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UNIVERSITY OF SURREY

CVSSP Newsletter

Centre for Vision, Speech and Signal Processing

Welcome to our 10th Edition

Prof. Adrian Hilton
Head of CVSSP

CVSSP had a busy 2014 starting the year with a major EPSRC Programme Grant Award of £5.4M for research in spatial audio. The Centre was also highly successful in securing over £2M of additional funding by winning three Innovate UK projects for collaboration with the UK creative industries building on our well established track-record in this area, as well as two major projects in the area of 3D content & multimedia funded by the EU FP7, Action TV (User Interaction Aware Content Generation for Social TV) and BRIDGET (Bridging the Gap for Enhanced Broadcast).

In January PhD student Nadejda Roubtsova and her supervisor Dr Jean-Yves Guillemaut received the Best Paper Award at the Computer Vision Conference VISIGRAPP held in Lisbon. In June CVSSP academic Dr Krystian Mikolajczyk received the prestigious Longuet-Higgins Prize for 'Fundamental Contributions to Computer Vision'. The PRAvDA project, led by Prof. Phil Evans, received an IET Innovation Award in 'Model-based Engineering' for pioneering research in proton therapy for cancer treatment.

In the past year, CVSSP hosted various events such as the 52nd AES International Conference on Sound Field Control. CVSSP was home to a one week test film production as part of the EU SCENE project. This event brought together professional cinematographers using the SCENE camera and production technologies for Digital Cinema and Virtual Studio effects. The SCENE short-film and technologies were showcased at several industry events including CINEC (Munich) and CVMP (London) receiving considerable interest.

The Centre also successfully completed three major EU FP7 funded projects (ROMEO, SCENE and RE@CT) in the Autumn achieving 'excellent' ratings for the research and impact. At the close of the year as part of the Department of Electronic Engineering, CVSSP received the long awaited Research Excellence Framework (REF) results achieving 93% of research rated as 'world-leading' or 'internationally excellent'.

We continued to strengthen and nurture our research by supporting PhD students across all the different areas. During the past year 17 PhD students successfully defended their theses and 8 new students have joined us since October. In January 2015 Prof. Mark Plumbley joined CVSSP as Professor of Signal Processing to strengthen our activities in Machine Listening. I look forward to 2015 being another productive year of outstanding research, innovation and technology transfer with our industry partners.

PRaVDA Project Wins IET Award for Model Based Engineering

Prof. Phil Evans, Dr Gavin Poludniowski and Ms Michela Esposito of CVSSP are part of the PRaVDA research collaboration that recently won the IET Innovation Award for Model Based Engineering for Proton CT: 'Seeing Cancer During Proton Therapy'. The annual IET awards span 15 categories including electronics, healthcare and sustainability, and are judged by a panel of over 80 esteemed industry and academic experts.

The team is developing a method of using proton beams with image radiotherapy which will have the potential to reduce damage to healthy tissue.

Over half of all cancer patients receive radiotherapy as part of their cancer treatment and most radiotherapy is delivered using high-energy external beams of x-rays. However in addition to killing cancer cells, these beams can cause damage to the healthy tissue surrounding tumours. By using a high-energy beam of protons and using imaging to determine where it deposits its dose in the patient, less damage should be caused to healthy tissue near the tumour.

Prof. Evans commented "We are very excited about the success of PRaVDA and are delighted to have won high profile recognition with the IET Award. We believe that this research will be especially beneficial for childhood cancers and hope that it will revolutionise the way radiotherapy is delivered, greatly reducing side-effects."

The PRaVDA research team at the IET Awards (Prof. Phil Evans is third from left and Dr Gavin Poludniowski is fourth from the right)

Research Focus

SCENE: Novel Scene Representations for Richer Networked Media

SCENE was a 36 month project funded by the European Commission under the Seventh Framework Programme FP7 running from 1st November 2011 to 31st October 2014. The aim of the project was to develop novel representations for digital media to create and deliver richer media experiences by bridging the gap between sample based representations (video), which are photorealistic but difficult to manipulate and model-based representations (graphics), which are fully manipulatable but often lack realism. The SCENE representation and its associated tools make it possible to capture 3D video, combine seamlessly with computer graphics, manipulate and deliver it to either 2D or 3D platforms in either linear of interactive form.

The consortium, led by Prof. Adrian Hilton, who was the Scientific and Technical Coordinator, consisted of nine partners: the University of Surrey (UK), Barcelona Media (Spain), ARRI (Germany), Brainstorm (Spain), Technicolor (Germany), 3DLized (France), HHI (Germany), iMinds (Belgium) and Intel Visual Computing Institute (Germany).

The research team in CVSSP was responsible for the development of novel algorithms for temporally consistent surface reconstruction and space-time shape editing, two tasks which proved essential in order to enable conversion of raw video+depth input data into a structured spatio-temporally coherent representation and enable interactive editing of the content with minimal user interaction.

