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Entertainment Computing – ICEC 2007

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Foreword

Welcome to the proceedings of ICEC 2007

It is our honor to edit this volume of LNCS reporting the recent progress in entertainment computing. We are pleased with the solid work of all the authors who contributed to ICEC 2007. ICEC 2007 attracted 99 technical papers. Based on a thorough review and selection process by 87 international experts from academia and industry as members of the Program Committee, a high-quality program was compiled. The International Program Committee consisted of experts from all over the world: 6 from the UK, 3 from Singapore, 1 from Lebanon, 30 from China, 2 from The Netherlands, 9 from Japan, 6 from Germany, 1 from Greece, 3 from Canada, 11 from the USA, 3 from Korea, 2 from Austria, 1 from Hungary, 1 from Spain, 1 from Portugal, 2 from Italy, 2 from France, 1 from Switzerland, 1 from Sweden, and 1 from Finland. The final decision was made by review and conference Chairs based on at least three reviewers' feedback available online via the conference management tool and E-mail. As a result, 25 full papers and 23 regular papers were accepted as submitted or with minor revisions. For the remaining submissions, 16 were recommended to change according to the reviews and were submitted as posters. In all the papers, five were published in the *International Journal of Virtual Reality*, three were recommended to the *Journal of Computer Animation and Virtual Worlds*, and six were recommended to the *Journal of Computer Science and Technology*. This proceedings volume presents 64 technical contributions which are from many different countries: Singapore, China, Japan, Korea, The Netherlands, Czech Republic, Spain, USA, Germany, France, Australia, Canada, etc. The accepted technical papers are compiled and presented in this volume in the order they were presented at the conference. They are classified into the following presentation sessions: (1) Augmented, Virtual and Mixed Reality; (2) Computer Games; (3) Image Processing; (4) Mesh and Modeling; (5) Digital Storytelling and Interactive Systems; (6) Sound, Music and Creative Environments; (7) Video Processing; (8) Rendering; (9) Computer Animation and Networks; (10) Game-Based Interfaces; (11) Robots and Cyber Pets. All poster papers are listed separately and presented in a specific section of this book.

July 2007

Lizhuang Ma
Matthias Rauterberg
Ryohei Nakatsu

Preface

Entertainment is playing a very important role in our life by refreshing our mind, activating our creativity and providing different media for expression. Recently, with the advances made in graphics, image processing, sensors, networks, and media technologies, new types of entertainment have been emerging such as video games, edutainment, robots, augment reality, and online games. Entertainment has been merged into different fields of science, society, economy as well as our daily life. It is valuable to enhance the efficiency of many aspects, such as teaching, learning, playing, working, communicating and exchanging knowledge. New forms of entertainment are emerging and are studied by many scientists and engineers from different research fields. Entertainment has become one of the major research areas in information technology. Since there are rapidly expanding industries and markets devoted to entertainment, new technologies and methodology must be laid out for these increasing demands.

The emerging forms of entertainment have been changing our lives, and it is urgent for us to discuss various aspects of entertainment, to analyze the principle and structure of entertainment and to promote entertainment-related research.

With this basic motivation, the General Assembly of the International Federation of Information Processing (IFIP) approved in August 2002 the establishment of SG16 to monitor and promote research and development activities related to entertainment computing throughout the world. One of the major activities of SG16 is to organize and support the International Conference of Entertainment Computing (ICEC). The ICEC is expected to bring together researchers, developers, and practitioners working on entertainment computing topics, such as theoretical studies, social and cultural aspects, new hardware/software development, integrated systems, human interfaces and interactions, and applications.

