IMI Annual Activity Report
Core Research Group and BeingThere Centre
1st January 2014 to 31st December 2014
The Institute for Media Innovation (IMI) at Nanyang Technological University (NTU), Singapore is a world-class research institute in Interactive New Media launched in April 2008 by Professor Bertil Andersson. It is directed by Professor Nadia Thalmann, a world renowned authority on virtual reality research. IMI positions itself as an incubator of cutting-edge and interdisciplinary new media-related research. The institute provides opportunities for researchers and experts to come together and collaborate on a wide array of multidisciplinary research projects. IMI contributes to the field of 3D Telepresence by leading the international research Centre, BeingThere Centre (BTC), funded by Media Development Authority (MDA). IMI collaborates with the Interdisciplinary Graduate School by selecting and co-supervising PhD students.

**IMI MISSIONS**

- To develop cutting-edge new media research in its core research group.
- To lead the research and the international collaboration of the BeingThere Centre in 3D Telepresence.
- To create synergy and interactions with NTU schools to empower New Media interdisciplinary research through integrated projects and joint PhD supervisions.
- To promote and develop industrial applications in Singapore and elsewhere in the world.
- To organize or participate to local and international events such as conference, workshops, seminars and lectures.
“...This research institute is dedicated to creating an environment where technology and creativity can coexist and develop.”

Prof Bertil ANDERSSON
NTU President and IMI Founding Chairman

“IMI strives to be an incubator of multidisciplinary cutting edge media related research ideas and establish Singapore as a key player at the forefront of the global interactive digital media innovation.”

Prof Nadia MAGNENAT THALMANN
Director, Institute for Media Innovation
1st row from the left: Xerxes Marlon Jr. N RIVERA, Dr Jun LEE, Rubha Shri NARAYANAN, Dr Zhijun ZHANG, Yiep Soon THAM, Dr Aryel BECK, Neetha DAS

2nd row from the left: Yaminn KHIN, Jianfeng REN, Li Jun TEH, Marilyn ZENG, Prof Daniel THALMANN, Jess LIM, Prof Nadia MAGNENAT THALMANN, Dr Zerrin YUMAK, Roman VLASOV, Juzheng ZHANG, Srikanth SRIDHAR, Hui LIANG
RESEARCH
The Institute for Media Innovation through its core research group has developed cutting-edge research in 3D Immersive situations, 3D interactive games, 3D fashion, 3D crowd simulation and 3D immersive medical applications in link with the LKC School of Medicine. IMI core group has created behavior for an innovative realistic female humanoid robot that is able to interact with people and recognize sound and gestures. Motion capture techniques have been also developed in order to analyze body motion. The core group in IMI has funded and facilitated collaborative multidisciplinary research projects in various fields of interactive digital media. 27 collaborative projects with the participation of NTU schools have been achieved. For example, we can cite the Virtual Pink Dolphin project, the faces segmentation and Expression for Autonomous Avatars, the Award winning film Unframed, and the interactive crowd.

**Humanoid Social Robots**

- Enabling realistic humanoid robot to interact with humans in a natural and believable way
- Developing new technologies for real time motion generation of social gestures (Gaze, Lip synchronization, etc)
- Social decision making to support human robot interaction including attention system and social reflexes
CORE RESEARCH AREAS

Multi-modal and Multi-party Interactions

- Modelling conversational engagement based on multi-modal sensory input
- Computational models of turn-taking and floor control decisions
- Speech, gaze and gestures for signalling turn-taking and engagement

Sound Based Awareness

- This research supports the humanoid robot or virtual humans to perceive the sound environment around it
- It adds a new dimension of awareness by which the robot or virtual human can understand where a sound is coming from (localization) and turn in that direction, and also recognize a variety of sounds (classification) and respond in a human-like manner
- Research topics include action recognition based on audio visual cues, analyzing the level of engagement of a user based on visual and para-verbal cues, etc
Personalized Emotional Interaction

- This research focuses on modelling personalized emotional interactions for virtual characters or social robots
- The virtual characters or social robots with optimistic or pessimistic personalities, interacts with users as a receptor to answer their questions and make affective response to their comments
- The personalities of the virtual characters or social robots are identifiable from their consistent behaviour patterns, which are controlled by the personality-characterized mood dynamics

Robust Real-time Face Recognition

- Real-time Face tracking and recognition using simple and robust features
- Improved robustness to image noise, pose, illumination and facial-expression variations
- Easily adaptable to a wide range of recognition applications
CORE RESEARCH AREAS

Human-Robot Interaction by Upper Body Gesture Understanding

- CyberGlove and the Kinect are integrated to capture human head, hand and arm posture simultaneously
- Novel human upper body gesture understanding and interaction system is developed
- An effective and real-time human upper body gesture recognition algorithm is developed

