Browse-to-Search *

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ABSTRACT

This demonstration presents a novel interactive online shopping application based on visual search technologies. When users want to buy something on a shopping site, they usually have the requirement of looking for related information from other web sites. Therefore users need to switch between the web page being browsed and other websites that provide search results. The proposed application enables users to naturally search products of interest when they browse a web page, and make their even causal purchase intent easily satisfied. The interactive shopping experience is characterized by: 1) in session—it allows users to specify the purchase intent in the browsing session, instead of leaving the current page and navigating to other websites; 2) in context—the browsed web page provides implicit context information which helps infer user purchase preferences; 3) in focus—users easily specify their search interest using gesture on touch devices and do not need to formulate queries in search box; 4) natural-gesture inputs and visual-based search provides users a natural shopping experience. The system is evaluated against a data set consisting of several millions commercial product images.

Categories and Subject Descriptors

H.5.1. [**Information Interfaces and Presentation (e.g. HCI)**]: Multimedia Information Systems

General Terms

Algorithms, Experiments, Human Factors.

Keywords

Visual search, user interaction, online shopping, gesture

1. INTRODUCTION

Typical online shopping experience mainly contains three activities: *browsing*, *search* and *transaction*. Usually users will spend many efforts in *browsing* and *search* activities to do product research, while the step of placing order costs much less time. Consider the two main categories of shopping websites: 1) online shopping sites like Amazon.com; 2) product search engine like Google Product Search, users often need to frequently switch between *browsing* and *search*. For example, when a user is browsing a laptop product page on Amazon, he or she may also want to search similar products on Amazon, or the price information of the same laptop of other shopping sites. Obviously, the frequent switch between websites is not efficient, especially when touch devices like tablet PC or pad are used.

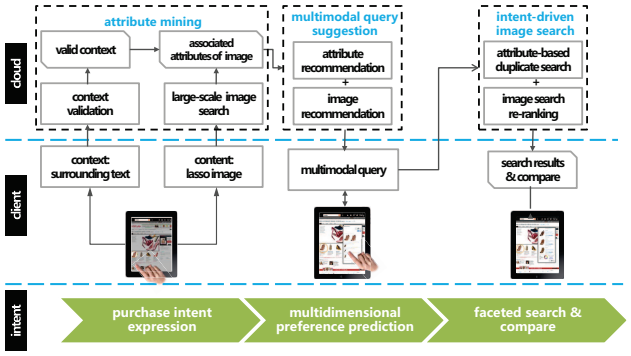

Figure 1: The architecture and process flow.

In the industrial efforts, Google recently released a new feature in Chrome, "Google Related", to recommend relevant information during users' browsing sessions [1]. However, users cannot specify their search intents and in many cases they have to conduct separate search. Some recent academic efforts are towards interactive search [2, 4, 5], but they do not concern the integrated browse and search behaviors.

In this demonstration, we present a novel interactive shopping application. The system involves a natural user interaction which seamlessly integrates the browse and search behaviors to promote user's online shopping experience. The user can specify the purchase intent by selecting objects naturally using gestures (instead of the conventional query methods such as typing keywords in text box or using an input image to do search) when browsing e-commerce websites or even some ordinary Web pages, and to obtain the relevant products instantly within the same browsing session. In this work, we infer user search intent by analyzing visual properties of the user selection, with help of the context information collected from the browsed web page. The faceted search is conducted to rank candidate products.

* This work was performed when Shiyang Lu visited Microsoft Research Asia as a research intern.

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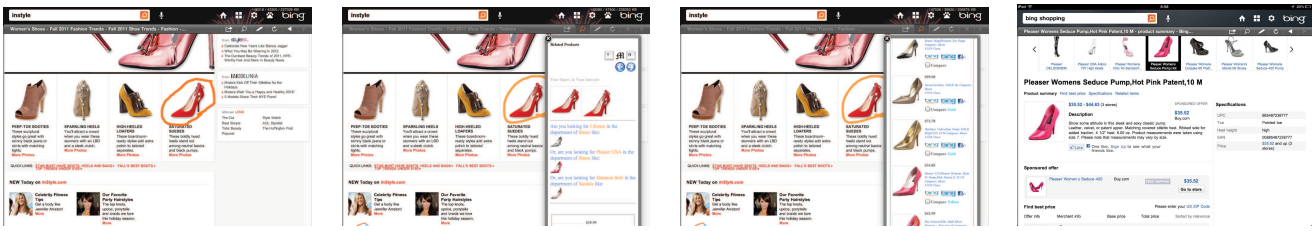
MM'12, October 29–November 2, 2012, Nara, Japan.
ACM 978-1-4503-1089-5/12/10.



(a) Purchase Intent Expression (b) Multi-Preference Prediction (c) Faceted Search & Compare (d) Purchase

Figure 2: User interfaces of the "Browse-to-Search" system.

2. SYSTEM ARCHITECTURE

In order to capture the purchase intent, and facilitate users making further decisions, our system is designed with a three-stage process as illustrated in Fig. 1: 1) purchase intent expression allows users to select the interested product image at the client side using multi-touch gestures on Tablet PC (called "Lasso" gesture in the system). The backend server in the cloud recognizes the selected visual content and also analyzes the surrounding context; 2) multidimensional preference prediction is accomplished through the multi-modality query suggestion strategy at the cloud which recommends the relevant product attributes with the associated images to help users designate the dominant preferences; 3) faceted search & compare performs a joint textual-visual search at the cloud side and return the most relevant products to the users for better decision-making.

3. SYSTEM IMPLEMENTATION

3.1 Purchase Intent Expression

We introduce a natural gesture by circling a region to indicate the object inside the interested image. Such intent expression method provides a unique experience as (1) users do not have to formulate a text query, which is inconvenient for a touch device; and (2) it is not necessary to upload a query image, which usually needs several steps to complete.

Then the selected visual content and the context formed by the surrounding texts are transferred to the cloud side. There are three modules to understand users' intent: (1) *context validation* aims to extract the valid product specific attributes; (2) *large-scale image search* aims to understand the properties of the products by finding similar images from the visual perspective; and (3) *attribute mining* aims to discover attributes, such as the prices, brand names, categories, etc., by analyzing the outputs of the above two modules.

3.2 Multidimensional Preference Prediction

Multimodal query suggestion algorithm [6] runs at the cloud to analyze the multidimensional preferences of the purchase intent among the similar product images, and to suggest the most representative attributes with keywords (by *attribute recommendation*) and images (by *image recommendation*) to the users at the client side.

We use the stored associated metadata of the similar images and the extracted context to exploit the semantic attributes representing the preferences. We bound two characteristics: representativeness and divergence to ensure the suggested attributes are not only representative of the dominant preferences, but also reflect the diversity of aspects.

3.3 Faceted Search & Compare

A two-step *intent-driven image search* process is performed to search the relevant products. The first step is an attribute-based search step, which joins all the faceted aspects of the user intent, visual content and context. The second step is to re-rank the returned images and allow users to compare the products for making a decision.

4. SYSTEM DEMONSTRATION

The system is deployed as an application on iPad and running through a database with 5 million product images, which currently supports 83 product categories. Fig. 2 shows the user interface of the system. A user expresses his/her purchase intent as shown in Fig. 2(a); the preference predicted results shown as Fig. 2(b) and faceted search results shown as Fig. 2(c); Fig. 2(d) shows the linked purchase page if the user clicks the interested product.

We perform the normalized discount accumulation gain (nDCG) measure [6] to evaluate our search strategy. The nDCG score of the top returned products is improved from 45.37% by the vocabulary-tree based method [3] to 75.54% by the proposed method. The subjective evaluation demonstrates the merit of the system with 73.47% satisfying scores on a 12 users feedback. We also evaluate the system latency. Averagely, it returns a satisfying result within 1.5 seconds.

5. CONCLUSIONS

We present a novel system to integrate the browse and search behaviors into one explorative lifecycle for online shopping. The system is deployed on Tablet Pad by taking the advantages of the multi-touch interfaces and the proposed interactive visual search solution. Our experimental results with both objective and subjective evaluations indicate that the system is effective and efficient in terms of search performance, user satisfaction in usability, and overall boosting in online shopping experience.

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October 29 - November 2, 2012
Nara, Japan

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The Proceedings of the 20th ACM International Conference on Multimedia

Co-located with:

ACM Multimedia 2012

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ACM SIGMM

Association for
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2 Penn Plaza, Suite 701
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ISBN: 978-1-4503-1089-5

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Printed in the USA

Message from the General Chairs

We are delighted to welcome you to 20th ACM International Conference on Multimedia, ACM Multimedia 2012, which is held from October 29th to November 2nd, 2012 in Nara, Japan. Welcome to Japan's ancient capital, the cradle of Japanese culture and final destination of the Silk Road.