Let us briefly review the history of ICEC. The annual conference started in 2002 as the International Workshop on Entertainment (IWEC 2002), which was held May 14-17, 2002 in Makuhari, Japan. The workshop attracted more than 100 participants, and 60 papers were published in the proceedings by Kluwer. Based on the success of IWEC 2002, SG16 upgraded the workshop to a conference and organized ICEC 2003. ICEC 2003 was held May 8-10, 2003 at the Entertainment Technology Center of Carnegie Mellon University, Pittsburgh, USA. ICEC 2003 was also successful, with more than 100 attendees and 20 highly selected papers. All of the papers of ICEC 2003 were accepted by ACM for inclusion in their ACM online digital library. The following year, ICEC crossed the Atlantic Ocean to Europe, and ICEC 2004 was held September 1-3, 2004 at the Technical University of Eindhoven in The Netherlands. The conference attracted more than 150 attendees, and 27 full papers were published by Springer in the *Lecture Notes in Computer Science* (LNCS) series. In 2005, ICEC came back to

Japan, and was held at Kwansai Gakuin University, Sanda. In this conference the Committee selected more than 50 papers, and these papers are published in the LNCS volume. In 2006, ICEC was hosted by Microsoft Research and the University of Cambridge, in Cambridge, UK. In the conference the Committee selected more than 60 papers.

Finally, in 2007, ICEC was hosted for the first time in Shanghai, China, hosted by Shanghai Jiao Tong University, sponsored by the Natural Science Foundation of China, Autodesk and Microsoft Japan.

For the success of ICEC 2007, we express our special thanks to all the people who worked so hard to organize the conference: the Shanghai Jiao Tong University for the support and to all the individuals who supported the organization with the Local Organization Committee.

We are also grateful for the contribution of all the paper reviewers as well as the sponsors and cooperating societies.

Special thanks to the support of the joint laboratory of Intelligent Computing and Systems between Microsoft Research Asia and Shanghai Jiao Tong University, the special group of computer animation and digital entertainment of China Association of Images and Graphics, and the 973 Plan of China 2006CB303105.

July 2007

Lizhuang Ma
Matthias Rauterberg
Ryohei Nakatsu

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IFIP TC14

SG16 (Specialist Group on Entertainment Computing) was established at the General Assembly of IFIP (International Federation on Information Processing) in 2001. On August 28, 2006 the General Assembly of IFIP decided to establish the new Technical Committee TC14 on Entertainment Computing. Therefore SG16 will convert into TC14:

Aims

To encourage computer applications for entertainment and to enhance computer utilization in the home, the Technical Committee will pursue the following aims:

- To enhance algorithmic research on board and card games
- To promote a new type of entertainment using information technologies
- To encourage hardware technology research and development to facilitate implementing entertainment systems
- To encourage non-traditional human interface technologies for entertainment

Scopes

(1) Algorithm and strategy for board and card games

- Algorithms of board and card games
- Strategy control for board and card games
- Level setup for game and card games

(2) Novel entertainment using ICT

- Network-based entertainment
- Mobile entertainment
- Location-based entertainment
- Mixed reality entertainment

(3) Audio

- Music informatics for entertainment
- 3D audio for entertainment
- Sound effects for entertainment

(4) Entertainment and human interface technologies

- Haptic and non-traditional human interface technologies
- Mixed reality human interface technologies for entertainment

(5) Entertainment robots

- ICT-based toys
- Pet robots
- Emotion model and rendering technologies for robots

(6) Entertainment systems

- Design of entertainment systems
- Entertainment design toolkits
- Authoring systems

(7) Theoretical aspects of entertainment

- Sociology, psychology and physiology for entertainment
- Legal aspects of entertainment

(8) Video game and animation technologies

- Video game hardware and software technologies
- Video game design toolkits
- Motion capture and motion design
- Interactive story telling
- Digital actors and emotion model

(9) Interactive TV and movies

- Multiple view synthesis
- Free viewpoint TV
- Authoring technologies

(10) Edutainment

- Entertainment technologies for children's education
- Open environment entertainment robots for education