Real-time Fall Detection Approach for Elderly People

- Real-time robust skeleton extraction based on a single depth camera
- The novel detection algorithm is pose-invariable
- It is faster and higher accuracy than the state-of-the-art methods

Immersive Virtual Environments

- Developing technologies to increase the feeling of presence when users manipulate 3D object. This is especially relevant to medical simulations in which users learn to perform some operations
- Conducting research on direct hand manipulation methods that can be applied to Oculus Rift
- Finding what gives the highest degree of immersion and what device is the most cost effective for that
**INTERDISCIPLINARY RESEARCH PROJECTS**

**Integrating a User within a Group or a Crowd using Computer Vision and Synthetic Vision**  
*Period of Funding: 1 Dec 2012 - 30 Jun 2014*

**PI:** Asst Prof YUAN Junsong (EEE)  
**Co-PI:** Prof Daniel THALMANN (SCE)

The project consists in integrating smoothly a user (avatar) inside a moving Virtual Group in front of a large 3D screen (or if possible in the IMI Immersive room). The Virtual Group will be composed of autonomous Virtual Humans (agents). Gestures and actions of the user will be analysed using Computer Vision, e.g. regular and depth cameras. One original aspect of the project is to combine the classical Computer Vision with Synthetic Vision. Agents will be able to navigate and avoid collisions using the information coming from a camera (Computer Vision) and using a synthetic vision rendered from their point-of-view.

**3D Interactive Visualization of the Human Body in an Immersive Situation**  
*Period of Funding: 1 Mar 2013 - 28 Feb 2014*

**PI:** Assoc Prof CAI Yiyu (MAE)  
**Co-PI:** Prof Nadia MAGNENAT THALMANN (IMI)  
**Clinical Collaborator:** Dr TEO Yee Hong (TTSH)  
**International Collaborator:** Prof Franz-Erich WOLTER (Leibniz University Hannover, Germany)

This project aims to develop novel 3D interactive and immersive technique for medical education application. The project if developed will allow medical students in their early learning journey to access realistic information (anatomic and medical) in a manner of low cost, fidelity and easy to repeat. Based on this project, we will apply to various surgical simulations such as obstetric management and knee recovery after orthopaedic surgery. Students can have surgical training using virtual patients with different parameters to perform surgical operation using interactive devices (e.g., cybergloves) and predict optimal surgical outcome.
Nadine is one of the most realistic female humanoid robots around the world and is the first to be modelled after a western female, Prof Nadia Magnenat Thalmann. It has been constructed by Kokoro's Actroid technology. This robot has a realistic artificial skin and is able to display very realistic facial and body expressions. It also has a controllable upper-body capable of realistic human movements. Nadine has a total of 26 DoF for facial expressions and upper body movements. Nadine can speak, display emotions, understand some situations and express natural gestures. This makes it ideal for the study of Human-Robot Interaction.
The Immersive Room allows viewers to be fully immersed in the virtual world. It has a big 320 degrees field of view bowl shape curved screen with 5 projectors, which shoot a stereoscopic image on the screen. The projectors use active stereoscopic technology and work on 120 Hz (60 Hz per eye), together with wireless stereo shuttle glasses being synchronized with them. Further on, the projectors are connected to five high-end workstations, where interactive applications and simulations are being computed and rendered using software platforms, such as Unity 3D. The software platform synchronizes all projectors and workstations to render corresponding image for each eye at the right moment, as well as makes the resulting image continuous and seamless by applying special shaders to the part of image being rendered on each workstation. Further on, the Immersive Room has motion capture facilities, as well as other devices.
Using multiple optical cameras, this motion capture system provides a passive and real-time solution for full body optical marker tracking for studying of human movement and animation:

- Creating realistic 3D animated movements
- Human motion recognition, analysis and understanding
- Biomechanics, sports and gait studies
- Man-machine interactions
- Intelligent gaming
WEEKLY RESEARCH MEETING
More than 20 students coming from various schools are located at IMI. Playing a crucial part in ensuring the future of New Media in Singapore, IMI aims to educate the next generation of scientists and technologists and encourage them to share and benefit from their knowledge of engineering, art, design, business, educational and behavioral research.

"IMI offers doctoral students vibrant multidisciplinary research capabilities. In particular, they have an opportunity to work in the area of cutting-edge interactive 3D simulation with top equipment as the IMI Immersive Room and real-time motion capture in a multidisciplinary team. Through their personal work, seminars, courses, and interaction with research experts, PhD candidates are prepared for research positions in leading academic institutions as well as private and public organizations."

