Reality in education
- Interactive storytelling
- Collaborative learning environments

Human-Computer Interaction

- Human-Computer Interaction technology
- Gestural-based interaction
- Touchless interaction with patient's data and medical images
- Use of Nintendo Wii for the interaction with virtual objects
- Use of Kinect for the interaction with data and objects
- Interaction techniques for AR/MR

Lucio Tommaso De Paolis

Assistant Professor in Information Processing Systems
Director of Augmented and Virtual Reality Laboratory (AVR Lab)
Department of Engineering for Innovation - University of Salento, Italy

phone: +39 0832 297284
fax: +39 0832 297284
e-mail: lucio.depaolis@unisalento.it
web: www.avr.unisalento.it

Lucio Tommaso De Paolis is an Assistant Professor of Information Processing Systems at the Department of Engineering for Innovation of the University of Salento, Italy.
De Paolis is the Director of the Augmented and Virtual Reality Laboratory (AVR Lab) at the Department of Engineering for Innovation of the University of Salento and the responsible of the Research Division "Advanced Techniques of Virtual Reality for Medicine" of the D.R.e.A.M (Laboratory of Interdisciplinary Research Applied to Medicine) at the Lecce Hospital, Italy.

He received the Master Degree in Electronic Engineering from the University of Pisa (Italy) in 1994 and after, first at the Scuola Superiore S.Anna of Pisa and then at the University of Salento, his research interest has concerned the study of the interactions in the virtual environments and the development of human-computer interfaces. This study has been focused on the building of realistic simulators for surgical training and on the developing of applications in medicine and surgery and in cultural heritage using the Virtual Reality and Augmented Reality technologies.

De Paolis has been in 2012 visiting professor at the Vytautas Magnus University of Kaunas (Lithuania), in 2011 visiting professor at the University of Tallinn (Estonia), in 2007 and 2010 visiting researcher at the Centro de Ciencias Aplicadas y Desarrollo Tecnológico (CCADET) – Universidad Nacional Autónoma de México (UNAM) – Mexico City (Messico), and in 2007 and 2009 visiting researcher at Computer Graphics Laboratory, Sabanci University of Istanbul (Turkey).

De Paolis is the organizer of the Italian Conference "Medicine Meets Virtual Reality: Applications in Italy of Virtual Reality in Medicine and Surgery" that this year arrived to the 5th edition.
De Paolis has been member of programme committee and chair, tutorial speaker, invited speaker and organizer of special sessions in international conferences focused on Virtual Reality applications.

Tutorial speaker at international conferences:

Eighth International Conference on Innovations in Information Technology (Innovations'12)
Al-Ain, Abu-Dhabi, United Arab Emirates - March 18–20, 2012
http://www.it-innovations.ae/iit2012/index.html
Title of tutorial: *Virtual and Augmented Reality Applications*

EURO-MEDITERRANEAN MEDICAL INFORMATICS and TELEMEDICINE (EMMIT 2010)
Split, Croatia - September 26–28, 2010
Title of tutorial: *Virtual Reality in Medicine and Surgery*

Organiser of special sessions at international conferences:

The 2013 International Conference on Computational Science and its Applications (ICCSA 2013)
Ho Chi Minh City, Vietnam.- June 24-27, 2013
Special Session: **Virtual Reality in Medicine and Surgery**
http://www.iccsa.org/sessions

The 2011 International Conference on Computational Science and its Applications (ICCSA 2011)
Santander, Spain - June 20-23, 2011
Special Session: **Virtual Reality in Medicine and Surgery**
http://www.avr.unisalento.it/wp-content/ICCSA_2011/spec_vers_ICSSA_2011/ICCSA_2011.html

The 10th IEEE Intern. Conference on Information Technology and Applications in Biomedicine (ITAB 2010)
Corfu, Greece - November 2-5, 2010
Special session: **Virtual Reality in Medicine and Surgery**
http://medlab.cs.uoi.gr/itab2010/index.php?option=com_content&view=article&id=220&Itemid=405