Like the Silk Road of ancient times, multimedia today provides a medium allowing the diverse exchange of ideas across many fields including signal processing, information retrieval, machine learning, content analysis, networking, applications, human-centered systems, art and education and many more. Because of this confluence, multimedia has become one of the fastest growing and most interesting areas in Computer Science. It is again in 2012 that Nara, Japan is a final destination, this time for sharing ideas in multimedia.

ACM Multimedia is the premier conference and worldwide event bringing together multimedia experts and practitioners across academia and industry. The central feature of the conference, which continues this year as in every year since its inception, is the outstanding Technical Program. This year's conference features both oral and poster presentations covering all aspects of the multimedia field chosen through a highly selective review process. Notably, this year's conference includes special Technical Program activities recognizing the 20th anniversary of ACM Multimedia.

In addition to the Technical Program, this year's conference features a diverse range of activities including Panels, Demonstrations and Tutorials. Additionally, a wide array of Workshops brings focus on new topics for investigation. The conference features also special sessions on Brave New Ideas, a Grand Challenge contest and Open Source Software Competition and includes a Doctoral Symposium for mentoring graduate students. Finally, the conference provides a rich Multimedia Art Exhibition to stimulate artists and researchers alike to meet and discover the frontiers of multimedia artistic communication!

The 20th Anniversary Keynote Talk and 20th Anniversary Panel

This year celebrates the 20th Anniversary of ACM Multimedia, which was first initiated by the ACM SIGMM in 1993. To mark this auspicious occasion, the conference features a 20th Anniversary Keynote Talk and a 20th Anniversary Panel. These two events reflect on major milestones and achievements in multimedia as well as discuss promising ideas and directions for the future.

Innovations for this Year's Conference:

In attempt to continuously improve ACM Multimedia and ensure its vibrant role for the multimedia community, we have made a number of enhancements for this year's conference:

- The Technical Program Committee defined eleven Technical Areas for major focus for this year's conference, including introducing new Technical Areas for Multimedia Activity and Event Understanding and Social Media to reflect their growing interest and promise.
- Technical Short Papers are presented as plenary posters to make them more visible at this year's conference, which reflects the growing quality of short papers.
- Plenary sessions bring singular focus to conference activities in the morning sessions each day, and afternoon sessions are held in parallel to allow pursuit of more specialized interests at the conference.
- Workshops and Tutorials are held on separate days from the main conference in order to reduce conflict with the regular Technical Program.

- Since Workshops are important seeds for the next generation of multimedia, two complementary workshop registrations are provided for invited talks of each workshop to encourage participation of notable speakers.
- The Multimedia Art Exhibition features both invited and selected artists and is open for two weeks in the satellite venue close to the main conference with good public access, which allows stimulation broadly to visitors to Nara.
- Following the last year's precedent, Tutorials are made free for all participants.
- Recognizing that students are the lifeblood of our next generation of multimedia thinkers, this year's Student Travel Grant is greatly expanded.

We hope these innovations make for a special conference this year.

We greatly acknowledge those who have contributed to the success of ACM Multimedia 2012. We thank the many paper authors and proposal contributors for the various technical and program components. We thank the large number of volunteers, including the Organizing Committee members and Technical Program Committee members who worked very hard to create this year's outstanding conference. Every aspect of the conference was also aided by local committee members, mainly from the Kansai area in Japan, to whom we are very grateful. We thank also ACM staff and Sheridan Printing Company for their constant support.

Finally, we thank our many supporters from Japan and around the world who generously supported ACM Multimedia 2012. They include FXPAL, Google, HUAWEI, IBM Research, NTT DOCOMO, Technicolor, DeNA, HP, KDDI R&D Labs, Microsoft Research, Mitsubishi Electric, OMRON, Panasonic, SHARP, YAHOO! LABS, Facebook, foo.log, Fuji Xerox, GREE, IBM Japan, NETCOMPASS, Nikon, NTT DATA, TOSHIBA, YAHOO! JAPAN, ARUBA and CTC. Other generous support was kindly provided by JSPS, KDDI Foundation, Nara Visitors Bureau, Springer, Telecommunication Advancement Foundation.

Enjoy ACM Multimedia 2012!

ACM Multimedia 2012 General Chairs

Kiyoharu Aizawa
The University of Tokyo

Noboru Babaguchi
Osaka Univeristy

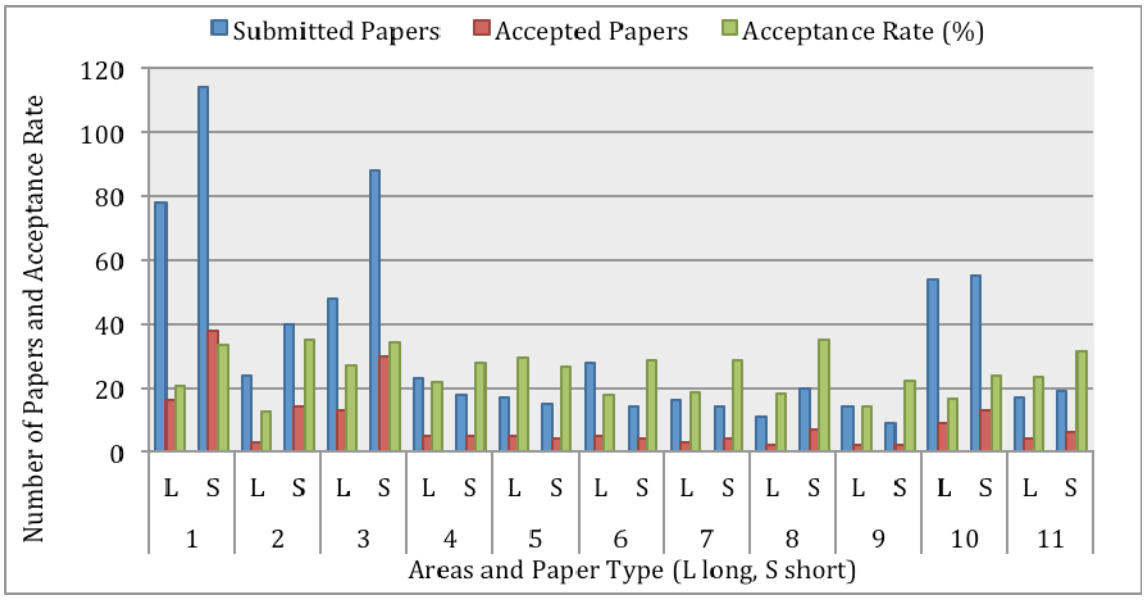
John R. Smith
IBM T. J. Watson Research Center

Message from the Technical Program Chairs

We are very pleased to be able to present an exciting technical program at ACM Multimedia 2012 in Nara, Japan. The outcome of the work of the Technical Program Committee (TPC) is of course entirely depending on the quantity and quality of submitted papers, which was excellent in 2012. Following the guidelines of the ACM Multimedia Review Committee, the conference is structured into 11 Areas, with a two-tier TPC, a double-blind review process, and a target acceptance rate of 20% for long papers and 30% for short papers.

Based on the experience from last year's ACM Multimedia and the responses to our "Call for Areas" that we issued to the community, we selected the following Areas for ACM Multimedia 2012: (1) Media Content Analysis and Processing, (2) Multimedia Activity and Event Understanding, (3) Multimedia Search and Retrieval, (4) Mobile and Location-Based Media, (5) Social Media, (6) Multimedia Systems and Middleware, (7) Media Transport and Sharing, (8) Multimedia Security and Forensics, (9) Multimedia Authoring, Production and Consumption, (10) Multimedia Interaction and Applications, (11) Multimedia Art, Entertainment and Culture.

The two-tier TPC was staffed in a two stage process: first we invited for each area in between two to four Area Chairs, and together with the Area Chairs we invited for the 11 Areas the TPC members. The number of Area Chairs and TPC members per Area was related to the estimated numbers of submissions to the Areas. The response to the Call for Papers in form of long and short papers was overwhelming. Out of all received papers, 331 and 407 papers went through review process for full and short paper track, respectively. The distribution to the different Areas was as expected unbalanced, ranging from the most popular Areas 1 and 10 with 78 and 54 long paper submissions, to the least popular Areas 8 and 9 with 11 and 14 long paper submissions respectively. The following figure gives a full overview on the number of submission and acceptance rate per Area and per paper type.



Each submission was reviewed by at least three TPC members with very few exceptions. The authors of long papers received the reviews and wrote a rebuttal. The reviewers had an on-line discussion of the submissions, their reviews, and the rebuttal comments from the authors. Based on this on-line process, the

Area Chairs wrote a meta-review for each paper before the physical TPC meeting at IBM T. J. Watson Research Center Hawthorn on June 16 and 17.