Prof Daniel THALMANN
PhD Coordinator of PhD students located at IMI
**Current PhD Projects**

**Real-Time Social Feedback System for Monitoring and Enhancing Multi-Party Discussions**

Student: Debsubhra CHAKRABORTY  
Supervisor: Asst Prof Justin DAUWELS (EEE)  
Co-supervisor: Prof Daniel THALMANN (IMI)  
Mentor: Prof Nadia MAGNENAT THALMANN (IMI)

This research focuses on developing a system to provide users with real-time feedback on their social behavior in meetings and group discussions where at least 3 people are present. The system will primarily use non-verbal audio and video signals such as voice pitch, posture etc. for analysis using machine learning algorithms. At a later stage, language and keywords processing can reinforce such learning to provide contextual feedback.

**Multimodal Interface with Augmented Reality for Industrial Applications**

Student: DINH Quang Huy  
Supervisor: Assoc Prof SEET Gim Lee, Gerald (MAE)  
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)  
Mentor: Assoc Prof LIN Weisi (SCE)

Despite technological advancement in improving the interface between humans and robots, designing a user-friendly and intuitive industrial interface remains one of the most technical challenging problems for researchers. The project will not only propose a novel device to interact with industrial robot which is capable of overcoming the limitations of the current interface but also identify a framework for Human-Robot interaction that recognizes the deficiencies of current systems.
Memetic Stigmergy: A Multi-method Approach in Studying Decentralized Loci across Social Networks

Student: ENG Weiwen Herbert
Supervisor: Assoc Prof Patrick WILLIAMS (HSS)
Co-supervisor: Asst Prof CHEW Lock Yue (SPMS)
Mentor: Asst Prof Kenneth FEINSTEIN (ADM)

The current study seeks to contribute to extant research concerning the effects of online discursive anonymity in the context of campus communities. Its central thesis is that contrasting conditions of discursive anonymity manifest according to a 2x2 full factorial framework (Identity Condition: anonymous vs. pseudonymous x Authentication: Present vs. Absent) would predict significant differences between the conditions in levels of the measures of social cohesion. A longitudinal field experiment will be conducted where the intervention employed will be the use of Fessup, an anonymous social network for community confessions. Fessup is a work-in-progress mobile application accessible via iOS and Android.

Simulation and Automatic Navigation of an Intravascular System

Student: CHEN Yong
Supervisor: Assoc Prof CAI Yiyu (MAE)
Co-supervisor: Prof Daniel THALMANN (SCE)

To make the vascular surgery easier and more efficient, the project aims to design an automatic navigation system for catheter manipulation. The system consists of catheter control, navigation and simulation. The coordinates of the catheter tip is obtained by an embedded sensor, and the whole system works in real time.
Developing a Testbed for Evaluating Trust and Reputation Systems in E-commerce Environment

Student: Athirai Aravazhi IRRISSAPPANE  
Supervisor: Asst Prof ZHANG Jie (SCE)  
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)

My research focus is to develop a comprehensive testbed to evaluate the robustness of the Trust and Reputation systems, so that it would be beneficial for the researchers in the field to analyse and compare their trust models with the purpose of improving their performance.

Monitoring of Group Discussions: a Socio-engineering Approach

Student: Yasir TAHIR  
Supervisor: Asst Prof Justin DAUWELS (EEE)  
Co-supervisor: Prof Daniel THALMANN (SCE)

The research is focused on developing a real time automated system that can monitor group discussion using audio and video signals, which can provide suggestion in real time to improve group interaction. The ultimate goal is to improve the current computer systems and social robots that suffer from a lack of social skills, we will explore the social signals and social behaviours, including social interactions, social attitude, and social relations/ roles to build more socially intelligent model for robots.
The Role of Embodiment and Presence on the Development of Leadership Capabilities in Massively Multiplayer Online Role-playing Games

Student: EE Changshun Andrew
Supervisor: Asst Prof JUNG Younbo (WKWSCI)
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)

Given the advent and prevalent use of virtual environments in New Media, such as in social media (e.g. Second Life), users – especially the young and adolescent – may acquire and master skills essential for proficient navigation of these environments. Specifically, I am interested in the role of virtual embodiment and presence on leadership development among users of these virtual environments.

Automated Thyroid Nodule Detection using 2D Ultrasound Images

Student: Subbarao Nikhil NARAYAN
Supervisor: Assoc Prof Pina MARZILIANO (EEE)
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)

The main aim of this project is to eliminate the subjectivity involved when measuring the volume of a thyroid gland/nodule and hence reduce the high inter-observer variation during identifying a thyroid nodule. The prognosis for thyroid carcinoma is based on the maximum dimension of the nodule under observation hence eliminating subjectivity will significantly improve the chances for accurate diagnosis.
Quality Assessment in Computer Graphics

Student: LI Qiaohong
Supervisor: Assoc Prof LIN Weisi (SCE)
Co-supervisor: Prof Daniel THALMANN (SCE)

The research aims to combine human vision system and 3D scene information into the objective quality assessment metrics enable automatic detection and elimination of rendered images of unacceptable quality.