Keynote speaker at international conferences:

The Eighth International Conference on Systems (ICONS 2013)
January 27 - February 1, 2013 - Seville, Spain
Title: *Virtual and Augmented Reality Applications*

2011 IEEE International Conference on Information and Education Technology (ICIET 2011)
Guiyang, China - January 26–28, 2011
Title: *Virtual Reality in Medicine and Surgery*

Member of Programme Committee of international conferences:

The Fourth International Conference on Advances in Computer-Human Interactions (ACHI 2013)
Nice, France February 24 - March 1, 2013
http://www.iaria.org/conferences2013/ACHI13.html

MIMOS – II Decennale
Roma, Italy - October 9-11, 2012
http://lnx.mimos.it/mimos_decennale/index.php?option=com_content&view=article&id=39&Itemid=153

5th International Workshop on Intelligent Interfaces for Human-Computer Interaction (IIHCI 2012)
Palermo, Italy – July 4-6, 2012
http://www.ihealthlab.icar.cnr.it/iihci2012/

The Fourth International Conference on Advances in Computer-Human Interactions (ACHI 2012)
Valencia, Spain - January 30 - February 4, 2012
http://www.iaria.org/conferences2013/ACHI13.html

La Medicina Incontra la Realtà Virtuale: Applicazioni in Italia della Realtà Virtuale in Medicina e Chirurgia
Bologna, Italy - November 3, 2011
http://www.mimos.it/chirurgiavirtuale11

10th International Workshop on Biomedical Engineering
Kos Island, Greece - October 5-7, 2011
http://medlab.cc.uoi.gr/10thbioeng/

The Fourth International Conference on Advances in Computer-Human Interactions (ACHI 2011)
Gosier, Guadeloupe, France - February 23-28, 2011
http://www.iaria.org/conferences2011/ACHI11.html

The 10th IEEE Intern. Conference on Information Technology and Applications in Biomedicine (ITAB 2010)
Corfu, Greece - November 2-5, 2010
http://medlab.cs.uoi.gr/itab2010/

La Medicina Incontra la Realtà Virtuale: Applicazioni in Italia della Realtà Virtuale in Medicina e Chirurgia
Pisa, Italy - December 14, 2010
http://www.mimos.it/chirurgiavirtuale10

The Third International Conference on Advances in Computer-Human Interactions (ACHI 2010)
St. Maarten, Netherlands Antilles - February 10-16, 2010
http://www.iaria.org/conferences2010/ACHI10.html

La Medicina Incontra la Realtà Virtuale: Applicazioni in Italia della Realtà Virtuale in Medicina e Chirurgia
Lecce, Italy - October 5, 2009
www.mimos.it/chirurgiavirtuale09

2009 World Congress on Computer Science and Information Engineering (CSIE 2009)
Los Angeles/Anaheim, USA - March 31 - April 2, 2009
http://world-research-institutes.org/conferences/CSIE/2009/index.html

The Second International Conferences on Advances in Computer-Human Interactions (ACHI 2009)
Cancun, Mexico - February 1-6, 2009
http://www.iaria.org/conferences2009/ACHI09.html

Intern. Workshop on High Performance and Grid Computing in Medicine and Bioinformatics (HiPGCoMB)
Sydney, Australia - December 10-12, 2008
http://www.cs.usyd.edu.au/~ispa2008/

The 6th WSEAS International Conference on ARTIFICIAL INTELLIGENCE, KNOWLEDGE ENGINEERING and DATA BASES (AIKED '07)
Corfu Island, Greece - February 16-19, 2007
http://www.wseas.us/e-library/conferences/2007corfu/aiked/committee.htm

The 5th WSEAS International Conference on COMPUTATIONAL INTELLIGENCE, MAN-MACHINE SYSTEMS and CYBERNETICS (CIMMACS '06)
Venice, Italy - November 20-22, 2006
http://www.worldses.org/conferences/2006/venice/cimmacs/