The project resulted in the following major technological achievements:
• The development of a motion SCENE camera prototype which enables synchronous capture of RGB and depth data through the same optics and at production frame-rate.
• The introduction of the Scene Representation Architecture (SRA) allowing a unified representation of both computer generated and captured video data to facilitate post production.
• A toolkit of algorithms for converting the input video+depth data into spatio-temporally coherent representations and manipulation of the content.

The project focused on two user cases to demonstrate the potential of the technology. The virtual studio user case demonstrated the application of RGBZ capture and rendering for real-time production. The digital cinema user case demonstrated the application to generation of complex visual effects such as scene relighting, refocusing or retargeting. Both cases were demonstrated during production trials held in CVSSP's studio in June 2014.
More details on the project can be found on the project website http://3d-scene.eu

Examples of visual effects produced in the Digital Cinema user case: scene refocusing (left), spatio-temporally coherent overlay of CG elements onto dynamic video input (centre), scene relighting (right)

Newly Named IEEE Fellow Joins CVSSP

The IEEE (Institute of Electrical and Electronics Engineers) has named Prof. Mark Plumbley as a 2015 Fellow in recognition of his contributions to latent variable analysis – the analysis and separation of mixtures of signals to find their hidden (latent) variables – placing him in an elite group of engineers whose work has created real impact in their field. The world's leading professional association for advancing technology for humanity, with 400,000 members in 160 countries, the IEEE bestows the honour of Fellow on less than 0.1 per cent of its members annually. Prof. Plumbley's research focuses on the analysis and processing of audio and music using a wide range of signal processing techniques, including independent component analysis (ICA) and sparse representation.

He has led numerous high profile research projects including a £1.4 million EPSRC (Engineering and Physical Sciences Research Council) Leadership Fellowship and two £1 million EPSRC Platform Grants. He has also been instrumental in building sustainable software for audio and music research through the EPSRC-funded SoundSoftware project, which included 'bootcamps' to train researchers in the principles of reproducible research. Prof. Plumbley's expertise in machine listening – technology that makes sense of sounds – will further strengthen CVSSP's knowledge in this field. He aims to broaden the areas where the technology is used, exploring new directions such as security, assisted living and environmental monitoring. Among the projects he will be leading at Surrey are a new EPSRC project on 'Musical Audio Repurposing using Source Separation', and two EU Marie Curie Training Networks.

Research Focus

RE@CT: Immersive Production and Delivery of Interactive 3D Content

RE@CT was a three year EU FP7 project developing new technologies for interactive 3D content production and video-realistic character animation. The project was led by BBC R&D (UK) with partners Surrey, Vicon (UK), INRIA and Artifacto (France), and Fraunhoffer HHI (Germany).

Character animation forms an integral part of many broadcast and film productions and is an essential component of computer games. Motion capture (MoCap) is frequently used to animate characters, offering excellent control and realism at relatively low cost. However, current full-body MoCap is restricted to tracking the skeleton (limbs) of a person only.

Over the past decade, researchers in CVSSP's Visual Media Research Group (VMRG) have pioneered the next generation of markerless Motion Capture MoCap technology. The technology builds a full 3D representation of a performer, capturing not only limb positions but also surface dynamics such as flowing hair and clothing. The new technology has been named "4D Video", because it captures a sequence of 3D character models over time. Unlike classic MoCap, 4D Video requires no visible markers to be worn during capture. This means that the technology could eventually be used side-by-side with existing production: a shoot for a science-fiction TV drama could simultaneously yield a video-realistic animated character for visual effects in post-production or for use in an accompanying computer game. Such a co-production of visual assets could yield significant future cost savings for the creative industries.

RE@CT has already delivered a prototype animation engine that delivers video-realistic animated characters from 4D video. The technology works by seamlessly stitching together and blending small fragments of 4D MoCap. For example, a few seconds of an actor walking, running and turning can be used to synthesise arbitrarily long sequences of that character walking along any path. Uniquely, these characters can be controlled interactively, in real-time, for example to produce a character the user may control unpredictably within a computer game. A proof of concept game has already been developed using Augmented Reality: a technology that overlays computer graphics on real-world scenes. The game and related technologies were showcased at the International Broadcasting Convention in Amsterdam and has been used to create an interactive dance educational tool for the BBC iWonder website.

Video-realistic animated characters seamlessly composited into real world video

For further information, visit the project website at http://react-project.eu/. Members of CVSSP involved in the project include Prof. Adrian Hilton (PI), Dr John Collomosse (CI), Dr Peng Huang (interactive animation), Dr Dan Casas-Guix (interactive animation), Mr Marco Volino (4D video representation), Miss Maria Barot (facial alignment).

