Institute for Media Innovation (IMI) is a world-class research institute in Interactive New Media.

IMI positions itself as an incubator of cutting edge, 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 was launched in April 2008 in response to Singapore’s call to make the development of Interactive and Digital Media a National priority.
“...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
OUR MISSIONS & GOALS

1. To develop cutting-edge new media research within IMI.

2. To lead the international collaboration BeingThere Centre at NTU.

3. To create synergy and interactions with the schools to empower New Media interdisciplinary research through integrated projects and joint PhD supervisions.

4. To promote and disseminate New Media activities in Singapore and all over the world.
Chair of the Steering Committee
Prof Stephen Kevin SMITH, Vice President (Research), President’s Office

Members of the Steering Committee
1. Prof Peter Rainer PREISER, Associate Provost (Graduate Education), President’s Office
2. Prof KHOR Khiam Aik, Associate Provost (Research), President’s Office
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The heart of IMI core research is in Virtual Humans, a full domain of research that will last at least all the 21st century as it is to model real humans as they are and how they behave. Virtual Humans technology is a very INTERDISCIPLINARY field.

The ultimate goal of the Virtual Humans research is to communicate with them and do things together. Because of that, we need to model their knowledge, reasoning, memory, consciousness, emotions, various attitudes, etc. Virtual Humans are intelligent and autonomous.

Social Robots & Autonomous Virtual Humans
The general objective of IMI core research framework is to create true synergies between the real and the virtual worlds. This means the development of a true interaction between real people, virtual humans and robots in a way of creating a believable relationship.

Virtual Reality & 3D Telepresence
We mix real people with the virtual ones that communicate anywhere and anytime. They meet each other as 3D entities behaving and reacting in a very natural way.

Serious Game for Training
We develop educational games for learning and training purpose with the aid of virtual tutors or virtual trainers.
Research Areas

**Fashion & Cloth Simulation**
Using any photos or catalogues showing the garments, we can model the garment, animate it in 3D and fit it to any body size.

**Medical Simulation**
From patient specific MRI data, images are segmented automatically. Organs and tissues are reconstructed and visualized in 3D for simulation.

**Crowd Simulation**
In the scenario of natural disasters (tsunami, flood, or earthquake), real people can be immersed among a virtual crowd and be trained how to respond in such situations.
An Immersive Virtual Endomicroscopic Environment: Towards Innovation in Photodynamic Therapy for Mucosal Cancer

PI: Assoc Prof LIN Feng (SCE)
Co-PIs: Assoc Prof Valerie LIN Chunling (SBS)
Asst Prof Mark Joseph CHAVEZ (ADM)
Asst Prof QIAN Kemao (SCE)

This project is aimed at innovation in photodynamic therapy (PDT) for mucosal cancer via microstructure-level simulation of the complex therapeutic procedures. In a joint research project on *in vivo* cellular fluorescence imaging with National Cancer Centre Singapore, cancerous cells in superficial tissues of live animal models are detected with a confocal laser scanning fluorescence endomicroscope and a real-time computer visualization system. The study shows great potential of extending such a diagnostic system to a therapeutic tool. The key is for the radiochemists and endomicroscope based surgeons to well understand the fluorescence images and thus can assess the therapeutic margins online. An immersive environment which facilitates simulation based training is looked for.

Seeing, Hearing, Touching and Controlling Your Brain Waves

PI: Asst Prof Justin DAUWELS (EEE)
Co-PI: Asst Prof Martin CONSTABLE (ADM)

The human brain is arguably one of the most complex systems in the universe. Nowadays various technologies exist to record brain waves, e.g., electroencephalograms (EEG) and functional magnetic resonance imaging (fMRI). Those brain imaging tools allow researchers to gain understanding of the complex inner mechanisms of the brain. On the other hand, abnormal brain waves have shown to be associated with particular brain disorders (e.g., Alzheimer's disease and epilepsy). Therefore, the analysis of brain waves plays an important role in clinical diagnosis as well.


**Stereo Pictorial Space**

**PI:** Asst Prof Ina Conradi CHAVEZ (ADM)
**Co-PI:** Prof SUN Xiaowei (EEE)

The research delves into innovative applications of 3D Stereoscopy technologies and their evocative possibilities as an immersive art digital media. This project draws inspiration from the idea of pushing the limits of perceptibility, from the fascination of the surreal and abstract art, and from the aesthetics of high-definition, to explorations into inventive applications of 3D Stereoscopy as an art digital media expression. Formed as collaboration among faculty from the School of Art, Design and Media, and the School of Electrical and Electronic Engineering at NTU along with collaborators from local industry, new technology-based art media would to converge seemingly unrelated fields of art aesthetic and science. This would result in new ideas and initiatives in synthetic image technology innovations within academic research environment.

**The Archive of The Indigenous Languages and Cultures of South East Asia (AILCSEA)**

**PI:** Asst Prof Francesco CAVALLARO (HSS)
**Co-PIs:** Assoc Prof NG Bee Chin (HSS)
Asst Prof Alexander Robertson COUPE (HSS)
Asst Prof GOH Geok Yian (HSS)
Asst Prof Fabrizio GALLI (ADM)
Asst Prof Astrid Al MKHLAAFY (ADM)

Even according to the most optimistic views, we will see about 3000 languages disappear by the year 2100. It is imperative that steps are taken to preserve these endangered languages. The project involves setting up a safe long-term digital media repository at NTU that will serve as an archive for multimedia data pertaining to endangered languages and cultures. This will encourage co-operation amongst an international network of researchers to provide advice and collaboration, encourage endangered communities to safeguard their languages and cultural traditions, and allow researchers to access the documentation created for any language on the archive.
A Versatile Simulation-based Virtual Marionette Framework