Neuroimaging as a Surrogate Marker to Assess Cognitive Substrates in Cognitive Training Software

Student: TAN Jiat Chow
Supervisor: Assoc Prof THENG Yin Leng (WKWSCI)
Co-supervisor: Assoc Prof Annabel CHEN (HSS)

Brain training software has experienced rapid growth in recent years. These brain training software make claims of improving cognitive or brain functions and the goal of the proposed work is to evaluate these claims using neuroscience methods e.g. near infra-red optical imaging (NIRS), electroencephalography (EEG).
Vision Based Optimal Path Formation Control and Obstacle Avoidance for Multiple Mobile Robots

Student: Shakeel AHMAD
Supervisor: Asst Prof HU Guoqiang (EEE)
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)

The optimal path control and obstacle avoidance problem of vision-guided mobile robot with dynamical and sensing constraints will first be investigated.

Robotic Enhanced Tele-communication System

Student: LI Bingbing
Supervisor: Assoc Prof CHEN I-Ming (MAE)
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)

This project is aim at developing a robot system which enhance the current telecommunication system in terms of delivering non-verbal information such as body movement and emotional information.

Three Dimensional Content Processing and Delivery over Communication Network

Student: HOU Junhui
Supervisor: Assoc Prof CHAU Lap-Pui (EEE)
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)

This project aims to improve the quality and speed of real-time 3D processing and transmission. The results obtained from this project would be useful for areas requiring interactive 3D visual output, e.g. computer games, and virtual reality.
**Current PhD Projects**

**Study of Nonverbal Communication in Telepresence Robot**

Student: GU Yuanlong William  
Supervisor: Assoc Prof SEET Gim Lee, Gerald (MAE)  
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)

The research topic focuses on the use of nonverbal communication to improve the interactive experience in human-robot interaction (HRI). The objective is to improve the interpersonal relation between the system and interactant, by showing emotion, degree of involvement and etc, through the mode of nonverbal communication.

**Learning Based Scene Understanding**

Student: WANG Anran  
Supervisor: Assoc Prof CAI Jianfei (SCE)  
Co-supervisor: Asst Prof WU Jianxin (SCE)

The objective of this research is to investigate the existing interactive image segmentation algorithms and then design a better solution. We aim at designing and developing more intuitive and intelligent image segmentation algorithms using learning technology. We are particularly interested in how to combine the interactive image segmentation and learning technology to fast segment a large set of images.
Acoustic Source Localization in Room Environment

Student: WU Kai
Supervisor: Asst Prof Andy KHONG W. H. (EEE)

The knowledge of the acoustic source location is of much importance in several applications including hands-free communication systems, teleconferencing, automatic camera steering, etc. We are currently working on speech source localization in this reverberant and noisy environment.

Distributed and Constrained Conformal Mapping

Student: ZHANG Minqi
Supervisor: Assoc Prof HE Ying (SCE)

The research is focused on creating efficient conformal mapping algorithm by proposing a distributed and constrained conformal mapping. The distributed feature makes it favorable for the GPU and become very efficient.
CURRENT PhD PROJECTS

Markerless Motion Capture of Human Based on Monocular Camera

Student: BIAN Zhenpeng
Supervisor: Asst Prof CHAU Lap Pui (EEE)
Co-supervisor: Prof Daniel THALMANN (IMI)

Motion capture of human is a highly active research area due both to the number of potential applications and its inherent complexity. The research focuses on real-time markerless motion capture of human, especially based on monocular camera.

Resolving Data Sparsity and Cold Start in Recommender Systems

Student: GUO Guibing
Supervisor: Asst Prof ZHANG Jie (SCE)
Co-supervisor: Prof Daniel THALMANN (IMI)

The main research problems we desire to address are the two severe issues that original Collaborative filtering inherently suffers from: data sparsity and cold start. Data sparsity arises from the phenomenon that users in general rate only a limited number of items; Cold start refers to the difficulty in bootstrapping the Recommender systems for new users. We aims to solve these issues in both 2D and 3D environments.
**Group Structure and Social Behaviour Simulation Based on Implementation of Psychological Models of Emotionality and Motivation**

Student: Jaroslaw Slawomir KOCHANOWICZ  
Supervisor: Assoc Prof TAN Ah Hwee (SCE)  
Co-supervisor: Prof Daniel THALMANN (IMI)

This specific research aims to identify the certain significant concepts within psychology and sociology, to enable implementation of a generic model of autonomous agents with individualised needs, goals, expression styles, capabilities, group identities, culture, coping strategies, history, world model, private social map and other characteristics.