On the first day of the TPC meeting, the Area Chairs, Technical Program Chairs, and General Chairs worked in breakout sessions and plenary sessions to select the papers to be accepted – except conflict-of-interest papers that were co-authored by Area Chairs. To seek for the fairness, no submissions were made by the General Chairs and Technical Program Chairs. For the selection process, the papers themselves, (meta-) reviews, on-line discussions and authors' rebuttal comments were considered. On the second day, the General Chairs and the TP Chairs finalized the technical program. One important part of this task was discussions and decisions for conflict-of-interest papers. The set of accepted papers results in an overall acceptance rate for long papers of 20.2% and for short papers of 31.2%. Finally, the set of 67 accepted long papers were structured into 17 oral sessions, including the Best Paper session. The Best Paper session comprises four papers from four different areas which compete for the Best Paper Award of ACM Multimedia 2012. The quality of these papers and their diversity promises that this session will be one of the highlights at the conference.

All accepted long papers were shepherded by Area Chairs or TPC members to achieve the highest possible quality for the camera-ready version of the papers. As such, we are now able to present this high quality Technical Program and want to thank all authors, TPC members, and Area Chairs for their dedication and hard work.

We hope to see you in Nara!

Shin'ichi Satoh
National Institute of Informatics, Japan

Thomas Plagemann
University of Oslo, Norway

Xian-Sheng Hua
Microsoft, USA

Rong Yan
Facebook, USA

Message from the ACM SIGMM Chair

ACM Multimedia 2012 is a continuation of an outstanding tradition to present best innovative work in the area of multimedia systems, content, applications, and interfaces, taking a very broad view of what is happening in the multimedia area. This year's ACM Multimedia 2012 is held in Nara, Japan, October 29–November 2, and it represents a very special occasion, since it marks the 20th anniversary of the ACM International Conference Multimedia (ACM Multimedia) venue. The first ACM Multimedia conference was presented in Anaheim, California, USA, August 1–6, 1993. Since then the ACM Special Interest Group in Multimedia (SIGMM) has been a leader in the international multimedia community, annually sponsoring the worldwide premier event in the field. The ACM Multimedia Conference consistently presents the most original, intriguing and important work in its discipline.

During the ACM Multimedia 2012 conference, we celebrate the 20th anniversary of the conference with an exciting program, but especially in this 'Message from the SIGMM chair' I want to stress two important events that are specifically designed to look back, reflect and consider new multimedia opportunities:

- The Panel "**Coulda, Woulda, Shoulda: 20 Years of Multimedia Opportunities**" is moderated by Klara Nahrstedt and Malcolm Slaney, and hosts four distinguished panelists, Lawrence Rowe, Ramesh Jain, Ralf Steinmetz, and Dick Bulterman. These pioneers discuss the exciting opportunities and accomplishments they have witnessed within the multimedia community during their 20 years in the field. They also take note of opportunities missed and express their enthusiasm about those still to come (http://www.acmmm12.org/panel-sessions/).
- The Special Issue on the "**20th Anniversary of ACM SIGMM Multimedia**" appears in the leading multimedia journal, the ACM Transactions on Multimedia Computing, Communications and Applications (TOMMCAP) in 2013, where historical views of multimedia technologies are to be presented together with the impact of past inventions on current and future multimedia technologies. The special issue is led by the Guest Editors, Klara Nahrstedt, Rainer Lienhart and Malcolm Slaney, with extensive support from the TOMCCAP Editor-in-Chief Ralf Steinmetz (http://tomccap.acm.org/TOMCCAP-CFP-2012-v2.pdf).

I wish to thank many members of the SIGMM community for the interesting and innovative ideas to celebrate the ACM Multimedia 20th anniversary, but special thanks goes to Malcolm Slaney, Kiyo Aizawa, Nobory Babaguchi, John Smith, Rainer Lienhart, Mohan Kankanhalli, Ramesh Jain, Ralf Steinmetz, Lawrence Rowe, Dick Bulterman, and our ACM SIGMM coordinator, Fran Spinola.

Klara Nahrstedt
ACM SIGMM Chair

Table of Contents

MM 2012 Conference Organization xxxi

MM 2012 Technical Program Committee xxxiii

MM 2012 Technical Demo Program Committee xxxvii

MM 2012 Area Chairs xxxviii

MM 2012 Additional Reviewers xxxix

MM2012 Sponsor & Supporters xl

Plenary Talk 1

Session Chair: Noboru Babaguchi *(Osaka University)*

- **Future Direction of Digital Content** 1
  Masahiro Fujita *(Sony Corporation)*

Panel 1: 20th Anniversary Panel

Session Chairs: Klara Nahrstedt *(University of Illinois at Urbana-Champaign)* and Malcolm Slaney *(Microsoft)*

- **Coulda, Woulda, Shoulda: 20 Years of Multimedia Opportunities (20th Anniversary Panel)** 3
  Klara Nahrstedt *(University of Ilinois at Urbana-Champaign)*, Malcolm Slaney *(Microsoft)*

Plenary Talk 2

Session Chair: Kiyoharu Aizawa *(The University of Tokyo)*

- **Decoding Visual Experience from the Human Brain** 5
  Yukiyasu Kamitani *(ATR Computational Neuroscience Laboratories)*

Panel 2: Panel Discussion

Session Chairs: Lexing Xie, *(Australian National University)*, David A. Shamma, *(Yahoo! Research)* and Cees Snoek *(University of Amsterdam)*

- **Content is Dead; Long-Live Content!** 7
  Lexing Xie *(Australian National University)*, David Ayman Shamma *(Yahoo! Research)*, Cees Snoek *(University of Amsterdam)*

Best Paper Session

Session Chair: John Smith *(IBM)*

- **Finding Perfect Rendezvous On the Go: Accurate Mobile Visual Localization and Its Applications to Routing** 9
  Heng Liu *(University of Science and Technology of China)*, Tao Mei *(Microsoft Research Asia)*, Jiebo Luo *(University of Rochester)*, Houqiang Li *(University of Science and Technology of China)*, Shipeng Li *(Microsoft Research Asia)*
- **Right Buddy Makes the Difference: An Early Exploration of Social Relation Analysis in Multimedia Applications** 19
  Jitao Sang, Changsheng Xu *(Chinese Academy of Sciences & China Singapore Institute of Digital Media)*
- **Propagation-Based Social-Aware Replication for Social Video Contents** 29
  Zhi Wang, Lifeng Sun *(Tsinghua University)*, Xiangwen Chen *(The Chinese University of Hong Kong)*, Wenwu Zhu *(Tsinghua University)*, Jiangchuan Liu *(Simon Fraser University)*, Minghua Chen *(The Chinese University of Hong Kong)*, Shiqiang Yang *(Tsinghua University)*
- **Action Recognition for Human-Marionette Interaction** 39
  Shih-Yao Lin, Chuen-Kai Shie, Shen-Chi Chen, Yi-Ping Hung *(National Taiwan University)*

Full Paper Session 1: Content-Based Image Retrieval

Session Chair: Benoit Huet *(EURECOM)*

- **A Bag-of-Objects Retrieval Model for Web Image Search** 49
  Yang Yang *(Nanjing University & Microsoft Research Asia)*, Linjun Yang *(Microsoft Research Asia)*, Gangshan Wu *(Nanjing University)*, Shipeng Li *(Microsoft Research Asia)*
- **Harvesting Visual Concepts for Image Search with Complex Queries** 59
  Liqiang Nie, Shuicheng Yan *(National University of Singapore)*, Meng Wang, Richang Hong *(Hefei University of Technology)*, Tat-Seng Chua *(National University of Singapore)*
- **Exploiting Visual Word Co-occurrence for Image Retrieval** 69
  Miaojing Shi, Xinghai Sun *(Peking University)*, Dacheng Tao *(University of Technology)*, Chao Xu *(Peking University)*
- **Attribute Feedback** 79
  Hanwang Zhang, Zheng-Jun Zha, Shuicheng Yan, Jingwen Bian, Tat-Seng Chua *(National University of Singapore)*

Full Paper Session 2: Audio and Music

Session Chair: Gerald Friedland *(ICSI and University of California, Berkeley)*

- **The Acoustic Emotion Gaussians Model for Emotion-Based Music Annotation and Retrieval** 89
  Ju-Chiang Wang *(National Taiwan University & Academia Sinica)*, Yi-Hsuan Yang, Hsin-Min Wang *(Academia Sinica)*, Shyh-Kang Jeng *(National Taiwan University)*
- **Context-Aware Mobile Music Recommendation for Daily Activities** 99
  Xinxi Wang, David Rosenblum, Ye Wang *(National University of Singapore)*
- **MusicScore: Mobile Music Composition for Practice and Fun** 109
  Zimu Liu, Yuan Feng, Baochun Li *(University of Toronto)*
- **Modeling the QoE of Rate Changes in SKYPE/SILK VoIP Calls** 119
  Chien-nan Chen, Cing-yu Chu, Su-ling Yeh, Hao-hua Chu, Polly Huang *(National Taiwan University)*