PI: Prof SEAH Hock Soon (SCE)
Co-PIs: Prof Alfred BRUCKSTEIN (SPMS)
        Prof Martin REISER (ADM)
        Assoc Prof CHEN I-Ming (MAE)
        Asst Prof Peer Mohideen SATHIKH (ADM)

This project aims to build a versatile simulation-based virtual marionette framework that enables users to produce 3D animations by manipulating suitably designed objects connected to sensors, viewed by a camera, or haptic devices such as data-gloves. The system, a Virtual Marionette Theater, enables people to train and learn to manipulate virtual characters or objects, and thereby become skilled animators whose marionettes move realistically, and become actor/avatars in the virtual world. To achieve this, the framework is designed to be immersive, user-friendly, interactive, and intuitive. On the other hand, the motion of the puppet (the output by manipulations and control processes) should be versatile enough. The virtual marionette will also be working together with a robotic marionette system controlled by the same user interface for cross-platform study and performance benchmark.

Time Rojak

PI: Prof Issac V KERLOW (ADM)

"Time Rojak" is a prototype for an interactive movie/installation that presents dialogs between six Singaporean characters. The voices of these characters come together to tell a story of identity in past and present Singapore. The storyline and the tone of the exchanges between characters can be modified interactively by the viewer using the Rojak interface. Rojak is one of the national Singaporean foods, where the raw dish ingredients are festively mixed by those eating. The ingredients of Rojak are not eaten separately, and the dish comes together only after the ingredients have been interactively mixed. The main concept behind the Rojak interface is that it allows viewers to interactively mix in a festive way the timelines and the storylines of this project. "Time Rojak" can also be enjoyed as a linear story displayed on a single monitor.
Virtual Pink Dolphins

Pl: Assoc Prof CAI Yiyu (MAE)
Co-PIs: Asst Prof CHIA Kok Hwee (NIE)
Prof Daniel THALMANN (IMI)
Assoc Prof ZHENG Jianmin (SCE)
Prof Nadia MAGNENAT-THALMANN (IMI)
Mr Norman Kiak Nam KEE (NIE)
Asst Prof Kenneth FEINSTEIN (ADM)

This project is interested to investigate the modeling, simulation and visualization of virtual pink dolphins for the purpose to design serious games to replace the real ones for applications in special education, therapy, and entertainment. Virtual Reality technology will be studied aiming to equip the virtual pink dolphins with multi-sensorial functions (visual, audio, and tactile) for human-dolphin communication. Special efforts are being made to study the virtual pink dolphin assisted therapy (VPDAT) and human-mediated learning for Autism Spectrum Disorder (ASD) children.

EEG-based Immersion and 3D Interaction: E-Learning, Art and Medical Application

Pl: Asst Prof Olga SOURINA (EEE)
Co-PIs: Asst Prof Ina CONRADI (ADM)
Assoc Prof THENG Yin Leng (WKWSCI)

EEG-based immersion and 3D interaction is a new direction in R&D on human computer interfaces. It has attracted recently more attention from the research community and industry as wireless EEG reading devices became easily available on the market. EEG-based technology has been applied in anaesthesiology, psychology, etc. In this project, we propose R&D of novel tools of brain state quantification that could be integrated in IMI Immersive Room and used in e-learning, art and medical applications.
iCAVE: Intelligent Agent-augmented CAVE System

PI: Assoc Prof MIAO Chun Yan (SCE)
Co-PIs: Dr SHEN Zhiqi (EEE)
Dr KIM Beaumie (NIE)

The objective of our research project is to develop an intelligent agent-augmented CAVE system, namely iCAVE, which overlays a semantic agent layer on top of the current CAVE system to achieve high level semantic analysis and virtual world adaptation with intelligent agents. Moreover, a case study “walking with dinosaurs” will be implemented within iCAVE.

The Birds Singing Club

PI: Assoc Prof Louis-Philippe DEMERS (ADM)

The Canary Birds were still deployed up to the late 20th century as indicators to warn miners against dangerous gases, hearing their joyful songs as long as there was enough fresh air. Not the safety aspects but indeed their singing skills have lead to the domestication, breeding and distribution of oscine birds all over the world.

For this artistic participatory installation, the living birds are transformed into “Canary Devices” which are mobile audio devices. The “Canary Devices” are to create a social platform between the owners themselves and the listeners (audience) in a real public space: the “Birds Singing Club.”

The “Birds Singing Club” is (a analogy of) a common birds exhibition place, which can be found in backyard areas such as Ang Mo Kio in Singapore. Posts are deployed where the birdcages can be hoisted up high like flags. The owners are staying alongside the field listening and discussing the skills of their “fosterlings.” To the audience, the bird cages act as icons to listen.
Walking Bach Slowly

**PI:** Asst Prof PerMagnus LINDBORG (ADM)

PerMagnus Lindborg's IMI Art & Technology Grant 2010 involves the design and construction of a physical multimedia installation structure in the shape of a prism, to integrate video tracking, sound synthesis and 3-dimensional sound diffusion with hypersonic and regular loudspeakers. Various audiovisual content can potentially be created for, and experienced within the space. We have designed the installation with a particular creative artwork in mind, "Walking Bach Slowly". Here, visitor movements determine the way sounds are created and diffused, to emulate the way that Johann Sebastian Bach was thinking his musical compositions, while walking in the countryside. The work emphasizes auditive and kinetic aspects of multimodal experiences: listening and walking.