**Depth Camera Based Hand Gesture Recognition**

Student: LIAN Hui  
Supervisor: Asst Prof YUAN Junsong (EEE)  
Co-Supervisor: Prof Daniel THALMANN (IMI)

The goal of this research is to design and implement algorithms for the recognition of postures and gestures of a user immersed in a Virtual Environment with Virtual Humans. This research will develop novel real-time recognition methods with trade-off between accuracy and speed in order to solve the problem efficiently.
Modeling Virtual Human With Episodic Memory

Student: ZHANG Juzheng
Supervisor: Assoc Prof ZHENG Jianmin (SCE)
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)

The research goal of this project is to refine the existing methods; episode representation, indexing scheme, matching methods and storage policy, if any, or develop new ones to find a more effective way to encode, store and retrieve episodic memory.

On Developing High-quality Immersive Rendering for Real-time 3D Teleconference

Student: ZHAO Mengyao
Supervisor: Asst Prof FU Chi-Wing (SCE)
Co-supervisor: Assoc Prof CAI Jianfei (SCE)

This project aims to investigate time-critical methods to analyze and model the input image-based information on real-time 3D object reconstruction and rendering from real scenes.
Modeling and Animating 3D Chinese Water Color Paintings

Student: CHENG Peng
Supervisor: Asst Prof MIAO Chun Yan (SCE)
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)

The research is focused on simulating the behavior of Chinese ink and analysing various artistic effects of colour ink diffusion. The study also looks how a scheme presents can be simulated automatically for their computer generated simulation.

3D Simulation of Articulation in Physiological Human

Student: ZHANG Wenjing
Supervisor: Assoc Prof ZHENG Jianmin (SCE)
Co-supervisor: Prof Nadia MAGNENAT THALMANN (IMI)

The research is to model the articulation of human to help with the diagnosis and treatment of certain disease. The research is mainly divided into two parts to build an accurate geometry model of human articulation from MRI.
MONTHLY RESEARCH SEMINAR
INDUSTRIAL COLLABORATIONS
INDUSTRIAL COLLABORATIONS

Collaboration MOU between IMI and NVIDIA

Desirous of promoting and developing cooperation in the field of GPU technologies, the MOU aims to foster closer ties between the two parties and to promote cooperative activities including exchange of information, organization of joint workshops, seminars and conferences.

Collaboration between IMI and Lee Kong Chian School of Medicine

To explore the use of a highly immersive augmented reality environment (HIARE) to provide a technological frame-work for uniformity of Phase 3 medical student safe and controlled exposure to acute medical emergencies.

Virtual Pink Dolphin-assisted Therapy for Children with Autism Funding Supported by Temasek Trust-funded Singapore Millennium Foundation

Research on autism and development of therapy for autism are of worldwide interest today. Several studies show dolphin-assisted-therapy (DAT) has positive effect to children-with-autism in terms of anxiety/stress relief, communication/learning improvement, and cognitive-performance/self-confidence increase.

Collaboration between IMI and PEC Ltd

PEC Ltd is a specialist engineering group servicing the oil and gas, petrochemical, oil and chemical terminal, and pharmaceutical industries. Their two core business activities are project works and maintenance services in the region. IMI and PEC Ltd tied up to develop simulation technology for engineering applications.
VISITS TO IMI
In the year 2014, IMI accommodated around 34 visits (more than 200 visitors from 11 countries).

Mr Jean-Pierre Greff and delegates from Swissnex Singapore (10 December 2014)

Delegates from Utrecht University, the Netherlands (9 July 2014)

Prof. Dr. Christoph Hölscher and Dr. Victor R. Schinazi from ETH Zurich (4 June 2014)

Delegates from Higher Education Management Program Switzerland (9 October 2014)

Mr Patrick Pang, Director (Digital Economy), National Research Foundation, Singapore and delegates (15 April 2014)

Delegates from Technology and Planning Division of iDA (infocomm Development Authority) Singapore (10 April 2014)
Ms Cristina Russo, Director for International Cooperations of DG Research of the European Commission and delegates (23 January 2014)

Dr Fritz Schiesser, President of ETH Board, Switzerland (6 January 2014)

Prof. Dr. Lino Guzzella, Rector, ETH Zürich, Switzerland and delegates (24 February 2014)

Mr Walid Benzarti, Director of Research and Technology from Thales and Prof Daniel Racoceanu, University Pierre and Marie Curie, Sorbonne University, France (3 April 2014)

Gerald Desmeules, Music Professor, Institute Jaques Dalcroze and Patrick Janoud, Old age care center Director, Geneva (11 February 2014)

Students from Hong Kong Design Institute (14 March 2014)
Prof Franz-Erich WOLTER
Welfenlab
Leibniz University of Hanover
Germany

Prof Hector OROZCO
Autonomous University of Mexico State
Mexico

Assoc Prof Miriam REINER
Technion Touch Lab
Technion University
Israel

Assoc Prof ZHANG Hong
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Asst Prof Arjan EGGES
Utrecht University
The Netherlands

Dr Hon Fai CHO
MIRALab
University of Geneva
Switzerland

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MPI
Tuebingen
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Matthias BECKER
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Andra CHINCISAN
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BEING THERE CENTRE
BeingThere Centre is an International Research Centre for Telepresence and Telecollaboration mainly based at the Institute for Media Innovation (IMI) in Nanyang Technological University (NTU), Singapore.