Full Paper Session 3: Video Applications

Session Chair: Alexander G. Hauptmann *(Carnegie Mellon University)*

- **PaperVideo: Interacting with Videos on Multiple Paper-like Displays** 129
  Roman Lissermann *(Technische Universität Darmstadt)*, Simon Olberding *(Massachusetts Institute of Technology)*, Benjamin Petry, Max Mühlhäuser *(Technische Universität Darmstadt)*, Jürgen Steimle *(Massachusetts Institute of Technology)*
- **MoViMash: Online Mobile Video Mashup** 139
  Mukesh Saini, Raghudeep Gadde, Shuicheng Yan, Wei Tsang Ooi *(National University of Singapore)*
- **An Interactive System of Stereoscopic Video Conversion** 149
  Zhebin Zhang, Chen Zhou, Bo Xin, Yizhou Wang, Wen Gao *(Peking University)*
- **Enabling "Togetherness" in High-Quality Domestic Video Conferencing** 159
  Ian Kegel *(BT Research & Technology)*, Pablo Cesar, Jack Jansen, Dick Bulterman *(Centrum Wiskunde & Informatica)*, Tim Stevens *(BT Research & Technology)*, Joke Kort *(TNO ICT)*, Nikolaus Färber *(Fraunhofer IIS)*

Full Paper Session 4: Large Scale Search

Session Chair: Chong-Wah Ngo *(City University of Hong Kong)*

- **Scalar Quantization for Large Scale Image Search** 169
  Wengang Zhou *(University of Texas at San Antonio)*, Yijuan Lu *(Texas State University)*, Houqiang Li *(University of Science and Technology of China)*, Qi Tian *(University of Texas at San Antonio)*
- **Query-Driven Iterated Neighborhood Graph Search for Large Scale Indexing** 179
  Jingdong Wang, Shipeng Li *(Microsoft Research Asia)*

- **SymCity: Feature Selection by Symmetry for Large Scale Image Retrieval** 189
  Giorgos Tolias, Yannis Kalantidis, Yannis Avrithis *(National Technical University of Athens)*
- **Embedding Spatial Context Information into Inverted File for Large-Scale Image Retrieval** 199
  Zhen Liu, Houqiang Li *(University of Science and Technology of China)*,
  Wengang Zhou, Qi Tian *(University of Texas at San Antonio)*

Full Paper Session 5: Person and Face Analysis

Session Chair: Nicu Sebe *(University of Trento)*

- **A Smile Can Reveal Your Age: Enabling Facial Dynamics in Age Estimation** 209
  Hamdi Dibeklioğlu, Theo Gevers *(University of Amsterdam)*, Albert Ali Salah *(Boğaziçi University)*,
  Roberto Valenti *(University of Amsterdam)*
- **Unsupervised Face-Name Association via Commute Distance** 219
  Jiajun Bu, Bin Xu, Chenxia Wu, Chun Chen, Jianke Zhu, Deng Cai, Xiaofei He *(Zhejiang University)*
- **On Shape and the Computability of Emotions** 229
  Xin Lu, Poonam Suryanarayan, Reginald B. Adams Jr. , Jia Li, Michelle G. Newman, James Z. Wang
  (The Pennsylvania State University)
- **Sense Beauty via Face, Dressing, and/or Voice** 239
  Tam V. Nguyen, Si Liu *(National Laboratory of Pattern Recognition)*,
  Bingbing Ni *(Advanced Digital Sciences Center)*, Jun Tan *(National University of Defense Technology)*,
  Yong Rui *(Microsoft Research Asia)*, Shuicheng Yan *(National University of Singapore)*

Full Paper Session 6: Video Distribution

Session Chair: Nalini Venkatasubrahanian *(University of California, Irvine)*

- **Leveraging Social Network Concepts for Efficient Peer-to-Peer Live Streaming Systems** 249
  Haiying Shen, Ze Li, Hailang Wang *(Clemson University)*, Jin Li *(Microsoft Research)*
- **Jetway: Minimizing Costs on Inter-Datacenter Video Traffic** 259
  Yuan Feng, Baochun Li *(University of Toronto)*, Bo Li *(Hong Kong University of Science and Technology)*
- **Control of Distributed Servers for Quality-Fair Delivery of Multiple Video Streams** 269
  Nesrine Changuel, Bessem Sayadi *(Alcatel-Lucent Bell Labs)*, Michel Kieffer *(University of Paris-Sud)*
- **GreenTube: Power Optimization for Mobile Videostreaming via Dynamic Cache Management** 279
  Xin Li *(George Mason University)*, Mian Dong, Zhan Ma, Felix Fernandes *(Samsung Telecommunications America)*

Full Paper Session 7: Visual Search

Session Chair: Qi Tian *(University of Texas at San Antonio)*

- **A Multimedia Analytics Framework for Browsing Image Collections in Digital Forensics** 289
  Marcel Worring, Andreas Engl, Camelia Smeria *(University of Amsterdam)*
- **Submodular Video Hashing: A Unified Framework Towards Video Pooling and Indexing** 299
  Liangliang Cao *(IBM T.J. Watson Research Center)*,
  Zhenguo Li, Yadong Mu, Shih-Fu Chang *(Columbia University)*
- **Exploratory Search of Long Surveillance Videos** 309
  Greg Castañón, Venkatesh Saligrama *(Boston University)*,
  André Louis Caron, Pierre-Marc Jodoin *(Université de Sherbrooke)*
- **When Video Search Goes Wrong: Predicting Query Failure Using Search Engine Logs and Visual Search Results** 319
  Christoph Kofler *(Delft University of Technology)*, Linjun Yang *(Microsoft Research Asia)*,
  Martha Larson *(Delft University of Technology)*, Tao Mei *(Microsoft Research Asia)*,
  Alan Hanjalic *(Delft University of Technology)*, Shipeng Li *(Microsoft Research Asia)*

Full Paper Session 8: Human-centric Media

Session Chair: Frank Nack *(University of Amsterdam)*

- **Don't Ask Me What I'm Like, Just Watch and Listen** 329
  Ruchir Srivastava, Jiashi Feng *(National University of Singapore)*, Sujoy Roy *(Institute for Infocomm Research)*, Shuicheng Yan, Terence Sim *(National University of Singapore)*
- **Controlling Urban Lighting by Human Motion Patterns Results from a Full Scale Experiment** 339
  Esben Skouboe Poulsen, Hans Jørgen Andersen, Ole B. Jensen, Rikke Gade, Tobias Thyrrestrup, Thomas B. Moeslund *(Aalborg University)*
- **In the Eye of the Beholder: Employing Statistical Analysis and Eye Tracking for Analyzing Abstract Paintings** 349
  Victoria Yanulevskaya, Jasper Uijlings, Elia Bruni *(University of Trento)*, Andreza Sartori *(University of Trento & Telecom Italia - SKIL)*, Elisa Zamboni *(University of Trento)*, Francesca Bacci *(Museum of Art of Trento and Rovereto)*, David Melcher, Nicu Sebe *(University of Trento)*
- **Online Crowdsourcing Subjective Image Quality Assessment** 359
  Qianqian Xu, Qingming Huang *(Chinese Academy of Sciences)*, Yuan Yao *(Peking University)*
- **Full Paper Session 9: Presentation and Organization** .....
  Session Chair: Heng Tao Shen *(The University of Queensland)*
- **Image Colorization Using Similar Images** 369
  Raj Kumar Gupta *(Nanyang Technological University)*, Alex Yong-Sang Chia *(Institute for Infocomm Research)*, Deepu Rajan *(Nanyang Technological University)*, Ee Sin Ng, Huang Zhiyong *(Institute for Infocomm Research)*
- **Semi-Automated Magazine Layout Using Content-Based Image Features** 379
  Mikko Kuhna, Ida-Maria Kivelä, Pirkko Oittinen *(Aalto University)*
- **Understanding Screen Contents for Building a High Performance, Real Time Screen Sharing System** 389
  Surendar Chandra, Jacob T. Biehl, John Boreczky, Scott Carter, Lawrence A. Rowe *(FX Palo Alto Laboratory Inc.)*
- **El-pincel - A Painter Cloud Service for Greener Web Pages** 399
  Bhojan Anand, Lee Kee Chong, Ee-Chien Chang, Mun Choon Chan, Ananda L. Akkihebbal, Wei Tsang Ooi *(National University of Singapore)*

Full Paper Session 10: Haptics

Session Chair: Yuichi Nakamura *(Kyoto University)*

- **Low Bitrate Source-Filter Model Based Compression of Vibrotactile Texture Signals in Haptic Teleoperation** 409
  Rahul Chaudhari, Burak Çizmeci *(Technische Universität München)*, Katherine J. Kuchenbecker *(University of Pennsylvania)*, Seungmoon Choi *(POSTECH)*, Eckehard Steinbach *(Technische Universität München)*
- **Vibrotactile Feedback of Motor Performance Errors for Enhancing Motor Learning** 419
  Troy McDaniel, Morris Goldberg, Shantanu Bala, Bijan Fakhri, Sethuraman Panchanathan *(Arizona State University)*
- **MOGAT: Mobile Games with Auditory Training for Children with Cochlear Implants** 429
  Yinsheng Zhou, Khe Chai Sim *(National University of Singapore)*, Patsy Tan *(Singapore General Hospital)*, Ye Wang *(National University of Singapore)*