Beyond Typography – Interactive Environment with Radio-frequency Identification Integration

**PI:** Asst Prof Jesvin YEO Puay Hwa (ADM)

Exploring the interface of art and technology, the outcome of this research project, Just Type, is a multi-channel exhibition that makes use of radio frequency identification (RFID) technology to explore the world of inspirational and experimental typefaces. The twenty-six videos introduce visitors the histories and personalities of typefaces and pangram art according to the algorithm of the videos' RFID tags, thereby allowing a unique interactive experience.
The Immersive Room at IMI

The immersive room allows the viewers to be completely immersed in the virtual world. It makes use of latest hardware and software including infrared emitters, high end projectors, stereoscopic active lightweight glasses, position trackers, and graphics workstations linked together in a local area network. Electromagnetic 6DOF tracking is implemented to monitor the viewers’ position and orientation. The stereoscopic visualization is supported by an integrated audio sound system. Peripheral devices such as force feedback devices, and gesture gloves can also be integrated into the system.
The Motion Capture System

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
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 a joint effort between 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.

Comparing with existing video teleconferencing systems, BeingThere Centre aims to give the illusion that distant participants are all present next to each other in the same room. To achieve that, research will be done in 3D video technology and in 3D autostereoscopic display. As part of the research, an animatronic robot-avatar can be teleoperated by a participant from a distant place and navigate in hospital rooms or in laboratories. An autonomous Virtual Human (VH) or Social Robot will be used in case a real user cannot attend the meeting. This VH will have some capacities as recognizing other faces and users’ emotions, memorizing facts and retrieving them according to the dynamic context. Its appearance will be similar to the real user and it will speak, show some emotions and make appropriate gestures according to the situation.

This project is funded by the Media Development Authority (MDA) of Singapore with 10 million dollars over 4 years. Each participating university has to contribute 1 million per year. The total budget of BeingThere Centre is 22 million.
BETINGTHERE CENTRE STEERING COMMITTEE

Prof Freddy BOEY
Deputy President and Provost
NTU, Singapore

Prof Roland SIEGWART
Vice President, Research and Corporate Relations
ETH Zurich, Switzerland

Mr Michael YAP
Deputy Chief Executive Officer
Media Development Authority, Singapore

Prof Anselmo LASTRA
Chair, Department of Computer Science
UNC Chapel Hill, USA
BEING THERE CENTRE EXECUTIVE TEAM

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

Dr Frank Yunqing GUAN  
Assistant Director (Administration)  
NTU, Singapore
Prototype 1: Room-based Telepresence System

A fitted room with a table for the standard group meeting situation. With two people engaged in a conversation experience true eye-contact whereas other participants see them from the side with parallax as in a real meeting room.

Prototype 2: Mobile, Autostereoscopic 3D Display and Telepresence Platform

A roving display which brings a 3D representation of a single distant person to a place, controllable by both users. The display is semitransparent and will bring the illusion of the other person being present into a room or a laboratory.
Prototype 3: Mobile Animatronics Telepresence System

An animatronic robotic mannequin onto which a faithful representation of the remote user is projected. The robot is remote controlled by the remote user and can navigate laboratories or hospital rooms.

Prototype 4: Autonomous Virtual Avatars for Telepresence

An autonomous digital human or social robot will be used in case a real user cannot attend the meeting. This digital human will have capacities as recognizing other faces and users’ emotions, memorizing facts and retrieving them according to the dynamic context. Its appearance will be similar to the real user. It will speak, show some emotions, and make appropriate gestures according to the situation.
"Telepresence stands at the forefront of current telecommunications innovations. The pooling of highly talented expertise and resources will enable us to make greater and faster progress in the fields of telepresence and telecollaboration. This will lead to many positive outcomes, such as improved quality of communication, faster decision-making, reduced travel expenses and risks, reduced carbon footprints, as well as applications for healthcare and medical care. The launch of this research collaboration is also timely and in line with our efforts to establish New Media one of our peaks of excellence in research."

Prof Bertil ANDERSSON
President, NTU
January 26, 2011
Back (left to right): Assoc Prof CAI Yiyu, Assoc Prof Gerald SEET, Asst Prof Philip FU, Dr QUAH Chee Kwang, Assoc Prof CHAM Tat Jen, Research Prof Greg WELCH, Assoc Prof ZHENG Jianmin, Assoc Prof CAI Jianfei, Prof SUN Chengzheng

Front (left to right): Assoc Prof CHEN I-Ming, Prof Henry FUCHS, Prof Nadia MAGNENAT-THALMANN, Prof Markus GROSS, Prof Anselmo LASTRA
NTU Key Researchers

Prof Nadia MAGNENAT-THALMANN
Co-director of BeingThere Centre
Director, Institute for Media Innovation

Assoc Prof CAI Jianfei
School of Computer Engineering

Assoc Prof CAI Yiyu
Institute for Media Innovation/School of Mechanical & Aerospace Engineering

Assoc Prof CHAM Tat Jen
School of Computer Engineering

Assoc Prof CHAU Lap Pui
School of Electrical & Electronic Engineering

Assoc Prof CHEN I-Ming
School of Mechanical & Aerospace Engineering

Asst Prof CHNG Eng Siong
School of Computer Engineering
ETH AND UNC Key Researchers

Asst Prof Olga SORKINE
ETH Zurich, Switzerland

Prof Marc POLLEFEYS
ETH Zurich, Switzerland

Prof Henry FUCHS
Co-director of BeingThere Centre
UNC Chapel Hill, USA

Prof Anselmo LASTRA
UNC Chapel Hill, USA

Prof Markus GROSS
Co-director of BeingThere Centre
ETH Zurich, Switzerland

Research Prof Greg WELCH
UNC Chapel Hill, USA
The IMI PhD Program is at the core of IMI's effort to promote New Media. 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 will 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
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)

Emotionally influenced behaviour is a target of growing number of research from various angles in AI since at least 3 decades. 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. This generic, flexible, modular and highly reusable implementation of above model will then be embedded in various environments as a basis of simulation of a dynamic social structure of realistic agents tackling problems as an emergent group.