It is funded by Media Development Authority of Singapore with joint effort from ETH Zurich (Switzerland), UNC Chapel Hill (USA) and NTU (Singapore). The objective of the BeingThere Centre is to make major technological and systems-level advances leading to a 3D credible experience of Telepresence in a fitted room using a mobile platform. The result will be a breakthrough in the quality of interpersonal communication at a distance allowing for eye contact and proper motion parallax among a group of users.
Prof Nadia MAGNENAT THALMANN  
Co-director  
NTU, Singapore

Prof Henry FUCHS  
Co-director  
UNC Chapel Hill, USA

Prof Markus GROSS  
Co-director  
ETH Zurich, Switzerland
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School of Computer Engineering

Assoc Prof CAI Jianfei
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DENG Teng
Research Fellow
NTU, Singapore

XU Di
Research Associate
NTU, Singapore
Novel Scene Acquisition and Display Technologies for a Next-generation Room-based Telepresence System

Principal Investigators:
Assoc Prof Tat Jen CHAM (NTU)
Prof Henry FUCHS (UNC)

Core Team Members:
Assoc Prof Jianfei CAI (NTU)
Dr Renjie CHEN (UNC)
Prof Jan-Michael FRAHM (UNC)
Assoc Prof Philip FU (NTU)
Andrei STATE (UNC)
Anran WANG (NTU)
Di XU (NTU)
Mingsong DOU (UNC)
Fuwen TAN (NTU)
Kurtis KELLER (UNC)
Jim MAHANEY (UNC)
Andrew MAIMONE (UNC)
Mengyao ZHAO (NTU)
Teng DENG (NTU)

Objectives:
Explore and develop technical and research methodologies for scene acquisition and display to enable the room-based Telepresence system
Simulate a highly realistic experience for users whereby distant remote rooms appear to be separated only by transparent glass walls

Mobile, Autostereoscopic 3D Display and Telepresence Platform

Principal Investigator:
Prof Markus GROSS (ETH)

Core Team Members:
Dr Pierre-Yves LAFFONT (ETH)
Dr Tobias MARTIN (ETH)
Claudia KUSTER (ETH)
Nicola RANIERI (ETH)

Objectives:
Design and build and entirely novel, mobile display platform enabling autostereoscopic display of collaborators at remote locations
A humanized, transparent OLED display combined with an LCD layer as an adaptive parallax barrier
A set of cameras and time-of-flight depth sensors will capture the three dimensional appearance, head position, and distance of the remote communication partner in real-time

BeingThere Centre Project 3

Animatronic Avatar: Development of a Robotic Avatar for Telepresence Interaction and Communication

Principal Investigators:
Assoc Prof Gerald SEET (NTU)
Prof I-Ming CHEN (NTU)
Research Prof Greg WELCH (UNC)
Prof Henry FUCHS (UNC)

Core Team Members:
Dr Choon Yue WONG (NTU)
Arjun NAGENDRAN (UCF)
Wee Ching PANG (NTU)
BURHAN (NTU)
Yu Bin ANG (NTU)
William GU (NTU)
Bingbing LI (NTU)
Quang Huy DINH (NTU)
Ryan SCHUBERT (UNC)

Objectives:
Develop a mobile Telepresence robot capable of navigating and gesturing autonomously or semi-autonomously in a typical office environment.
Address the need for Telepresence robot technology which provides rich interactivity without requiring the robot’s user to devote significant cognitive activity to the operation of the robot.

- L. L. Liu, B. B. Li, I. M. Chen, T. J. Goh and M. Sung, Interactive robots as social partner for communication care, IEEE International Conference on Robotics and Automation (ICRA 2014), Hong Kong, China, 31 May – June 7 2014
Autonomous Virtual Humans and Social Robots for Telepresence

Principal Investigators:

Prof Nadia MAGNENAT THALMANN (NTU)
Asst Prof Junsong YUAN (NTU)
Prof Daniel THALMANN (NTU)

Core Team Members:

Assoc Prof Ying HE (NTU)
Assoc Prof Lap-Pui CHAU (NTU)
Assoc Prof Jianmin ZHENG (NTU)
Assoc Prof Yiyu CAl (NTU)
Asst Prof Andy W.H. KHONG (NTU)
Dr Zerrin YUMAK (NTU)
Dr Zhijun ZHANG (NTU)
Dr Aryel BECK (NTU)
Junhui HOU (NTU)
Zhenpeng BIAN (NTU)
Hui LIANG (NTU)
Jianfeng REN (NTU)
Neetha DAS (NTU)