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- WG14.2 Chair: Hitoshi Matsubara (ex-officio member)
- WG14.3 Chair: Matthias Rauterberg
- WG14.4 Chair: Jaap Van Den Herik (ex-officio member)
- WG14.5 Chair: Andy Sloane (ex-officio member)
- WG14.6 Chair: Lyn Pemberton (ex-officio member)
- WG14.7 Chair: Naoko Tosa (ex-officio member)

Working Groups (WG)

WG14.1 - Digital Storytelling

Scopes

Storytelling is one of the core technologies of entertainment. Especially with the advancement of information and communication technologies (ICT), new types of entertainment called video games have been developed where interactive story development is the key that makes these games really entertaining. At the same

time, however, the difference between interactive storytelling and conventional storytelling has not been studied well. Also, as the development of interactive storytelling needs a lot of time and human power, it is crucial to develop technologies for automatic or semiautomatic story development. The objective of this working group is to study and discuss these issues.

WG14.2 - Entertainment Robot

Scopes

Robots are becoming one of the most appealing forms of entertainment. New entertainment robots and/or pet robots are becoming popular. Also, from theoretical point of view, compared with computer graphics-based characters/animations, robots are an interesting research object as they have a physical entity. Taking this into consideration, it was decided at the SG16 annual meeting that a new working group on entertainment robot is to be established.

WG14.3 - Theoretical Basis of Entertainment

Aims

For the benefit of society, to promote visibility and to increase the impact of research and development in the entertainment computing area, especially in the fields defined in the scope of this working group.

- To promote the quality and relevance of academic and industrial research and development in the entertainment computing area.
- To promote ethical behavior and appropriate recommendations or guidelines for research-related activities, for example, submission and selection of publications, organization of conferences, allocation of grants and awards, and evaluation of professional merits and curricula.
- To promote cooperation between researchers and with other established bodies and organizations pursuing the above aims.
- To contribute to assessing the scientific merits and practical relevance of proposed approaches for entertainment technology and applications.

Scopes

Although there are already huge entertainment industries such as video games, toys, movies, etc., little academic interest has been paid to such questions as what is the core of entertainment, which technologies of entertainment can be applied to other areas such as education, learning and so on. The main objective of this WG is to study these issues.

WG14.4 - Games and Entertainment Computing

Aims

To research and develop computing techniques for the improvement of computer games and other forms of computer entertainment.

Scopes

The scope of this workgroup includes, but is not limited to, the following applications, technologies, and activities.

Applications:

- Analytical games (e.g., Chess, Go, Poker)
- Commercial games (e.g., Action games, Role-playing games, Strategy games)
- Mobile games (e.g., Mobile phones, PDAs)
- Interactive multimedia (e.g., Virtual reality, Simulations)

Technologies:

- Search Techniques
- Machine-Learning Games
- Reasoning
- Agent Technology
- Human-Computer Interaction

WG14.5 - Social and Ethical Issues in Entertainment Computing

Aims

- Foster the ethical design, development, implementation, applications and use of entertainment computing.
- Encourage surveys and studies on social, ethical, and cultural aspects of entertainment computing. Develop methodologies for studying social, ethical, and cultural implications of entertainment computing.
- Establish a global platform for interaction, exchange, joint initiatives, and co-operation between such groups as:
 - the end users of entertainment computing
 - industrial developers and designers of entertainment computing
 - policy, decision making, social, and consultative bodies
 - academics and scientists.

Scopes

The social and ethical implications of entertainment computing, including:

- Actual and potential human usefulness or harm of entertainment computing
- Social impact of these technologies
- Developments of the underlying infrastructure
- Rationale in innovation and design processes
- Dynamics of technology development
- Ethical development
- Cultural diversity and other cultural issues
- Education of the public about the social and ethical implications of entertainment computing, and of computer professionals about the effects of their work

WG14.5 explicitly focuses on the position of, and the potentials for, vulnerable groups such as children, the less-educated, disabled, elderly and non-employed people, cultural minorities, unaware users, and others.