Modeling Virtual Human With Episodic Memory

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

Modeling virtual human with episodic memory is a multidiscipline research, combining knowledge and tools of Computer Graphics, Artificial Intelligence and Psychology. Although episodic memory is not a fresh idea in Psychology today, AI approaches that aim to integrate computational models of episodic memory into the virtual characters and social robots are explored not more than 5 years. Further researches on episode representation, indexing scheme, matching methods and storage policy remain to be done. The research goal of this project is to refine those existing methods, if any, or develop new ones to find a more effective way to encode, store and retrieve episodic memory.
CURRENT PHD PROJECTS

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)

For the past several years, real-time 3D object reconstruction and rendering from real scenes have become very hot research. Commercial applications attempted to stimulate the emergence of a number of real-time image-based modelling and rendering systems but their results are still unsatisfactory. The limiting factors most commonly associated with the current teleconferencing technology are the network bandwidth, as well as the image quality and 3D viewing capability and perception available on the receiver side. Such setting poses several technological challenges. This project aims to investigate time-critical methods to analyze and model the input image-based information.

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. It can be used in intuitive human-machine interaction, smart surveillance, character animation, virtual reality and motion analysis. The research area contains a number of hard and often ill-posed problems such as inferring the pose and motion of a highly articulated and self-occluding non-rigid 3D object from images. Our research focuses on markerless motion capture of human, especially based on monocular camera.
Cognitive Trust-driven Design of Intelligent Agents

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

This project aims to design and implement a robust and efficient 3D virtual agent driven by cognitive trust, in order to better model user’s taste and provide more reliable and accurate personalized recommendations than traditional agents on the basis of learned cognition (e.g. competence, willingness, risk acceptance) of the active user.

The main idea of our approach is to expand the trusted neighborhood of the active user. More specifically, the directed trust neighbours are merged into a single virtual proxy by means of majority rule and confidence filtering, after which the proxy is better representing the whole community than original user. And more neighbors are found by probing the highly similar users of the proxy. Therefore, the size of the trusted neighborhood is significantly increased, based on which great improvement is achieved in terms of both accuracy and coverage.

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. The Virtual Humans should be able to react to the gestures of the users. The great challenge in the project is that the gestures should be analyzed and recognized in real-time in order to generate the right behavior of the 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. A demo in the new Immersive Room at IMI will be part of this research.
CURRENT PHD PROJECTS

Modeling Interactive Storytelling

Student: XIAO Feng
Supervisor: Assoc Prof THENG Yin Leng (WKWSCI)
Co-supervisors: Prof Nadia MAGNENAT-THALMANN (IMI)
Assoc Prof MIAO Chunyan (SCE)

With the advance of Artificial Intelligence (AI) techniques, digital virtual storytelling has made great progress in the recent years. However, advanced AI technique itself cannot make a successful storytelling. Narrative theories have been studied well as best support for interactive storytelling endeavor, and varied models have been generated based on these narrative theories. But all of above perspectives are from the western view. However, Chinese elements have gained more and more attention, but Chinese culture phenomenon is not well studied in the IS field. There are many questions unanswered: how Chinese elements can be reflected in the interactive storytelling research? Will some of Chinese elements affect the narrative theories or make certain change on the theories? If the narrative theories change according to the Chinese elements, what will be the consequence on the narrative models? These will be the main research focus of the project.

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)

Chinese color ink painting is a traditional art form, a non-photorealistic rendering, that is over three thousand years old. Simulating the behavior of Chinese ink is challenging. Various artistic effects of color ink diffusion are analyzed, and a scheme presents how they can be simulated automatically for their computer-generated simulation.
CURRENT PHD PROJECTS

Design of a Reputation Mechanism for 3D E-Commerce

Student:  FANG Hui
Supervisor:  Asst Prof ZHANG Jie (SCE)
Co-supervisor:  Prof Nadia MAGNENAT-THALMANN (IMI)

The research attempts to design a feedback-based reputation mechanism to solve the inherited trust problems in 3D e-commerce which is getting more feasible and popular. With 3D technology, the constructing processes such as feedback provision, feedback computation, feedback presentation and user decision making will be changed.

3D Reconstruction of Human Bodies with Clothes from Un-calibrated Monocular Video Images

Student:  Qui C.T. TRAN
Supervisor:  Prof SEAH Hock Soon (SCE)
Co-supervisor:  Prof Nadia MAGNENAT-THALMANN (IMI)

This research focuses on reconstructing the 3D geometries of human bodies with clothes from video images captured by a single un-calibrated camera. The research will need to address challenges in handling un-calibrated and un-completed data. The deformable surfaces of clothes also pose interesting problems to the topic. The output of the research can enable promising applications in animation, fashion, sport analysis, etc.

Research on Multimedia Community-based Question Answering

Student:  YUAN Quan
Supervisor:  Asst Prof CONG Gao (SCE)
Co-supervisor:  Prof Nadia MAGNENAT-THALMANN (IMI)

Community-based question-answering (CQA) portals, e.g., Yahoo! Answers and Naver have enjoyed growing popularity. However, existing CQA is still suffering from some limitations, among which is the unitary input modality - text. This research focuses on Multimedia Community-based Question Answering (MCQA), a new type of CQA that enables users to post questions with photos and video. This research involves with question organization, multimedia question retrieval, expert user discovery and recommendation, and QA in 3D virtual space.
CURRENT PhD PROJECTS

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. Such a simulation should be accurate enough for a good prediction and also efficient to be practical usable. The research is mainly divided into two parts to build an accurate geometry model of human articulation from MRI. The process should be as automatic as possible. Based on the geometry model, a physical model is built to represent the behavior of the articulation. Such a physical model should be solved efficiently and also presents the physical behavior accurately.