Objectives:

To replace a virtual participant by its virtual counterpart or create autonomous ones
Social Robot or Virtual Human should react according to the user’s input and current knowledge and awareness
To model the interactions between real and virtual humans and social robots
To create mixed activities

Novel Scene Acquisition and Display Technologies for a Next-Generation Room-based Telepresence System

Principal Investigators:

Assoc Prof CHAM Tat Jen (NTU)
Prof Henry FUCHS (UNC)
Prof Markus GROSS (ETH)

Core Team Members:

Dr. Pierre-Yves LAFFONT (ETH)
Dr. Tobias MARTIN (ETH)
Claudia KUSTER (ETH)
Nicola RANIERI (ETH)
Yu GUO (NTU)

Objectives:

Conduct broad experimental investigations into advanced hardware and software technologies to support future systems for immersive 3D Telepresence with multiple users per site, unburdened by any head gear, supporting full bidirectional eye contact
Investigate 3D capture/acquisition, 3D display, as well as the related domain of 3D data encoding and representation in the context of Telepresence

• J.C. Bazin, Y. Seo, R. Hartley, and M. Pollefeys, Globally Optimal Inlier Set Maximization with Unknown Rotation and Focal Length, European Conference on Computer Vision (ECCV 2014), Zurich, Switzerland, September 6-12, 2014

47
BEING THERE CENTRE STEERING COMMITTEE MEETINGS IN 2014

13 May 2014
ETH, Zurich

20 October 2014
NTU, Singapore
**BeingThere Centre Exhibition at SIGGRAPH ASIA 2014**

4-6 December 2014
Shenzhen, China
Vision and Objectives

Project 1: Room-based Telepresence

Project 2: Animatronics Avatar

Project 3: Advanced Technologies for 3D Capture, Communication, and Display

Project 4: Autonomous Virtual Human and Social Robot

SIGGRAPH Asia 2014 International Workshop on Autonomous Virtual Humans and Social Robot for Tele-presence
Shenzhen, China
3 December 2014
BEING THERE CENTRE EXHIBITION AT MEDIA EXPLOITS 2014

4 November 2014
Biopolis, Singapore
2014 BeingThere Centre Workshop

23-24 October 2014
Furama Riverfront Hotel, Singapore
Invited talk: New trends in 3D Telepresence: BeingThere through Social Robots and Virtual Humans

Prof Nadia Magnenat Thalmann gave the keynote speech at International Symposium on Human-centered Interaction for Coexistence, CHIC FORUM 2014, KIST, Korea on 16 May 2014.
HIGHLIGHTS OF BEING THERE CENTRE ACHIEVEMENTS IN 2014

- BTC project on the cover of MIT Press Journal “Presence”

BTC publications in MIT Press Journal “Presence”:

Human–Robot Interaction by Understanding Upper Body Gestures
Yang Xiao, Zhijun Zhang, Aryel Beck, Junsong Yuan, Daniel Thalmann

A Study on High-Level Autonomous Navigational Behaviors for Telepresence Applications
Wee Ching Pang, Gerald Seet, Xiling Yao

Modelling Multi-Party Interactions among Virtual Characters, Robots, and Humans
Zerrin Yumak, Jianfeng Ren, Nadia Magnenat Thalmann, Junsong Yuan

- The paper by Ms Wang Anran, PhD student from BTC (NTU), has been awarded the Top 10% Paper in IEEE International Workshop on Multimedia Signal Processing (MMSP’2014)

- Best Poster Award - Merit Award in NVidia Poster Contest, GPU Technology Conference South East Asia Workshop 2014, by Ms Zhao Mengyao, PhD student from BTC (NTU)
PUBLICATIONS & OUTREACH
IMI Core Research Group & BTC

D. Thalmann, *Crowd Simulation*, International Conference on Multidisciplinary Research & Practice (ICMRP-2014), Ahmedabad, India, November 30, 2014

N. Magnenat Thalmann, *Social Robots and Virtual Humans as Assistive Tools for Improving Our Quality of Life*, 5th International Conference on Digital Home (ICDH 2014), Guangzhou, China, November 28-30, 2014

D. Thalmann, *Problems and Challenges in Crowd Simulation*, International Conference on Contemporary Computing and Informatics (IC3I 2014), Mysore, India, November 27-29, 2014


H. Fuchs, *Prospects for Immersive Virtual Reality and Telepresence for Archaeology*, 5th International Conference on Remote Sensing in Archaeology, Durham, NC, USA, October 12, 2014


D. Thalmann, *Crowd Modelling and Simulation*, Universitas Ahmad Dahlan, Faculty of Industrial Technology, Yogyakarta, Indonesia, August 20, 2014