WG14.6 - Interactive TeleVision (ITV)

Aims

- To promote visibility and to increase the impact of research and development in the ITV field
- To bring together interdisciplinary approaches to ITV research and development issues (e.g., content production, computer science, media studies)
- To encourage cooperation between researchers and other established bodies and organizations, through the development of joint project proposals
- To facilitate the development of suitable academic and practical teaching programs

Scopes

- Alternative content distribution (mobile TV, peer-to-peer TV, IPTV)
- Interactive storytelling, user-contributed content
- Interactive and personalized advertising systems
- Applications for t-commerce, t-learning, t-health, entertainment
- Ethical, regulatory and policy issues
- Interoperability of middleware, standards, multimedia metadata
- Authoring, production, and virtual reality systems
- Content management, digital rights management
- Multimedia, graphics, broadcast, and video technology
- Content-enriched communication services, video conferencing
- Personalization, user modeling, intelligent user interfaces
- Usability, accessibility, universal access, multimodal interaction

WG14.7 - Art and Entertainment

Scope

The influence of technology and scientific innovation is profoundly changing how we express ourselves. Arts and entertainment is a new field that represents the exciting convergence of technology with the established design discipline. The media arts and cinema offer a comprehensive approach to design that encourages innovation by media artists, scientists, and engineers. The working group will pursue the following activities:

Aims

- To explore the way art and cinema esthetics can play a role in different areas of computer science.
- One of its goals is to modify computer science by the application of the wide range of definitions and categories normally associated by making art and cinema.
- To go beyond the usual definition of art and cinema esthetics in computing, which most often refers to the formal, abstract qualities of such structures - a beautiful proof, or an elegant diagram.

- To research the broader spectrum of esthetics—from abstract qualities of symmetry and form to ideas of creative expression and pleasure—in the context of computer science.
- To prove the assumption behind art and cinema esthetic computing that the field of computing will be enriched if it embraces all of esthetics.

Invited Speakers

Nadia Magnenat-Thalmann

Professor Nadia Magnenat-Thalmann has pioneered research into virtual humans over the last 25 years. She obtained several Bachelor and Master degrees in various disciplines (psychology, biology, and chemistry) and a PhD in quantum physics from the University of Geneva. From 1977 to 1989, she was a professor at the University of Montreal where she founded the research lab MIRALab.

She was elected Woman of the Year by the Grand Montreal Association for her pioneering work on virtual humans, and her work was presented at the Modern Art Museum of New York in 1988. She moved to the University of Geneva in 1989, where she founded the Swiss MIRALab, an internationally interdisciplinary lab composed of about 25 researchers.

She is author and coauthor of more than 200 research papers and a dozen of books in the field of modeling virtual humans, interacting with them, and living in augmented life. She has received several scientific and artistic awards for her work, mainly on the Virtual Marylin and the film *Rendez-Vous a Montreal*, but more recently, in 1997, she was elected to the Swiss Academy of Technical Sciences, and has been nominated as a Swiss personality who has contributed to the advance of science in the 150 years history.

She has directed and produced several films and real-time mixed-reality shows, among the latest are *Dreams of a Mannequin* (2003), *The Augmented Life in Pompeii* (2004) and *Fashion in Equations* (2005). She is editor-in-chief of the *Visual Computer Journal* published by Springer and Co-editor-in-chief of *Computer Animation and Virtual Worlds* published by John Wiley. She has also participated in political events such as the World Economic Forum in Davos where she was invited to give several talks and seminars.

Qunsheng Peng

Qunsheng Peng is a professor of computer graphics at Zhejiang University. His research interests include realistic image synthesis, computer animation, scientific data visualization, virtual reality, and bio-molecule modeling. In the past few years, he published more than 100 papers concerned with shading models, real-time rendering, curved surface modeling, and infrared image synthesis in international journals and conferences. Among them, two papers won the Best Paper Award of *J. Computer and Graphics* 1988-1989 and the Best Paper Award of Eurographics 89. He has received a number of domestic scientific prizes and is the recipient of Chinagraph 2000 Achievements Award.