Full Paper Session 11: Event Recognition

Session Chair: Ansgar Scherp *(University of Koblenz-Landau)*

- **Visual Knowledge Transfer Among Multiple Cameras for People Counting with Occlusion Handling** 439
  Ming-Fang Weng, Yen-Yu Lin, Nick C. Tang, Hong-Yuan Mark Liao *(Academia Sinica)*
- **Leveraging High-Level and Low-Level Features for Multimedia Event Detection** 449
  Lu Jiang, Alexander G. Hauptmann, Guang Xiang *(Carnegie Mellon University)*

- **Interactive Data-Driven Discovery of Temporal Behavior Models from Events in Media Streams** 459
  Chreston Miller, Francis Quek *(Virginia Tech)*
- **Knowledge Adaptation for Ad Hoc Multimedia Event Detection with Few Exemplars** 469
  Zhigang Ma *(University of Trento)*, Yi Yang, Yang Cai *(Carnegie Mellon University)*, Nicu Sebe *(University of Trento)*, Alexander G. Hauptmann *(Carnegie Mellon University)*

Full Paper Session 12: Semantic Tagging

Session Chair: Lexing Xie *(Australian National University)*

- **Multi-View Learning from Imperfect Tagging** 479
  Zhongang Qi, Ming Yang, Zhongfei (Mark) Zhang *(Zhejiang University)*, Zhengyou Zhang *(Microsoft Research)*
- **Joint Statistical Analysis of Images and Keywords with Applications in Semantic Image Enhancement** 489
  Albrecht Lindner, Appu Shaji *(École Polytechnique Fédérale de Lausanne)*, Nicolas Bonnier *(Océ Print Logic Technologies)*, Sabine Süsstrunk *(École Polytechnique Fédérale de Lausanne)*
- **Image Annotation by Semantic Sparse Recoding of Visual Content** 499
  Zhiwu Lu, Yuxin Peng *(Peking University)*
- **Annotating Web Images Using NOVA: NOn-conVex group spArsity** 509
  Fei Wu, Ying Yuan *(Zhejiang University)*, Yong Rui *(Microsoft Research Asia)*, Shuicheng Yan *(NUS)*, Yueting Zhuang *(Zhejiang University)*

Full Paper Session 13: Image Analysis

Session Chair: Shuicheng Yan *(National University of Singapore)*

- **Query-Adaptive Shape Topic Mining for Hand-Drawn Sketch Recognition** 519
  Zhenbang Sun *(Shanghai Jiao Tong University)*, Changhu Wang *(Microsoft Research Asia)*, Liqing Zhang *(Shanghai Jiao Tong University)*, Lei Zhang *(Microsoft Research Asia)*
- **Correlated Attribute Transfer with Multi-Task Graph-Guided Fusion** 529
  Yahong Han *(Tianjin University)*, Fei Wu, Xinyan Lu *(Zhejiang University)*, Qi Tian *(University of Texas at San Antonio)*, Yueting Zhuang *(Zhejiang University)*, Jiebo Luo *(University of Rochester)*
- **Spatial Pooling of Heterogeneous Features for Image Applications** 539
  Lingxi Xie *(Tsinghua University)*, Qi Tian *(University of Texas at San Antonio)*, Bo Zhang *(Tsinghua University)*
- **Efficient Image Annotation for Automatic Sentence Generation** 549
  Yoshitaka Ushiku *(The University of Tokyo)*, Tatsuya Harada *(The University of Tokyo & JST PRESTO)*, Yasuo Kuniyoshi *(The University of Tokyo)*

Full Paper Session 14: Mobile Systems

Session Chair: Tao Mei *(Microsoft Research Asia)*

- **Dinner of Luciérnaga: An Interactive Play with iPhone App in Theater** 559
  Yu-Chuan Tseng *(Shih Hsin University)*, Kuan-Ying Wu *(National Chiao Tung University)*, Yi-Ching Huang *(National Taiwan University)*, Chi-Ping Chin *(MUTIENLIAO Interactive dot TW)*
- **Accelerating SURF Detector on Mobile Devices** 569
  Xin Yang, Kwang-Ting (Tim) Cheng *(University of California, Santa Barbara)*
- **IMShare: Instantly Sharing Your Mobile Landmark Images by Search-based Reconstruction** 579
  Lican Dai *(University of Science and Technology of China)*, Huanjing Yue *(Tianjin University)*, Xiaoyan Sun, Feng Wu *(Microsoft Research Asia)*
- **Discovering Areas of Interest with Geo-tagged Images and Check-ins** 589
  Jiajun Liu, Zi Huang *(The University of Queensland)*, Lei Chen *(Hong Kong University of Science and Technology)*, Heng Tao Shen *(The University of Queensland)*, Zhixian Yan *(École Polytechnique Fédérale de Lausanne)*

Full Paper Session 15: Image Content Analysis

Session Chair: Winston Hsu *(National Taiwan University)*

- **Scalable Mining of Small Visual Objects** 599
  Pierre Letessier *(INA & INRIA Sophia-Antipolis)*, Olivier Buisson *(INA)*, Alexis Joly *(INRIA Sophia-Antipolis)*
- **Snap-and-Ask: Answering Multimodal Question by Naming Visual Instance** 609
  Wei Zhang, Lei Pang, Chong-Wah Ngo *(City University of Hong Kong)*
- **"Hi, Magic Closet, Tell Me What to Wear!"** 619
  Si Liu *(National University of Singapore & Chinese Academy of Sciences)*,
  Jiashi Feng, Zheng Song *(National University of Singapore)*, Tianzhu Zhang *(Advanced Digital Sciences Center)*,
  Hanqing Lu, Changsheng Xu *(Chinese Academy of Sciences)*, Shuicheng Yan *(National University of Singapore)*
- **Constraint-Optimized Keypoint Inhibition/Insertion Attack: Security Threat to Scale-Space Image Feature Extraction** 629
  Chun-Shien Lu, Chao-Yung Hsu *(Academia Sinica)*

Full Paper Session 16: Social Media

Session Chair: Zhen Wen *(IBM T.J. Watson Research Center)*

- **Mining In-Class Social Networks for Large-Scale Pedagogical Analysis** 639
  Xiao-Yong Wei, Zhen-Qun Yang *(Sichuan University)*
- **SocialTransfer: Cross-Domain Transfer Learning from Social Streams for Media Applications** 649
  Suman D. Roy *(University of Missouri)*, Tao Mei *(Microsoft Research Asia)*,
  Wenjun Zeng *(University of Missouri)*, Shipeng Li *(Microsoft Research Asia)*
- **Hybrid Social Media Network** 659
  Dong Liu, Guangnan Ye, Ching-Ting Chen *(Columbia University)*,
  Shuicheng Yan *(National University of Singapore)*, Shih-Fu Chang *(Columbia University)*
- **Discovering Informative Social Subgraphs and Predicting Pairwise Relationships from Group Photos** 669
  Yan-Ying Chen *(National Taiwan University & Academia Sinica)*, Winston H. Hsu *(National Taiwan University)*,
  Hong-Yuan Mark Liao *(Academia Sinica)*

Author Index 679

Poster Session 1

Session Chair: Alberto Del Bimbo *(University of Florence)*

- **Video Saliency Detection in the Compressed Domain** 697
  Yuming Fang, Weisi Lin, Zhenzhong Chen *(Nanyang Technological University)*,
  Chia-Ming Tsai *(National Chung Cheng University)*, Chia-Wen Lin *(National Tsing Hua University)*
- **A Robust and Efficient Shot Boundary Detection Approach Based on Fisher Criterion** 701
  Chi Zhang, Weiqiang Wang *(Chinese Academy of Sciences)*
- **A Genetic Algorithm for Audio Retargeting** 705
  Stephan Wenger, Marcus Magnor *(Technische Universität Braunschweig)*
- **Seam Carving with Forward Gradient Difference Maps** 709
  Hyeonwoo Noh, Bohyung Han *(POSTECH)*
- **Surveillance Video Coding via Low-Rank and Sparse Decomposition** 713
  Chongyu Chen, Jianfei Cai, Weisi Lin *(Nanyang Technological University)*, Guangming Shi *(Xidian University)*
- **Enhanced Extraction of Moving Objects in Variable Bit-Rate Video Streams** 717
  Jui-Yu Yen , Bo-Hao Chen, Shih-Chia Huang *(National Taipei University of Technology)*
- **Context-Aware Affective Images Classification Based on Bilayer Sparse Representation** 721
  Bing Li, Weihua Xiong, Weiming Hu *(Chinese Academy of Sciences)*,
  Xinmiao Ding *(Shandong Institute of Business and Technology)*