The 7th WSEAS International Conference on AUTOMATION & INFORMATION (ICAI'06)
Cavtat, Croatia - June 13-15, 2006
http://www.worldses.org/conferences/2006/croatia/icai/index.html

LATEST PUBLICATIONS

Journal

- De Paolis L.T., Aloisio G., "Walking in a Virtual Town Using Nintendo Wiimote and Balance Board", SCIentific RESearch and Information Technology (SCIRES-IT), Vol. 1, Issue 2 (2011), pp. 21-32, CASPUR-CIBER Publishing, e-ISSN 2239-4303;
- De Paolis L.T., Aloisio G., " An Augmented Reality Platform for the Enhancement of Surgical Decisions in Pediatric Laparoscopy ", International Journal On Advances in Software, Vol. 4, No. 3&4, 2011, ISSN: 1942-2628;
- De Paolis L.T., Celentano M.G., Vecchio P., Oliva L., Aloisio G., "A Virtual Navigation in a Reconstruction of the Town of Otranto in the Middle Ages for Playing and Education", International Journal on Advances in Intelligent Systems, Vol. 4, No. 3&4, 2011, ISSN: 1942-2679;
- De Paolis L.T., Celentano M.G., Oliva L., Vecchio P., Aloisio G., "Otranto in the Middle Ages: a Serious Game for the Edutainment", International Journal of Information and Education Technology, Vol. 1, No. 1, pp. 47-57, 2011, ISSN: 2010-3689
- De Paolis L.T., Pulimeno M., Aloisio G., "Advanced Visualization and Interaction Systems for Surgical Pre-Operative Planning", Journal of Computing and Information Technology - CIT, Vol. 18, No. 4, pp. 385–392, 2010, ISSN 1330-1136;
- De Paolis L.T., Celentano M.G., Vecchio P., Oliva L., Aloisio G., "A Game-Based 3D Simulation of Life in the Middle Ages for the Edutainment in Cultural Heritage", International Journal on Advances in Intelligent Systems, Vol. 3, No. 3 & 4, pp. 162-173, 2010, ISSN: 1942-2679;
-

Chapter Book

- Tinelli A., Malvasi A., Gustapane S., De Nunzio G., Bochicchio M., De Paolis L., Aloisio G., "Robotic Assisted Surgery in Endoscopy: The Problem of Learning Curve", In: Laparoscopy: New Developments, Procedures and Risks, Chapter 2, Editor: Hana Terzic, Nova Science Publishers, 2011, ISBN 978-1-61470-747-9;
- Tinelli A., Malvasi A., Gustapane S., De Nunzio G., Bochicchio M., De Paolis L., Aloisio G., Tsin D.A. "The Utilization of Novel Technology in Risk Reducing Laparoscopic Gynecological Complications", In: Laparoscopy: New Developments, Procedures and Risks, Chapter 3, Editor: Hana Terzic, Nova Science Publishers, 2011, ISBN 978-1-61470-747-9;
- Tinelli A., De Paolis L., Aloisio G., De Nunzio G., Bochicchio M., Malvasi A. "Laparoscopic Trainers and Surgical Virtual Simulators in Laparoscopic Learning Curve", In: Laparoscopy: New Developments, Procedures and Risks, Chapter 6, Editor: Hana Terzic, Nova Science Publishers, 2011, ISBN 978-1-61470-747-9;
- De Paolis L.T., Aloisio G., "Augmented Reality in Minimally Invasive Surgery", Advances in Biomedical Sensing, Measurements, Instrumentation and Systems, Lecture Notes in Electrical Engineering, Vol. 55, Mukhopadhyay S.C. & Lay-Ekuakille A. (Eds.), Springer Publisher, December 2010, ISBN 978-3-642-05166-1.