Professor Peng graduated from Beijing Mechanical College in 1970 and received a Ph D from the Department of Computing Studies, University of East Anglia in 1983. He currently serves as a member of the editorial boards of several international and Chinese journals.

Matthias Rauterberg

Professor (G.W.) Matthias Rauterberg has held teaching and research positions at the Technical University of Hamburg-Harburg (Germany), University of Oldenburg (Germany), and Swiss Federal Institute of Technology (Switzerland). He was a senior researcher and lecturer for ‘human – computer interaction’ and ‘usability engineering’ in industrial engineering and computer science at the Swiss Federal Institute of Technology (ETH) and at the University of Zurich. He was the head of the Man – Machine Interaction research group (MMI) of the Institute of Hygiene and Applied Physiology (IHA) at the Department of Industrial Engineering (ETH). He holds a Diploma Degree (M Sc) in Computer Science, a Diploma Degree (M Sc) in Psychology, and a Bachelor Degree (B A) in Philosophy. He finished his PhD in Computer Science/Mathematics at the University of Zurich (Institute for Informatics). He is now full professor of Human Communication Technology and head of the research group ‘Designed Intelligence’ at the Department of Industrial Design of the Technical University Eindhoven (The Netherlands), and since 2004 has been visiting professor at the Kwansai Gakuin University (Japan).

Ryohei Nakatsu

Ryohei Nakatsu received a B S, M S, and Ph D degree in electronic engineering from Kyoto University in 1969, 1971, and 1982 respectively. After joining NTT in 1971, he mainly worked on speech recognition technology. In 1994, he joined ATR (Advanced Telecommunications Research Institute) as the president of ATR Media Integration and Communications Research Laboratories. From the spring of 2002 he has been a professor at the School of Science and Technology, Kwansai Gakuin University. At the same time he established a venture company, Nirvana Technology Inc., and became president of the company.

His research interests include emotion extraction from speech and facial images, emotion recognition, nonverbal communications, and integration of multimodalities in communications. In 1978, he received, Young Engineer Award from the Institute of Electronics, Information, and Communication Engineers Japan (IEICE-J). In 1996, he was the recipient of the best paper award from the IEEE International Conference on Multimedia. In 1999, 2000, and 2001, he got the Telecom System Award from the Telecommunication System Foundation and the best paper award from the Virtual Reality Society of Japan. In 2000, he got the best paper award from the Artificial Intelligence Society of Japan. He is a fellow of the IEEE and the Institute of Electronics, Information, and Communication Engineers Japan (IEICE-J), a member of the Acoustical Society of Japan,

Information Processing Society of Japan, and Japanese Society for Artificial Intelligence.

Lizhuang Ma

Lizhuang Ma, was born in 1963, and received his B Sc and Ph D degrees at Zhejiang University, China in 1985 and 1991, respectively. He was a post-doctoral fellow at the Department of Computer Science of Zhejiang University from 1991 to 1993. Dr. Ma was promoted to an Associative Professor and Professor in 1993 and 1995, respectively. Dr. Ma stayed at Zhejiang University from 1991 to 2002. He was a Visiting Professor at Fraunhofer IGD, Darmstadt, Germany from July to Dec. 1998, and visiting Professor at Center for Advanced Media Technology, Nanyang Technological University, Singapore from September 1999 to October 2000. He is now a Professor, PhD tutor, and the head of Digital Media Technology and the Data Reconstruction Lab. at the Department of Computer Science and Engineering, Shanghai Jiao Tong University, China from 2002. He is also the Chairman of the Center of Information Science and Technology for Traditional Chinese Medicine at the Shanghai Traditional Chinese Medicine University.