- **Gabor-Based Gradient Orientation Pyramid for Kinship Verification Under Uncontrolled Environments** 725
  Xiuzhuang Zhou *(Capital Normal University)*, Jiwen Lu *(Advanced Digital Sciences Center)*, Junlin Hu *(Nanyang Technological University)*, Yuanyuan Shang *(Capital Normal University)*
- **Robust Stroke-Based Video Animation via Layered Motion and Correspondence** 729
  Tao Lin *(Sun Yat-Sen University)*, Liang Lin *(Sun Yat-Sen University & Lotus Hill Research Institute)*, Qing Wang *(Sun Yat-Sen University)*
- **Texture Optimization for Seamless View Synthesis through Energy Minimization** 733
  Wenxiu Sun, Oscar C. Au, Lingfeng Xu, Yujun Li, Wei Hu, Zhiding Yu *(The Hong Kong University of Science and Technology)*
- **Semi-Supervised Multi-Instance Multi-Label Learning for Video Annotation Task** 737
  Xin-Shun Xu *(Shandong University & Nanjing University)*, Yuan Jiang *(Nanjing University)*, Xiangyang Xue *(Fudan University)*, Zhi-Hua Zhou *(Nanjing University)*
- **Geo-Location Inference on News Articles via Multimodal pLSA** 741
  Youjie Zhou *(University of North Carolina, Charlotte)*, Jiebo Luo *(University of Rochester)*
- **A Method for Detecting Salient Regions Using Integrated Features** 745
  Zhendong Mao *(Chinese Academy of Sciences & Nanjing University of Posts and Telecommunications)*, Yongdong Zhang, Ke Gao, Dongming Zhang *(Chinese Academy of Sciences)*
- **Deep Nonlinear Metric Learning with Independent Subspace Analysis for Face Verification** 749
  Xinyuan Cai, Chunheng Wang, Baihua Xiao, Xue Chen, Ji Zhou *(Chinese Academy of Sciences)*
- **Color Transfer Based on Multiscale Gradient-aware Decomposition and Color Distribution Mapping** 753
  Zhuo Su, Daiguo Deng, Xue Yang, Xiaonan Luo *(Sun Yat-sen University)*
- **On Sparse and Low-Rank Matrix Decomposition for Singing Voice Separation** 757
  Yi-Hsuan Yang *(Academia Sinica)*
- **Memorable Basis: Towards Human-Centralized Sparse Representation** 761
  Xiaoshuai Sun, Hongxun Yao *(Harbin Institute of Technology)*
- **Detecting Text in the Real World** 765
  Trung Quy Phan, Palaiahnakote Shivakumara, Chew Lim Tan *(National University of Singapore)*
- **Face Image Super-Resolution via Nearest Feature Line** 769
  Zhen Han, Junjun Jiang, Ruimin Hu, Tao Lu, Kebin Huang *(Wuhan University)*
- **Modalities Consensus for Multi-Modal Constraint Propagation** 773
  Zhenyong Fu, Hongtao Lu *(Shanghai Jiao Tong University)*, Horace H.S. Ip *(City University of Hong Kong)*, Zhiwu Lu *(Peking University)*
- **Joint Semantic Segmentation by Searching for Compatible-Competitive References** 777
  Ping Luo, Xiaogang Wang *(The Chinese University of Hong Kong & Chinese Academy of Sciences)*, Liang Lin *(Sun Yat-sen University)*, Xiaoou Tang *(The Chinese University of Hong Kong & Chinese Academy of Sciences)*
- **An Effective Multi-Clue Fusion Approach for Web Video Topic Detection** 781
  Tianlong Chen *(Chinese Academy of Sciences)*, Chunxi Liu *(Graduate University of Chinese Academy of Sciences)*, Qingming Huang *(Chinese Academy of Sciences)*
- **3D Fingertip and Palm Tracking in Depth Image Sequences** 785
  Hui Liang *(Nanyang Technological University & Graduate University of Chinese Academy of Sciences)*, Junsong Yuan, Daniel Thalmann *(Nanyang Technological University)*
- **From Speech to Personality: Mapping Voice Quality and Intonation into Personality Differences** 789
  Gelareh Mohammadi *(Idiap Research Institute)*, Antonio Origlia *(University of Naples)*, Maurizio Filippone *(University of Glasgow)*, Alessandro Vinciarelli *(University of Glasgow and Idiap Research Institute)*

- **Predicting the Conflict Level in Television Political Debates: An Approach Based on Crowdsourcing, Nonverbal Communication and Gaussian Processes** 793
  Samuel Kim *(Idiap Research Institute)*, Maurizio Filippone *(University of Glasgow)*,
  Fabio Valente *(École Polytechnique Fédérale de Lausanne & University of Glasgow)*,
  Alessandro Vinciarelli *(Idiap Research Institute & University of Glasgow)*
- **Using Structural Patches Tiling to Guide Human Head-Shoulder Segmentation** 797
  Pengyang Bu, Nan Wang, Haizhou Ai *(Tsinghua University)*
- **Video Object Segmentation with Shortest Path** 801
  Bao Zhang, Handong Zhao, Xiaochun Cao *(Tianjin University)*
- **Video Object Cosegmentation** 805
  Ding-Jie Chen, Hwann-Tzong Chen, Long-Wen Chang *(National Tsing Hua University)*
- **Community as a Connector: Associating Faces with Celebrity Names in Web Videos** 809
  Zhineng Chen, Chong-Wah Ngo *(City University of Hong Kong)*, Juan Cao *(Chinese Academy of Sciences)*,
  Wei Zhang *(City University of Hong Kong)*
- **Comparison of Prediction-based Fusion and Feature-Level Fusion across Different Learning Models** 813
  Stavros Petridis, Sanjay Bilakhia *(Imperial College London)*,
  Maja Pantic *(Imperial College London & University Twente)*
- **Depth Estimation for Semi-Automatic 2D to 3D Conversion** 817
  Richard Rzeszutek, Raymond Phan, Dimitrios Androutsos *(Ryerson University)*
- **Predicting Domain Adaptivity: Redo or Recycle?** 821
  Ting Yao, Chong-Wah Ngo, Shiai Zhu *(City University of Hong Kong)*
- **Music/Speech Classification Using High-Level Features Derived from FMRI Brain Imaging** 825
  Xi Jiang *(The University of Georgia)*,
  Tuo Zhang *(Northwestern Polytechnical University & The University of Georgia)*,
  Xintao Hu *(Northwestern Polytechnical University)*, Lie Lu *(Dolby Laboratories)*,
  Junwei Han, Lei Guo *(Northwestern Polytechnical University)*, Tianming Liu *(The University of Georgia)*
- **Bilingual Analysis of Song Lyrics and Audio Words** 829
  Jen-Yu Liu, Chin-Chia Yeh, Yi-Hsuan Yang, Yuan-Ching Teng *(Academia Sinica)*
- **Self-Paced Dictionary Learning for Image Classification** 833
  Ye Tang, Yu-Bin Yang, Yang Gao *(Nanjing University)*
- **Cross Matching of Music and Image** 837
  Xixuan Wu *(Chinese Academy of Sciences & The Chinese University of Hong Kong)*,
  Yu Qiao *(Chinese Academy of Sciences)*, Xiaogang Wang *(The Chinese University of Hong Kong)*,
  Xiaoou Tang *(Chinese Academy of Sciences & The Chinese University of Hong Kong)*
- **Name that Room: Room Identification Using Acoustic Features in a Recording** 841
  Nils Peters, Howard Lei, Gerald Friedland *(International Computer Science Institute)*
- **Enhancing Visual Dominance by Semantics-Preserving Image Recomposition** 845
  Lai-Kuan Wong, Kok-Lim Wong *(National University of Singapore)*
- **Image Tag Re-Ranking by Coupled Probability Transition** 849
  Jie Xiao, Wengang Zhou, Xia Li *(University of Texas at San Antonio)*,
  Meng Wang *(Hefei University of Technology)*, Qi Tian *(University of Texas at San Antonio)*
- **Low Rank Metric Learning for Social Image Retrieval** 853
  Zechao Li, Jing Liu, Yu Jiang *(Chinese Academy of Sciences)*,
  Jinhui Tang *(Nanjing University of Science and Technology)*, Hanqing Lu *(Chinese Academy of Sciences)*
- **Can We Understand van Gogh's Mood? Learning to Infer Affects from Images in Social Networks** 857
  Jia Jia
  (Ministry of Education, Tsinghua National Laboratory for Information and Technology & Tsinghua University),
  Sen Wu, Xiaohui Wang, Peiyun Hu, Lianhong Cai, Jie Tang *(Tsinghua University)*