BOOKS & BOOK CHAPTERS

N. Magnenat Thalmann, O. Ratib, H.F. Choi (Eds.), 3D Multiscale Physiological Human, Springer, XII, 316 p. 110 illus., 2014


JOURNAL PAPERS


G. Guo, J. Zhang and N. Yorke-Smith, Leveraging Multiviews of Trust and Similarity to Enhance Clustering-Based Recommender Systems, Knowledge-Based Systems, November 2014


Z.P. Bian, J. Hou, L.P. Chau, and N. Magnenat Thalmann, Fall Detection Based on Body Part Tracking Using a Depth Camera, IEEE Journal of Biomedical and Health Informatics, April 2014

Y. Xiao, Z. Cao, J. Yuan, Entropic Image Thresholding based on GLGM Histogram, Pattern Recognition Letters, 40, 47-55, April 2014


G. Guo, J. Zhang, D. Thalmann, Merging Trust in Collaborative Filtering to Alleviate Data Sparsity and Cold Start, Knowledge-Based Systems, Volume 57, Pages 57–68, February 2014


Z. Yumak, J. Ren, N. Magnenat Thalmann, and J. Yuan, **Tracking and Fusion for Multiparty Interaction with a Virtual Character and a Social Robot**, SIGGRAPH Asia 2014 Autonomous Virtual Humans and Social Robot for Telepresence, Shenzhen, China, December 3, 2014


N. Magnenat Thalmann, Z. Zhang, **Social Robots and Virtual Humans as Assistive Tools for Improving Our Quality of Life**, 5th International Conference on Digital Home (ICDH 2014), Guangzhou, China, November 28-30, 2014

Q. Yuan, G. Cong, A. Sun, **Graph-Based Point-of-Interest Recommendation with Geographical and Temporal Influences**, 23rd ACM Conference on Information and Knowledge Management (CIKM 2014), Shanghai, China, November 3 - 7, 2014

J. Hou, L.P. Chau, Y. He and N. Magnenat Thalmann, **Low-Rank Based Compact Representation of Motion Capture Data**, IEEE International Conference on Image Processing (ICIP 2014), Paris, France, October 27-30, 2014


J.C. Bazin, Y. Seo, R. Hartley, and M. Pollefeys, **Globally Optimal Inlier Set Maximization with Unknown Rotation and Focal Length**, European Conference on Computer Vision (ECCV 2014), Zurich, Switzerland, September 6-12, 2014

A. Wang, J. Lu, G. Wang, J. Cai, and T.J. Cham, **Multi-Modal Unsupervised Feature Learning for RGB-D Scene Labeling**, European Conference on Computer Vision (ECCV 2014), Zurich, Switzerland, September 6-12, 2014
X. Yan, J. Yuan and H. Liang, *Efficient Online Spatio-Temporal Filtering for Video Event Detection*, European Conference on Computer Vision (ECCV 2014), Zurich, Switzerland, September 6-12, 2014


C. Fleury, T. Popa, T.J. Cham and H. Fuchs, *Merging Live and Pre-Captured Data to Support Full 3D Head Reconstruction for Telepresence*, 35th Annual Conference of The European Association for Computer Graphics (EUROGRAPHICS 2014), Strasbourg, France, April 7-11, 2014

M. Dou and H. Fuchs, *Temporally Enhanced 3D Capture of Room-Sized Dynamic Scenes with Commodity Depth Cameras*, IEEE Virtual Reality Conference, Minneapolis, Minnesota, USA, March 29 – April 2, 2014


N. Ranieri, M. Gross, *Vision Based Calibration of Parallax Barrier Displays*, Stereoscopic Display and Applications, California, USA, February 3-6, 2014


## CONTENTS

**Overview**
- About IMI .......................................................... 2
- IMI Missions ....................................................... 2
- Our Vision .............................................................. 3
- Our People ............................................................. 4

**Research**
- Core Research Areas ............................................. 6
- Interdisciplinary Research Projects .......................... 10
- Facilities .............................................................. 11
- PhD Students located at IMI .................................. 15
- Monthly Research Seminar ................................... 28

**Industrial Collaborations**
- Industrial Collaborations .................................. 30

**Visits to IMI**
- Visits to IMI ........................................................ 32
- Visiting Professors & Researchers ......................... 34

**BeingThere Centre**
- About BTC .......................................................... 36
- BTC Steering Committee ....................................... 37
- BTC International Advisory Board .......................... 37
- BTC Co-directors .................................................. 38
- BTC Team .............................................................. 39
- BTC Projects .......................................................... 43
- BTC SC Meetings in 2014 ....................................... 48
- BTC Events .............................................................. 49
- Highlights of BTC Achievements in 2014 ............... 54

**Publications & Outreach**
- Selected Keynotes & Invited Talks .......................... 56
- Selected IMI Publications ..................................... 57
- Media Coverage ...................................................... 62