This research direction will be continued with a focus on real-time animation for film production in the recently awarded InnovateUK REFRAME project.

CVSSP Academic Awarded 2014 Longuet-Higgins Prize

Dr Krystian Mikolajczyk has been awarded the 2014 Longuet-Higgins Prize for his 2003 CVPR paper 'A Performance Evaluation of Local Descriptors' with Cordelia Schmid. The Longuet-Higgins Prize is an award given annually by the Technical Committee on Pattern Analysis and Machine Intelligence of the IEEE Computer Society at the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), for 'Fundamental contributions in Computer Vision'. The award recognizes CVPR papers from ten years ago that have made a significant impact on computer vision research. The award is named after theoretical chemist and cognitive scientist H. Christopher Longuet-Higgins.

This is a highly prestigious award recognising Krystian's seminal contribution to the development of the field. The original conference paper together with the subsequent PAMI journal version has received over 5000 citations.

In Other News....

CVSSP Professor Delivers Talks Across the Globe

Prof. Josef Kittler delivered speeches in November at two prestigious events. Speaking at the '*Distinguished Speaker Seminar Series*' on Vision, Graphics and Speech at the Faculty of Information Technology (*Brno University of Technology Czech Republic*) on the 4th November, he gave an address about ' *3D Assisted 2D Face Recognition*'.

Later that month Prof. Kittler was a keynote speaker on the topic of '*Development and Applications of 3D Morphable Face Model*' at *DICTA 2014* (Digital Image Computing: Techniques and Applications Conference) *in Wollongong, Australia* (25-27 November 2014).

Future of Coding

PhD Student William Scott-Jackson working with Outreach and the Widing Partipation group has launched a coding club for local schools in Guildford. The aim of the club is to supplement the school curriculum and help teach the next generation these vital skills for our modern times.

The project has already seen success and is helping to encourage more people to explore and learn about coding and electronic engineering.

Congratulations to....

Well done to the research students who were awarded PhDs in 2014:

Dan Casas

'Interactive Video-Realistic Character Animation from 4D Performance Capture'

Saeed Kiani

'Blind Source Separation in Dynamic Contrast Enhanced Magnetic Resonance Imaging Renography

Philip Coleman

'Loudspeaker Array Processing for Personal Sound Zone Reproduction'

Chamitha de Alwis

'Optimizing Network Coding Algorithms for Multicast Applications'

Syed Zubair

'Dictionary Learning for Signal Classification'

Cemre Zor

'Analysis and Pruning of Ensemles Utilizing Bias and Variance Theory'

Alaleh Rashidnahab

'Simulation of Breast Lesions in X-ray Mammography Screening'

Violet Snell

' Shape and Texture Recognition for Automated Analysis of Pathology Images'

Elizabeth Chatziliari

' Social Media based Scalable Concept Detection'

Brian Holt

' Implicit Models for Automatic Pose Estimation in Static Images'

Konstantinos Avgerinakis

'Video Processing and Background Subtraction for Change Detection and Activity Recognition'

Paul Koppen

'Learning 3D Face Shape Features from Local Coherence'

Marek Olik

'Personal Sound Zone Reproduction with Room Reflections'

Aarushi Gaur

'Ranking Images Based on Aesthetic Qualities'

Lukasz Litwic

'Separation of Sound Sources: Machine Audition Perspective'

Congratulations also to the following students who passed their first year PhD confirmation in October 2014:

Junaid Mir (Dr A Fernando)

Michaela Spiteri (Dr E Lewis)

Oscar Mendez Maldonado (Dr N Pugeault)

Ryan Perera (Dr M Imran)

Thanuja Mallikarachchi (Dr A Fernando)

William Scott-Jackson (Dr E Lewis)

Finally, well done to those who were recently awarded the Graduate Certificate of Learning and Teaching:
Dr Chi-Ho Chan
Dr Andrew Gilbert
Dr Jean-Yves Guillemaut
Dr Eng-Jon Ong
Dr Nico Pugeault
Dr David Winridge
Dr Fei Yan

2014 Director's Award for Outstanding PhD Performance

Congratulations to *Michaela Spiteri and Thanuja Mallikarachchi who won the coveted Director's* Award for Outstanding First Year PhD Performance.
The winners were presented with their awards by Prof. Adrian Hilton and received a prize of £150.

Michaela Spiteri receiving her award from Prof. Hilton

Valued Member Wins VC'S Award

Lil Bahadur Gurung, our very own cleaner, has won the Vice Chancellor's Customer Service Award following a nomination by CVSSP.

This reflects both the dedication and cheerful attitude to the service he provides us with and his selfless contribution to the wider community through his charitable work.

We hope you enjoy this issue. If you have any queries about this newletter please email CVSSPAdmin@surrey.ac.uk.

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