Interactive Image Segmentation

Student: ZHU Hongyuan
Supervisor: Assoc Prof CAI Jianfei (SCE)
Co-supervisor: Prof Nadia MAGNENAT-THALMANN (IMI)

Image segmentation plays an important role in many fields of Computer Vision and Computer Graphics. Interactive image segmentation is an ad-hoc topic in recent years. The main objective of this research is to improve the segmentation with higher-level semantics provided by user input.
Current PhD Projects

Automatic 3D Clothing: from 2D Patterns to Garment
Student: ZHANG Yuzhe
Supervisor: Assoc Prof ZHENG Jianmin (SCE)
Co-supervisor: Prof Nadia MAGHENAT-THALMANN (IMI)

This project aims to develop algorithms and solutions for automatic modeling and prepositioning of garment from 2D pattern. And it mainly focuses on the process of converting 2D pattern into 3D garment and its application in virtual try-on. We will investigate how to manage 2D garment pattern and how to embed the knowledge from cloth-making industry into the pattern for automatic pattern assembly. We will construct a generic 3D body model with various geometric features and other information. We will develop automatic algorithms for constructing 3D garment from 2D patterns, which include topological connection, geometric matching, surface deformation, shape optimization, and learning.

How Privacy Concern Mediates Personality and Parental Mediation on Adolescents’ Online Information Disclosure
Student: LIU Cong
Supervisor: Assoc Prof ANG Pei-Hui, Rebecca (WKWSCI)
Co-supervisor: Assoc Prof May Oo Lwin (WKWSCI)

Personality traits (i.e., narcissism and social anxiety) and parental mediation on adolescents’ information disclosure on Facebook was studied. The role of privacy concern as a mediator was also examined. Over one thousand adolescents between 13 to 18 years old participated in this study. Results show that narcissism is directly associated with while social anxiety is indirectly associated with (through privacy concern) information disclosure. Parental mediation influences risky online behaviors of their children in both direct and indirect ways. Implications on promoting adolescents’ online safety will be discussed.
Cyber-learning in Cyberworlds

Student: LAI Danbo  
Supervisor: Assoc Prof Alexei SOURIN (SCE)  
Co-supervisor: Assoc Prof ZHAO Dongsheng (NIE)

When teaching subjects richly infused with mathematics, in particular geometry, topology and shape modeling, there is a frequent problem that the learners are not able to “visualize” the attendant theoretical concepts. This project proposes to immerse the learners in 3D AI-assisted shared virtual collaborative environments where mathematical formulas are used for immediate interactive definition and multi-sensory rendering of geometry, appearance and physical properties of the shapes.

Perceptually Based Selective Rendering

Student: DONG Lu  
Supervisor: Assoc Prof LIN Weisi (SCE)  
Co-supervisor: Assoc Prof ZHU Ce (EEE)

Computer Graphics is increasingly important to the growing needs of the film, games and virtual reality industries. The computational complexity of realistic, real-time image synthesis is still a big challenge under a reasonable cost constraint. Since the human visual system (HVS) is the ultimate receiver and appreciator of the resultant images, an appropriate perceptual model and its application can save significant rendering time by approximately computing those parts of a scene which the HVS will fail to notice. In this project, a perceptual model is to be exploited for image rendering (especially in illumination and shadow determination). Visual attention, contrast sensitivity and masking will be investigated. Then, the said model will be used to guide the computation of illumination and shadows. Experiments will be conducted to validate the effectiveness of the proposed method.
CURRENT PHD PROJECTS

Passive Approaches for Digital Image Forgery Detection

Student: Pravin KAKAR
Supervisor: Asst Prof Sudha NATARAJAN (SCE)
Co-supervisor: Assoc Prof SER We (EEE)

Fake images have become widespread in society today. As the credibility of images suffers, it is necessary to devise techniques in order to verify their authenticity. Traditionally, contextual knowledge and/or active approaches such as watermarking or signatures have been employed. However, contextual knowledge is not always available or applicable, and active approaches have shortcomings such as the requirement of insertion at the point of creation of the image or specialized hardware. In the face of such difficulties in authenticity verification, passive approaches have gained importance as they only use the characteristics of the image in question in order to establish its genuineness. Our research focuses on developing new techniques for passive image forensics, extending existing techniques, designing efficient algorithms and developing benchmarking databases. We have so far developed a technique for detecting splicing in motion blurred images, and are working on a novel technique for detecting region duplication forgeries.

Quantification of Brain Responses for Neurofeedback Game in 3D Virtual Environments

Student: WANG Qiang
Supervisor: Asst Prof Olga SOURINA (EEE)
Co-supervisor: Assoc Prof Vladimir Vladimirovich KULISH (MAE)

Human electroencephalograph (EEG) signals are the records of electrical potential produced by the brain along with its activities. Control by brain power is not only for entertainment but also useful for medication for kinds psychological disorders. Nowadays, the EEG device became more and more portable with less electrodes and Bluetooth wireless data transmitting. Applications without experimental environment and doctor’s guidance are on high demand. Existing algorithms for EEG signal processing cannot be compatible or effective enough with fewer electrodes and on-line. In order to maximize the flexible of EEG applications, more effective algorithm and more representative features are needed. The main objective of our project is exploiting new algorithms and new features for the brain state recognition for real-time applications with as fewer electrodes as possible.
CURRENT PHD PROJECTS