Dr. Ma has published more than 100 academic research papers both domestic and international journals, for instance, *Science in China*, *Computer-Aided Geometric Design*, and *Computers & Graphics*. The Science Press of Beijing has published a monograph by Dr. Ma, *Techniques and Applications for Computer Aided Geometric Modeling*. Dr. Ma is the recipient of the China National Excellent Young Scientist Foundation Award, first class member of the China National Hundred-Thousand-Ten-Thousand Talent Plan, the China National Award of Science and Technology for Young Scientists, and Second Prize of the Science and Technology of the National Education Bureau. His research interests include computer-aided geometric design, computer graphics, scientific data visualization, computer animation, digital media technology, and theory and applications for computer graphics, CAD/CAM.

Table of Contents

Session 1: Augmented, Virtual and Mixed Reality

A Training Oriented Driving Simulator	1
<i>Chao Sun, Feng Xie, Xiaocao Feng, Mingmin Zhang, and Zhigeng Pan</i>	
Ghost Hunter: A Handheld Augmented Reality Game System with Dynamic Environment	10
<i>Kyusung Cho, Wonhyoung Kang, Jaemin Soh, Juho Lee, and Hyun S. Yang</i>	
Tea Table Mediator: A Multimodal Ambient Display on the Table Exploiting Five Senses Convergence	16
<i>Hyun Sang Cho, Kyoung Shin Park, and Minsoo Hahn</i>	
Measuring Game-Play Performance and Perceived Immersion in a Domed Planetarium Projection Environment	22
<i>Timon Burney and Phillip Lock</i>	
Computer Game for Small Pets and Humans	28
<i>Roger Thomas Kok Chuen Tan, Adrian David Cheok, Roshan Lalintha Peiris, Imiyage Janaka Prasad Wijesena, Derek Bing Siang Tan, Karthik Raveendran, Khanh Dung Thi Nguyen, Yin Ping Sen, and Elvin Zhiwen Yio</i>	

Session 2: Computer Games

Identification with the Player Character as Determinant of Video Game Enjoyment	39
<i>Dorothee Hefner, Christoph Klimmt, and Peter Vorderer</i>	
Pass the Ball: Game-Based Learning of Software Design	49
<i>Guillermo Jiménez-Díaz, Mercedes Gómez-Albarrán, and Pedro A. González-Calero</i>	
Comparison of AI Techniques for Fighting Action Games - Genetic Algorithms/Neural Networks/Evolutionary Neural Networks.....	55
<i>Byeong Heon Cho, Chang Joon Park, and Kwang Ho Yang</i>	
Theory to Practice: Generalized Minimum-Norm Perspective Shadow Maps for Anti-aliased Shadow Rendering in 3D Computer Games	66
<i>Fan Zhang, Hanqiu Sun, Chong Zhao, and Lifeng Wang</i>	

Kansei Games: Entertaining Emotions 79
Ben Salem

Session 3: Image Processing

An Algorithm for Seamless Image Stitching and Its Application 85
Jing Xing, Zhenjiang Miao, and Jing Chen

A New Algorithm for Trademark Image Retrieval Based on Sub-block
of Polar Coordinates 91
Bei-ji Zou, Yi Yao, and Ling Zhang

Image Composition with Blurring Effect from Depth of Field 98
Hai Liu and Lizhuang Ma

Temporal Color Morphing 104
Xuezhong Xiao and Lizhuang Ma

Session 4: Mesh and Modeling

A New Progressive Mesh with Adaptive Subdivision for LOD Models . . . 115
Xiaohu Ma, Jie Wu, and Xiangjun Shen

Topology-Consistent Design for 3D Freeform Meshes with Harmonic
Interpolation 121
Bin Sheng and Enhua Wu

Implementation and Optimization Issues of the Triangular Patch-Based
Terrain System 133
Choong-Gyoo Lim, Seungjo Bae, Kyoung Park, and YoungJik Lee