- **Social Tag Alignment with Image Regions by Sparse Reconstructions** 861
  Yang Liu, Jing Liu, Zechao Li, Biao Niu, Hanqing Lu *(Chinese Academy of Sciences)*
- **Social Event Detection with Interaction Graph Modeling** 865
  Yanxiang Wang *(Australian National University)*, Hari Sundaram *(Arizona State University)*, Lexing Xie *(Australian National University, NICTA)*

Poster Session 2

Session Chair: Liangliang Cao *(IBM T. J. Watson Research Center)*

- **Visual Query Attributes Suggestion** 869
  Jingwen Bian, Zheng-Jun Zha, Hanwang Zhang *(National University of Singapore)*, Qi Tian *(University of Texas at San Antonio)*, Tat-Seng Chua *(National University of Singapore)*
- **Attribute-Assisted Reranking for Web Image Retrieval** 873
  Junjie Cai *(University of Texas at San Antonio)*, Zheng-Jun Zha *(National University of Singapore)*, Wengang Zhou, Qi Tian *(University of Texas at San Antonio)*
- **Query Expansion Enhancement by Fast Binary Matching** 877
  Xia Li, Wengang Zhou *(The University of Texas at San Antonio)*, Jinhui Tang *(Nanjing University of Science and Technology)*, Qi Tian *(The University of Texas at San Antonio)*
- **Compact Kernel Hashing with Multiple Features** 881
  Xianglong Liu *(Beihang University)*, Junfeng He *(Columbia University)*, Di Liu *(China Academy of Telecommunication Research of MIIT)*, Bo Lang *(Beihang University)*
- **Similar Image Search with a Tiny Bag-of-Delegates Representation** 885
  Weiwen Tu, Rong Pan *(Sun Yat-sen University)*, Jingdong Wang *(Microsoft Research Asia)*
- **Online Non-Feedback Image Re-Ranking via Dominant Data Selection** 889
  Chen Cao, Shifeng Chen, Yuhong Li *(Chinese Academy of Sciences)*, Jianzhuang Liu *(Chinese Academy of Sciences, Chinese University of Hong Kong & Huawei Technologies Co. Ltd.)*
- **Optimal Semi-Supervised Metric Learning for Image Retrieval** 893
  Kun Zhao *(Chinese Academy of Sciences)*, Wei Liu *(Columbia University)*, Jianzhuang Liu *(Chinese Academy of Sciences, CUHK & Huawei Technologies Co. Ltd.)*
- **View-Based 3D Object Retrieval by Bipartite Graph Matching** 897
  Yue Wen *(Tsinghua University)*, Yue Gao *(Tsinghua University & National University of Singapore)*, Richang Hong *(Hefei University of Technology)*, Huanbo Luan *(Tsinghua University & National University of Singapore)*, Qiong Liu *(Huazhong University of Science and Technology)*, Jialie Shen *(Singapore Management University)*, Rongrong Ji *(Columbia University)*
- **Local Geometry Adaptive Manifold Re-Ranking for Shape-Based 3D Object Retrieval** 901
  Ryutarou Ohbuchi, Yukinori Kurita *(University of Yamanashi)*
- **DLMSearch: Diversified Landmark Search by Photo** 905
  Junfeng Ye, Jia Chen, Zejia Chen, Yihe Zhu *(Shanghai Jiao Tong University)*, Shenghua Bao, Zhong Su *(IBM China Research Laboratory)*, Yong Yu *(Shanghai Jiao Tong University)*
- **Fast Semantic Image Retrieval Based on Random Forest** 909
  Hao Fu, Guoping Qiu *(University of Nottingham)*
- **Sketch-Based Image Retrieval on Mobile Devices Using Compact Hash Bits** 913
  Kai-Yu Tseng, Yen-Liang Lin, Yu-Hsiu Chen, Winston H. Hsu *(National Taiwan University)*
- **Towards Relevance and Saliency Ranking of Image Tags** 917
  Songhe Feng, Congyan Lang *(Beijing Jiaotong University)*, Bing Li *(NLPR, Institute of Automation & Chinese Academy of Sciences)*
- **Mobile-Based Advertisement Information Retrieval from Images and Websites** 921
  Yi-Feng Pan, Jian Sun, Siyuan Chen, Yuan He, Yingju Xia, Jun Sun, Satoshi Naoi *(Fujitsu R&D Center Co., Ltd.)*
- **A User Study on Image Browsing on Touchscreens** 925
  David Ahlström, Marco A. Hudelist, Klaus Schoeffmann *(Alpen-Adria-Universität Klagenfurt)*, Gerald Schaefer *(Loughborough University)*

- **Discriminative ICA Model with Reconstruction Constraint for Image Classification** 929
  Yanhui Xiao, Zhenfeng Zhu, Shikui Wei, Yao Zhao *(Beijing Jiaotong University)*
- **Search Web Images Using Objects, Backgrounds and Conditions** 933
  Jiemi Zhang, Chenxia Wu, Deng Cai *(Zhejiang University)*
- **Sparsity Cue in Image Copy Detection** 937
  Huan-Cheng Hsu, Chun-Rong Huang *(National Chung Hsing University)*, Chun-Shien Lu *(Academia Sinica)*
- **Near-Duplicate Video Retrieval Based on Clustering by Multiple Sequence Alignment** ... 941
  Yandan Wang *(Monash University)*, Mohammed Belkhatir *(University of Lyon)*,
  Bashar Tahayna *(Monash University)*
- **Neighborhood Preserving Hashing for Fast Similarity Search** 945
  Cong Liu, Hefei Ling, Fuhao Zou, Lingyu Yan *(Huazhong University of Science and Technology)*
- **Face Photo Retrieval by Sketch Example** 949
  Hamed Kiani Galoogahi, Terence Sim *(National University of Singapore)*
- **Geometric Context-Preserving Progressive Transmission in Mobile Visual Search** 953
  Junhai Xia, Ke Gao, Dongming Zhang, Zhendong Mao *(Chinese Academy of Sciences)*
- **Supervised Cross-Collection Topic Modeling** 957
  Haidong Gao, Siliang Tang, Yin Zhang, Dapeng Jiang, Fei Wu, Yueting Zhuang *(Zhejiang University)*
- **PDSS: Patch-Descriptor-Similarity Space for Effective Face Verification** 961
  Xiaohua Zhai, Yuxin Peng, Jianguo Xiao *(Peking University)*
- **Correlation-Based Burstiness for Logo Retrieval** 965
  Jerome Revaud, Matthijs Douze, Cordelia Schmid *(INRIA Grenoble)*
- **Large-Scale Simultaneous Multi-Object Recognition and Localization via Bottom Up Search-Based Approach** 969
  Chun-Che Wu, Yin-Hsi Kuo, Winston H. Hsu *(National Taiwan University)*
- **Sketch-Based Image Retrieval on a Large Scale Database** 973
  Rong Zhou, Liuli Chen, Liqing Zhang *(Shanghai Jiao Tong University)*
- **Dynamic Vocabularies for Web-based Concept Detection by Trend Discovery** 977
  Damian Borth *(University of Kaiserslautern)*, Adrian Ulges *(German Research Center for Artificial Intelligence)*,
  Thomas M. Breuel *(University of Kaiserslautern)*
- **Coherent Image Selection Using a Fast Approximation to the Generalized Traveling Salesman Problem** 981
  Meng Wang, Prakash Ishwar, Janusz Konrad *(Boston University)*, Cenk Gazen, Rohit Saboo *(Google Inc.)*
- **PRiSMA: Searching Images in Parallel** 985
  Pancho Tolchinsky *(Yahoo! Research)*, Luca Chiarandini *(Universtitat Pompeu Fabra & Yahoo! Research)*,
  Alejandro Jaimes *(Yahoo! Research)*
- **Local Visual Words Coding for Low Bit Rate Mobile Visual Search** 989
  Yue Wu *(University of Science and Technology of China)*, Shiyang Lu *(The University of Sydney)*,
  Tao Mei *(Microsoft Research Asia)*, Jian Zhang, Shipeng Li *(Microsoft Research Asia)*
- **Virtual Reference View Generation for CBIR-based Visual Pose Estimation** 993
  Robert Huitl, Georg Schroth, Sebastian Hilsenbeck, Florian Schweiger, Eckehard Steinbach
  (Technische Universität München)
- **Detecting the Directions of Viewing Landmarks for Recommendation by Large-Scale User-contributed Photos** 997
  Yen-Ta Huang, Kuan-Ting Chen, Liang-Chi Hsieh, Winston H. Hsu *(National Taiwan University)*,
  Ya-Fan Su *(Chunghwa Telecom Co., Ltd.)*
- **Efficient Mobile Landmark Recognition Based on Saliency-Aware Scalable Vocabulary Tree** 1001
  Kim-Hui Yap, Zhen Li, Da-Jiang Zhang , Zhan-Ke Ng *(Nanyang Technological University)*
- **Client-Side Backprojection of Presentation Slides into Educational Video** 1005
  Yekaterina Kharitonova, Qiyam Tung, Alexander Danehy, Alon Efrat, Kobus Barnard *(University of Arizona)*