CBAN: An Embedded Patient Monitoring Body Area Network

Student: Surabh RASTOGI
Supervisor: Assoc Prof LIN Feng (SCE)
Co-supervisor: Asst Prof Mark CHAVEZ (ADM)

We present a novel embedded Body Area Network (BAN) solution leveraging the computation horsepower of many concurrent microprocessor cores to process biopotential data in real-time. After examining various approaches for this purpose we will describe the design methodology for the proposed BAN and explore the configuration space looking for the most effective solution, performance, cost and energy-wise. This BAN solution provides higher levels of user satisfaction as expected from novel healthcare delivery scenarios (e.g., mobility and customization) while the architecture in its heart achieves these targets by complex hardware methods (such as multitasking, parallel processing) and performs beyond the expectations of accurate real time diagnosis, analysis and monitoring of diseases. Other advantages offered by our proposed BAN are larger time margin to run diagnosis algorithms, energy efficiency, expansion capabilities and improved scalability to challenging higher sampling frequencies.

Statistical Machine Learning Techniques with Applications to Image Retrieval

Student: ZHANG Lining
Supervisor: Assoc Prof WANG Libo (EEE)
Co-supervisor: Assoc Prof LIN Weisi (SCE)

During the past few years, content-based image retrieval has attracted substantial attention for its potential application in multimedia management. It is motivated by the explosive growth of image records and online accessibility of remotely stored images. An effective search scheme is urgently required to manage the huge image database. Traditional statistical machine learning methods, such as supervised learning, unsupervised learning and active learning, have been extensively studied separately in machine learning community; there are few comprehensive works to investigate these techniques conformably for content-based image retrieval. In this work, we study several statistical machine learning techniques, e.g., supervised learning, semi-supervised learning, subspace learning and active learning in a synergistic way to maximize the effectiveness of a learning task, and thus enhance the performance of the image retrieval systems.
CURRENT PHD PROJECTS

Development of Aesthetic Algorithms for Acquired and Generated Digital

Student: ZHANG Xiaoyan
Supervisor: Assoc Prof Kap Luk CHAN (EEE)
Co-supervisor: Asst Prof Martin CONSTABLE (ADM)

This project explores the structural models behind visual appeal and the development of algorithms to apply them to acquired and/or generated digital images. The development of aesthetic algorithms derived from pre-existent artistic models is a focus of the project. Image attributes will be studied for their relationship to visual appeal. Operations such as post-exposure refocusing, re-rendering of the scene from an alternate viewpoint, single-image based on matting and composition and automatic scene segmentation will be explored. Machine learning methodology will be explored for automatic model generation for use in aesthetic rendering. These algorithms would be applied to still, moving and real-time digital images and would transform their appearance in a way previously only achievable by experienced artists.

Computer-aided Prosody Evaluation for Language Learning

Student: ZHAO Sixuan
Supervisor: Prof KOH Soo Ngee (EEE)
Co-supervisor: Assoc Prof NG Bee Chin (HSS)

The nativeness of prosody has been a huge problem of non-native English learners for long time. Computer-aided prosody evaluation system can give feedback automatically and thus facilitate the practice and improvement of English learners. In our project, a reference-independent prosody evaluation method using Support Vector Machine (SVM) is proposed to evaluate the learner’s prosody without reference utterances. Unlike reported systems that perform evaluation at the word or syllable level, prosodic unit, a concept in linguistics field, is adopted to improve the evaluation accuracy. Furthermore, a new idea of accent conversion is proposed to provide English learners with useful feedbacks. The learner’s speech is modified to reduce the foreign accent and then the modified speech is played to the learner for his practice. As a result, non-native English learners can listen to accent-reduced speech with their own voices to improve their speaking skills.
Opening speech by Prof Bertil ANDERSSON, NTU President
April 13, 2011
August 4, 2011

Shape and Image Cognition, Construction and Compression via Tools from Differential Geometry
Prof Franz-Erich WOLTER
Institute of Man-machine Communication
Leibniz University of Hanover, Germany

May 4, 2011

Sampling in the Age of Sparsity
Prof Martin VETTERLI
École Polytechnique Fédérale de Lausanne, Switzerland University of California Berkeley, USA

March 22, 2011

Mixed Reality and Human Interface for Metaverse Computing
Prof HYUN Seung Yang
Professor and Director
AIM (AI & Media) Lab, Dept. of Computer Science
Center for Advanced Image Media Technology
Korea Advanced Institute of Science and Technology (KAIST), Korea

November 26, 2010

Innovation in Biomedical Engineering and Information Technology
Prof (David) Dagan FENG
Professor and Director
Biomedical & Multimedia Information Technology Research Group
School of Information Technologies
University of Sydney, Australia

October 22, 2010

Intelligent Robotics: Gadgets, Algorithms and Applications
Prof Ray JARVIS
Director, Intelligent Robotics Centre
Dept. of Electrical & Computer Systems
Monash University, Australia
**PhD Interdisciplinary Seminars**

- **May 6, 2011**
  - Presented by:
    - ZHANG Xiaoyan
    - LAI Danbo
    - Pravin KAKAR

- **March 29, 2011**
  - Presented by:
    - Assoc Prof Marina L. GAVRILOVA (University of Calgary, Canada)
    - ZHANG Lining
    - DONG Lu
    - ZHAO Sixuan

- **February 22, 2011**
  - Presented by:
    - ZHU Hongyuan
    - Saurabh RASTOGI
    - LIU Cong, Veronica
    - Dr Kingkarn SOOKHANAPHIBARN (Ritsumeikan University, Japan)

- **August 18, 2011**
  - Presented by:
    - WANG Qiang
    - FANG Hui
    - BIAN Zhenpeng
January 25, 2011
Presented by:
WANG Qiang
CHENG Peng
ZHANG Wenjing