Deforming Surface Simplification Based on Feature Preservation 139
Shixue Zhang and Enhua Wu

Procedural Modeling of Residential Zone Subject to Urban Planning
Constraints 150
Liyang Wang, Wei Hua, and Hujun Bao

Session 5: Digital Storytelling and Interactive Systems

Concept and Construction of an Interactive Folktale System 162
Kozi Miyazaki, Yurika Nagai, Takenori Wama, and Ryohei Nakatsu

Cultural Computing and the Self Concept: Towards Unconscious
Metamorphosis 171
Tijn Kooijmans and Matthias Rauterberg

A Role Casting Method Based on Emotions in a Story Generation System	182
<i>Ruck Thawonmas, Masanao Kamozaiki, and Yousuke Ohno</i>	
A Novel System for Interactive Live TV	193
<i>Stefan M. Grünvogel, Richard Wages, Tobias Bürger, and Janez Zaletelj</i>	
Using Narrative Cases to Author Interactive Story Content	205
<i>Ivo Swartjes</i>	

Session 6: Sound, Music and Creative Environments

Multi-track Scratch Player on a Multi-touch Sensing Device	211
<i>Kentaro Fukuchi</i>	
PanoMOBI: Panoramic Mobile Entertainment System	219
<i>Barnabas Takacs</i>	
Application MDA in a Collaborative Modeling Environment	225
<i>Wuzheng Tan, Lizhuang Ma, Zhiliang Xu, and Junfa Mao</i>	
Age Invaders: User Studies of Intergenerational Computer Entertainment	231
<i>Eng Tat Khoo, Tim Merritt, Adrian Cheok, Mervyn Lian, and Kelvin Yeo</i>	

Session 7: Video Processing

Dynamic Texture Synthesis in the YUV Color-Space	243
<i>Leilei Xu, Hanqiu Sun, Jiaya Jia, and Chenjun Tao</i>	
Video Affective Content Recognition Based on Genetic Algorithm Combined HMM	249
<i>Kai Sun and Junqing Yu</i>	
Video Processing and Retrieval on Cell Processor Architecture	255
<i>Junqing Yu and Haitao Wei</i>	
A Hybrid Image Coding in Overdriving for Motion Blur Reduction in LCD	263
<i>Jun Wang, Kyeongyuk Min, and Jongwha Chong</i>	
See, Hear or Read the Film	271
<i>Carlos Teixeira and Ana Respicio</i>	

Session 8: Rendering

A Practical Framework for Virtual Viewing and Relighting	282
<i>Qi Duan, Jianjun Yu, Xubo Yang, and Shuangjiu Xiao</i>	

Interactive Image Based Relighting with Physical Light Acquisition	288
<i>Jianjun Yu, Xubo Yang, and Shuangjiu Xiao</i>	
Real-Time Rendering of Daylight Sky Scene for Virtual Environment . . .	294
<i>Changbo Wang</i>	
Robust Dense Depth Acquisition Using 2-D De Bruijn Structured Light	304
<i>Zhiliang Xu, Lizhuang Ma, and Wuzheng Tan</i>	

Session 9: Computer Animation and Networks

Semiautomatic Rule Assist Architecture Modeling	315
<i>Hua Liu, Hongxin Zhang, and Hujun Bao</i>	
Online Expression Mapping for Performance-Driven Facial Animation	324
<i>Hae Won Byun</i>	
Predicting Peer Offline Probability in BitTorrent Using Nonlinear Regression	339
<i>Dongdong Nie, Qinyong Ma, Lizhuang Ma, and Wuzheng Tan</i>	