Conference Proceedings

- De Mauro A., Mazars J., Manco L., Mataj T., Hernández A., Andrés Cortés C., De Paolis L. T., "Intraoperative Navigation System for Image Guided Surgery", The Sixth Intern. Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2012), July 4-6, 2012, Palermo, Italy, pp.486-490;
- De Paolis L.T., "Serious Game for Laparoscopic Suturing Training", The Sixth International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2012), July 4-6, 2012, Palermo, Italy;
- De Mauro A., Mazars J., Manco L., Mataj T., Hernández A., De Paolis L. T., "Intraoperative Navigation System for Spine Surgery", International Journal of Computer Assisted Radiology and Surgery – CARS 2012, Pisa, Italy, 2012;
- De Paolis L.T., Aloisio G., "Augmented Reality in Minimally Invasive Surgery", the 5th International Conference on Advances in Computer-Human Interactions (ACHI 2012), January 30 - February 4, 2012, Valencia, Spain;
- De Paolis L.T., Ricciardi F., Aloisio G., "Image-Guided Platform for the Radiofrequency Ablation of the Hepatic Tumours" 14th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2011), September 18-22, 2011 Toronto, Canada;
- De Paolis L.T., Aloisio G., "Advanced Interface for the Pre-Operative Planning in Pediatric Laparoscopy", The 33rd Intern. Conference on Information Technology Interfaces (ITI 2011), June 27-30, 2011, Cavtat, Dubrovnik, Croatia;
- De Paolis L.T., Ricciardi F., Dragoni A., Aloisio G., "An Augmented Reality Application for the Radio Frequency Ablation of the Liver Tumors", Computational Science and Its Applications - ICCSA 2011, Lecture Notes in Computer Science, vol. 6785, Springer-Verlag, 2011, pp. 572-581, ISBN 978-3-642-21897-2;
- De Paolis L.T., Aloisio G., "Advanced Interface for the Pre-Operative Planning and the Simulation of the Abdominal Access in Pediatric Laparoscopy", Computational Science and Its Applications - ICCSA 2011, Lecture Notes in Computer Science, vol. 6785, Springer-Verlag, 2011, pp. 562-571, ISBN 978-3-642-21897-2;
- De Paolis L.T., Celentano M.G., Vecchio P., Oliva L., Aloisio G., "A Simulation of Life in a Medieval Town for Edutainment and Touristic Promotion", 7th International Conference on Innovations in Information Technology (Innovations '11), April 25-28, 2011 – Abu Dhabi, UAE;
- De Paolis L.T., Pulimeno M., Aloisio G., "An Augmented Reality Application for the Enhancement of Surgical

Decisions", The 4th International Conference on Advances in Computer-Human Interactions (ACHI 2011), February 23-28, 2011, Gosier, Guadeloupe, France;

- De Paolis L.T., Manco M., Aloisio G., "Navigation and Interaction in the Virtual Reconstruction of the Town of Otranto in the Middle Ages", The 4th International Conference on Advances in Computer-Human Interactions (ACHI 2011), February 23-28, 2011, Gosier, Guadeloupe, France;
- De Paolis L.T., Celentano M.G., Vecchio P., Oliva L., Aloisio G., "Experiencing a Town of the Middle Ages: an Application for the Edutainment in Cultural Heritage", The 2011 IEEE International Conference on Information and Education Technology (ICIET 2011), January 26-28, 2011, Guiyang, China;
- De Paolis L.T., Pulimeno M., Aloisio G., "Augmented Reality Application for the Trocars Insertion in Pediatric Laparoscopy", The 18th Medicine Meets Virtual Reality Conference, (MMVR 18), February 8-12, 2011, Newport Beach, Los Angeles, CA, USA;
- De Paolis L.T., Pulimeno M., Aloisio G., "Advanced Platform for Visualization and Interaction with the 3D Patient Model in Pediatric Laparoscopy", 10th IEEE International Conference on Information Technology and Applications in Biomedicine (ITAB 2010), November 3-5, 2010, Corfu, Greece;