November 23, 2010
Presented by:
ZHANG Yuzhe
FANG Hui
Dr QUAH Chee Kwang (Research Fellow, IMI)

November 9, 2010
Presented by:
Qui C.T. TRAN
YUAN Quan
LI Le

October 26, 2010
Poster presentation and demos by PhD students
Presentation by Dr WANG Yanbin (Research Fellow, IMI)
IMI – SCHOOL JOINT SEMINARS

April 15, 2011
Learning from Serious Games: Processing the Experience
Prof David CROOKALL
University of Nice Sophia Antipolis, France
This seminar was jointly organized by IMI and SCE

February 7, 2011
Needs-based Assessment of Learning and Behavioural Problems: A Practice Based Model
Assoc Prof SUI Lin Goei
UV University Amsterdam and Windesheim University of Applied Sciences, The Netherlands
This seminar was jointly organized by IMI and NIE

September 14, 2011
Virtual Reality Applications and Lightweight Graphics Rendering
Assoc Prof Gaoqi HE
East China University of Science and Technology, Shanghai, China
This seminar was jointly organized by MAE and IMI

September 14, 2011
Current Progress of Mobile Interactive Media and Entertainment Group
Asst Prof Henry Been-Lirn DUH
National University of Singapore, Singapore
This seminar was jointly organized by IMI and MAE

October 4, 2010
A Generalization of the Hausdorff Dimension of Fractal Sets on $\mathbb{R}^n$
Prof JIANG Huikun
Nanjing University, China
This seminar was jointly organized by MAE and IMI
TUTORIALS

June 3, 2011

EON-SDK
Kelvin LEE
Senior Manager – Technical Solutions
EON Reality Pte Ltd

May 30, 2011

Building 3D Simulations with OGRE and Python
Asst Prof Arjan EGGES
Department of Information and Computing Sciences
Utrecht University, The Netherlands

March 15, 2011

EON Professional
Kelvin LEE
Senior Manager – Technical Solutions
EON Reality Pte Ltd
Our People
Dr Brian Foster ALLEN  
PhD (University of California, Los Angeles, USA)

Dr Flavien Jackie PICON  
PhD (University of Paris XI, France)

Dr WANG Yanbin  
PhD (Tsinghua University, China)

Dr CHEN Yujun  
PhD (Tsinghua University, China)

Dr Hector Rafael OROZCO AGUIRRE  
PhD (National Polytechnic Institute, Guadalajara, Mexico)
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KOH Kian Hua
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MSc (Nanyang Technological University, Singapore)

Qui C.T. TRAN
Research Associate
MSc (National University of Singapore, Singapore)

Rohit Kumar DUBEY
Research Associate
MSc (Nanyang Technological University, Singapore)

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BsDIA (Ateneo De Naga University, The Philippines)

Valroman Romero FRANCISCO
3D Animator
BsDIA (Ateneo De Naga University, The Philippines)

Ghanapriya NAGARAJAN
Project Officer (Fashion Designer)
BSc (Nanyang Academy of Fine Arts, Singapore)

Cubile Gracee Rachiel AURE
Executive Assistant
BSBA (Philippine School of Business Administration, The Philippines)
Professors (PI) Associated to IMI

- Assoc Prof Francesco Paolo CAVALLARO
  School of Humanities and Social Sciences
- Assoc Prof Louis-Philippe DEMERS
  School of Art, Design & Media
- Asst Prof PerMagnus LINDBOURG
  School of Art, Design & Media
- Asst Prof Olga SOURINA
  School of Electrical & Electronic Engineering
- Asst Prof Ina CONRADI
  School of Art, Design & Media
- Prof Isaac V KERLOW
  School of Art, Design & Media
- Assoc Prof MIAO Chun Yan
  School of Computer Engineering
- Prof Daniel THALMANN
  PhD Coordinator Institute for Media Innovation / School of Computer Engineering
- Assoc Prof Lin Feng
  School of Computer Engineering
- Prof SEAH Hock Soon
  School of Computer Engineering
- Asst Prof Justin DAUWELS
  School of Electrical & Electronic Engineering
- Asst Prof YEO Puay Hwa Jesvin
  School of Art, Design and Media
PROFESSORS AND RESEARCHERS VISITED IMI

Prof Franz-Erich WOLTER
Welfenlab
Leibniz University of Hanover
Germany

Asst Prof Arjan EGGES
Utrecht University
The Netherlands

Asst Prof Francois VIALATTE
ParisTech
France

Dr Mustafa KASAP
MIRALab
University of Geneva
Switzerland

Dr Sookhanaphibarn KINGKARN
Ritsumeikan University
Japan

Dr Zerrin KASAP
MIRALab
University of Geneva
Switzerland
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Delegates from the Mexican Universities (July 1, 2011)

Delegates of CGIV2011 (August 19, 2011)

Delegates from National Cheng-Kung University, Taiwan (September 6, 2011)

Delegates of Sony and EON Reality (September 13, 2011)

Mr T R Anand from SRM University, Chennai, India (August 15, 2011)

Delegates from SingTel (June 10, 2011)

Delegates from the University of Atam Jaya, Yogyakarta, Indonesia (May 25, 2011)

Delegates from Jetro Singapore, (Japan Trade Centre) (August 23, 2011)

Delegates from BBC News (Malaysia) (April 28, 2011)
VISITORS TO IMI

Delegates from Bryn Mawr College and Haverford College (February 24, 2011)

Prof Ma Dexiu and delegates from Shanghai Jiaotong University (October 7, 2010)

Delegates from Ubon Ratchathani University, Indonesia (October 22, 2010)

Delegates from the Federal University of Rio Grande do Sul (UFRGS), Brazil (November 3, 2010)