Session 10: Game Based Interfaces

Game Design Guided by Visual Attention	345
<i>Li Jie and James J. Clark</i>	
Dialogs Taking into Account Experience, Emotions and Personality	356
<i>Anne-Gwenn Bosser, Guillaume Levieux, Karim Sehaba, Axel Buendia, Vincent Corruble, Guillaume de Fondaumière, Viviane Gal, Stéphane Natkin, and Nicolas Sabouret</i>	
Marching Bear: An Interface System Encouraging User’s Emotional Attachment and Providing an Immersive Experience	363
<i>Nagisa Munekata, Takanori Komatsu, and Hitoshi Matsubara</i>	
Marble Market: Bimanual Interactive Game with a Body Shape Sensor	374
<i>Kentaro Fukuchi and Jun Rekimoto</i>	

Session 11: Robots and Cyber Pets

Concept and Architecture of a Centaur Robot	381
<i>Satoshi Tsuda, Yohsuke Oda, Kuniya Shinozaki, and Ryohei Nakatsu</i>	

An Embedded System of Face Recognition Based on ARM and HMM	389
<i>Yanbin Sun, Lun Xie, Zhiliang Wang, and Yi An</i>	
Activity Recognition Using One Triaxial Accelerometer: A Neuro-fuzzy Classifier with Feature Reduction	395
<i>Jhun-Ying Yang, Yen-Ping Chen, Gwo-Yun Lee, Shun-Nan Liou, and Jeen-Shing Wang</i>	
GFE – Graphical Finite State Machine Editor for Parallel Execution ...	401
<i>David Obdrzalek and Jan Benda</i>	
Posters	
Media Me: Body and Personal Media Interaction	407
<i>Owen Noel Newton Fernando, Imiyage Janaka Prasad Wijesena, Adrian David Cheok, Ajith Parakum Madurapperuma, Lochandaka Ranathunga, Mei Gangwen, Miyuru Dayarathna, Srinivasan Mariappan, and Lee Rui Jie Jerome</i>	
Background Subtraction Using Running Gaussian Average and Frame Difference	411
<i>Zhen Tang, Zhenjiang Miao, and Yanli Wan</i>	
Playing and Cheating in Ambient Entertainment	415
<i>Anton Nijholt</i>	
Selfish Search on Playing Shogi	421
<i>Takeshi Ito</i>	
The Effects of Network Loads and Latency in Multiplayer Online Games	427
<i>Jin Ryong Kim, Il Kyu Park, and Kwang Hyun Shim</i>	
Design for Debate in Robotics: Questioning Paradigms in a Techno-social Discourse	433
<i>Wouter Reeskamp and Katrien Ploegmakers</i>	
Extracting Realistic Textures from Reference Spheres	437
<i>Zuoyong Zheng, Lizhuang Ma, and Zhou Zeng</i>	
Application and Research on Affection Model Based on Bayesian Network	441
<i>Lin Shi, Zhiliang Wang, and Zhigang Li</i>	
A Survey on Projector-Based PC Clustered Distributed-Rendering Large Screen Displays and Techniques	445
<i>Munjae Song and Seongwon Park</i>	

Automated Personal Authentication Using Both Palmprints	450
<i>Xiangqian Wu, Kuanquan Wang, and David Zhang</i>	
A TV Commercial Monitoring System Using Audio Fingerprinting	454
<i>Seungjae Lee and Jin S. Seo</i>	
Player Immersion in the Computer Game Narrative	458
<i>Hua Qin, Pei-Luen Patrick Rau, and Gavriel Salvendy</i>	
Music Video Viewers' Preference Evaluation Criteria and Their Characteristics	462
<i>Maiko Kamata and Michiaki Yasumura</i>	
Virtual Consumption: Using Player Types to Explore Virtual Consumer Behavior	466
<i>Penny Drennan and Dominique A. Keeffe</i>	
Codebook Design of Keyblock Based Image Retrieval	470
<i>Hui Liu and Cai-ming Zhang</i>	
Template Based Image Mosaics	475
<i>Yoon-Seok Choi, Bon-Ki Koo, and Ji-Hyung Lee</i>	
Author Index	479