Prof Nakamura and delegates from Ritsumeikan University, Japan (March 4, 2011)

Dr Tan Chin Nam and Mr Michael Yap from MDA (March 28, 2011)

Prof Tom DEFANTI, pioneer in Visualization and Virtual Reality (March 23, 2011)

Prof Ma Dexiu and delegates from Shanghai Jiaotong University (October 7, 2010)
## Selected Keynotes & Invited Talks

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SELECTED IMI PUBLICATIONS


O. Sourina, Y. Liu and M.K. Nguyen, Real-time EEG-based Emotion Recognition for Music Therapy, Accepted by Journal on Multimodal User Interfaces, 2011

O. Sourina, Q. Wang, Y. Liu and M.K. Nguyen, Fractal-based Brain State Recognition from EEG, Accepted by Human Computer Interaction, 2011


I. Conradi and I.Y.Y. Xiang, **The Undiscovered Country, The Art of Pictorial 3-D Stereo Animation**, International Conference on Cyberworlds, Conference Special Session on Arts and Virtual Worlds, Banff, Alberta, Canada, October 4-6, 2011


F. Lin, A. Jean, C.P. Leng and L. Danbo, **Constructing Suffix Tree of Endogenous Feature on FPGA for High-Performance Identification of DNA Signatures**, The 11th IEEE Conference on Bioinformatics and Bioengineering, Taiwan, October 24-26, 2011


J. Schmid, J. Kim and N. Magnenat-Thalmann, **Coupled Registration-Segmentation: Application to Femur Analysis with Intra-subject Multiple Levels of Detail MRI Data**, MICCAI, Springer, LNCS, Vol. 6362, pp. 562-569, September 2010


O. Sourina, B.T. Ang and M.K. Nguyen, **Fractal-based Approach in Analysis of Intracranial Pressure (ICP) in Severe Head Injury**, The 10th IEEE International Conference on Information Technology and Applications in Biomedicine , pp. 1-4, Greece, November 2-5, 2010


M. Constable and X. Zhang, **Depth-based Analyses of Landscape Paintings and Photographs According to Itten’s Contrasts.** The 4th Pacific-Rim Symposium on Image and Video Technology, pp.481-486, Singapore, 2010


P. Kakar and N. Sudha, **Detecting Copy-Paste Forgeries using Transform-Invariant Features**, The IEEE International Symposium on Consumer Electronics, Singapore, June 14-17, 2011


P. Kakar, N. Sudha and W. Ser, **Image Authentication by Motion Blur Consistency Verification**, The IEEE TENCON Conference, Fukuoka, Japan, pp. 188-193, November 21-24, 2010


SELECTED IMI MEDIA COVERAGE

@NTU, Jan/Feb 2011
BeingThere Centre develops new telepresence prototypes and solutions

4G Wireless Evolution, Jan 26, 2011
New $22m research centre by NTU, ETH and UNC will make virtual communication reality

Berner Zeitung, Jan 26, 2011
New $22m research center by NTU, ETH and UNC to make virtual communication reality

Computer Business Review, Jan 26, 2011
NTU, ETH Zurich and University of North Carolina collaborate to start new R&D on realtime 3-D communication

EurolInvestor (UK), Jan 26, 2011
New $22m research center by NTU, ETH and UNC to make virtual communication reality

ifeng.com, Jan 26, 2011
$22m research centre by NTU, ETH and UNC will make virtual communication reality

Lianhe Zaobao, Jan 27, 2011
The BeingThere Centre

News.XinMSN, Nov 16, 2010
IMI leads research into virtual humans

@NTU, Nov/Dec 2010
IMI & New Media

Bernama, Jan 26, 2011
Singapore Sets Up Centre To Develop Virtual Communication

China Daily, Jan 26, 2011
Singapore, U.S. and Switzerland to jointly develop 3D real-time teleconference system

EFY Times.com, Jan 26, 2011
New $22m research centre by NTU, ETH Zurich and UNC-Chapel Hill

i.Bits Newsletter, March 20, 2011
BeingThere and Research into Telepresence

India Times.com, Jan 26, 2011
New $22m research center by NTU, ETH and UNC to make virtual communication reality

News.XinMSN, Jan 26, 2011
$22m centre for telepresence

Panorama, Feb 2011
New research to make virtual communication a reality
PCtipp (Switzerland), Jan 27, 2011
ETH Zurich in the footsteps of Star Wars

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New $22m research centre by NTU, ETH and UNC will make virtual communication reality

Scientific Computing.com, Jan 26, 2011
New $22m research center by NTU, ETH and UNC to make virtual communication reality

Swissnexus, Nov 17-26, 2010
Digital Nights 2010
IMI collaborates with MIRALab to feature Virtual Fashion Show at Digital Nights 2010

The Business Times, Jan 27, 2011
Robots to fix an executive’s jetsetting woes?

The Straits Times, Nov 16, 2010
IMI - catalyst for interdisciplinary research at NTU

Today, Nov 17, 2010
BeingThere, even when you are not

Xinhua Online (China), Jan 26, 2011
Singapore, U.S. and Switzerland to jointly develop 3D real-time teleconference system

PremiumPresse (Germany), Jan 26, 2011
New $22m research centre by NTU, ETH and UNC will make virtual communication reality

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Smart Grid, Jan 26, 2011
Singapore, U.S. and Switzerland to jointly develop 3D real-time teleconference system

Telepresence Options.com, Jan 26, 2011
New $22m research center by NTU, ETH and UNC to make virtual communication reality

Today, Nov 17, 2010
Virtual Human and Virtual Try On

Yahoo! Malaysia News, Jan 26, 2011
Singapore sets up centre to develop Virtual Communication
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