- **A Study on the User Perception to Color Variations** 1009
  Marco V. Bernardo, António M. G. Pinheiro, Manuela Pereira, Paulo Torrão Fiadeiro *(Universidade da Beira Interior)*
- **Parallel Deblocking Filtering in H.264/AVC Using Multiple CPUs and GPUs** 1013
  Bart Pieters, Charles Hollemeersch, Jan De Cock, Wesley De Neve, Peter Lambert, Rik Van de Walle *(Ghent University)*
- **Energy-Aware Adaptations in Mobile 3D Graphics** 1017
  Mohammad Hosseini, Alexandra Fedorova, Joseph Peters *(Simon Fraser University)*, Shervin Shirmohammadi *(University of Ottawa)*
- **ITEM: Immersive Telepresence for Entertainment and Meetings with Commodity Setup** 1021
  Viet Anh Nguyen, Tien Dung Vu, Hongsheng Yang, Jiangbo Lu *(Advanced Digital Sciences Center)*, Minh N. Do *(University of Illinois at Urbana-Champaign)*
- **Reducing Cross-Group Traffic with a Cooperative Streaming Architecture** 1025
  Zhijie Shen, Roger Zimmermann *(National University of Singapaore)*
- **QoE-based Opportunistic Transmission for Video Broadcasting in Heterogeneous Circumstance** 1029
  Wen Ji *(Chinese Academy of Sciences)*, Zhu Li *(Futurewei Technology)*, Yiqiang Chen *(Chinese Academy of Sciences)*
- **ROI-based Protection Scheme for High Definition Interactive Video Applications** 1033
  Kiana Calagari, Mohammad Reza Pakravan *(Sharif University of Technology)*, Shervin Shirmohammadi *(University of Ottawa)*
- **Advanced Downlink LTE Radio Resource Management for HTTP-Streaming** 1037
  Thomas Wirth, Yago Sánchez, Bernd Holfeld, Thomas Schierl *(Fraunhofer Heinrich Hertz Institute)*

Poster Session 3

Session Chair: Sethuraman Panchanathan *(Arizona State University)*

- **Touch Saliency** 1041
  Mengdi Xu *(National University of Singapore)*, Bingbing Ni *(Advanced Digital Science Center)*, Jian Dong *(National University of Singapore)*, Zhongyang Huang *(Panasonic Singapore Laboratories)*, Meng Wang *(Hefei University of Technology)*, Shuicheng Yan *(National University of Singapore)*
- **Robust Cross-Media Transfer for Visual Event Detection** 1045
  Yang Yang *(The University of Queensland)*, Yi Yang *(Carnegie Mellon University)*, Zi Huang, Jiajun Liu *(The University of Queensland)*, Zhigang Ma *(University of Trento)*
- **Predicting Human Activities Using Spatio-Temporal Structure of Interest Points** 1049
  Gang Yu, Junsong Yuan *(Nanyang Technological University)*, Zicheng Liu *(Microsoft Research, Redmond)*
- **Human Action Recognition and Retrieval Using Sole Depth Information** 1053
  Yan-Ching Lin *(Academia Sinica)*, Min-Chun Hu *(Academia Sinica & National Cheng Kung University)*, Wen-Huang Cheng, Yung-Huan Hsieh, Hong-Ming Chen *(Academia Sinica)*
- **Recognizing Actions Using Depth Motion Maps-Based Histograms of Oriented Gradients** 1057
  Xiaodong Yang, Chenyang Zhang, YingLi Tian *(The City College, City University of New York)*
- **Activity-Based Person Identification Using Sparse Coding and Discriminative Metric Learning** 1061
  Jiwen Lu *(Advanced Digital Sciences Center)*, Junlin Hu *(Nanyang Technological University)*, Xiuzhuang Zhou, Yuanyuan Shang *(Capital Normal University)*
- **Detection Bank: An Object Detection Based Video Representation for Multimedia Event Recognition** 1065
  Tim Althoff, Hyun Oh Song, Trevor Darrell *(University of California, Berkeley)*
- **A New Heat-Map-based Algorithm for Human Group Activity Recognition** 1069
  Hang Chu, Weiyao Lin *(Shanghai Jiao Tong University)*, Jianxin Wu *(Nanyang Technological University)*, Xingtong Zhou, Yuanzhe Chen *(Shanghai Jiao Tong University)*, Hongxiang Li *(University of Louisville)*

- **Multimedia Event Recounting with Concept Based Representation** 1073
  Qian Yu, Jingen Liu, Hui Cheng, Ajay Divakaran, Harpreet Sawhney *(SRI International Sarnoff)*
- **What Is Happening: Annotating Images with Verbs** 1077
  Gang Tian, Genliang Guan, Zhiyong Wang, Dagan Feng *(The University of Sydney)*
- **Hybrid Generative-Discriminative Recognition of Human Action in 3D Joint Space** 1081
  Zhe Wu, Xiong Li, Xu Zhao, Yuncai Liu *(Shanghai Jiao Tong University)*
- **Parsing Collective Behaviors by Hierarchical Model with Varying Structure** 1085
  Cong Zhang, Xiaokang Yang, Jun Zhu, Weiyao Lin *(Shanghai Jiao Tong University)*
- **Toward Next Generation Coaching Tools for Court Based Racquet Sports** 1089
  Damien Connaghan, Noel E. O'Connor *(Dublin City University)*
- **Predicting Participants in Public Events Using Stock Photos** 1093
  Neil O'Hare, Luca Maria Aiello, Alejandro Jaimes *(Yahoo! Research)*
- **Breaking Row-Column Shuffle Based Image Cipher** 1097
  Weihai Li, Yupeng Yan, Nenghai Yu *(University of Science and Technology of China)*
- **On the Music Content Authentication** 1101
  Wei Li, Bilei Zhu, Zhurong Wang *(Fudan University)*
- **Secure Cloud-based Medical Data Visualization** 1105
  Manoranjan Mohanty *(National University of Singapore)*, Pradeep Atrey *(University of Winnipeg)*, Wei Tsang Ooi *(National University of Singapore)*
- **State-based Steganography in Low Bit Rate Speech** 1109
  Ke Zhou, Jin Liu *(Huazhong University of Science and Technology)*, Hui Tian *(National Huaqiao University)*, Chunhua Li *(Huazhong University of Science and Technology)*
- **Markov-based Image Forensics for Photographic Copying from Printed Picture** 1113
  Jing Yin, Yanmei Fang *(Sun Yat-sen University)*
- **Secure Content Sharing for Social Network Using Fingerprinting and Encryption in the TSH Transform Domain** 1117
  Conghuan Ye, Hefei Ling, Fuhao Zou, Cong Liu *(Huazhong University of Science and Technology)*
- **Conversationally-Inspired Stylometric Features for Authorship Attribution in Instant Messaging** 1121
  Marco Cristani *(University of Verona)*, Giorgio Roffo, Cristina Segalin, Loris Bazzani *(Istituto Italiano di Tecnologia)*, Alessandro Vinciarelli *(University of Glasgow)*, Vittorio Murino *(Istituto Italiano di Tecnologia)*
- **Dynamic Camera Calibration Method for Free-Viewpoint Experience in Sport Videos** 1125
  Hiroshi Sankoh, Masaru Sugano, Sei Naito *(KDDI R&D Laboratories, Inc.)*
- **Improving Dense Image Correspondence Estimation with Interactive User Guidance** 1129
  Kai Ruhl, Benjamin Hell, Felix Klose, Christian Lipski, Sören Petersen, Marcus Magnor *(TU Braunschweig)*
- **Personalized Video Recommendation through Tripartite Graph Propagation** 1133
  Bisheng Chen *(South China University of Technology)*, Jingdong Wang *(Microsoft Research Asia)*, Qinghua Huang *(South China University of Technology)*, Tao Mei *(Microsoft Research Asia)*
- **Clothing Genre Classification by Exploiting the Style Elements** 1137
  Shintami C. Hidayati *(National Taiwan University of Science and Technology)*, Wen-Huang Cheng *(Academia Sinica)*, Kai-Lung Hua *(National Taiwan University of Science and Technology)*
- **AttachedShock: Facilitating Moving Targets Acquisition on Augmented Reality Devices Using Goal-Crossing Actions** 1141
  Chuang-Wen You *(Dartmouth College)*, Yung-Huan Hsieh, Wen-Huang Cheng *(Academia Sinica)*
- **MixPad: Augmenting Interactive Paper with Mice & Keyboards for Cross-Media and Fine-Grained Interaction with Documents** 1145
  Xin Yang *(University of California, Santa Barbara)*, Chunyuan Liao, Qiong Liu *(FX Palo Alto Laboratory, Inc.)*
- **Detecting Rule of Simplicity from Photos** 1149
  Long Mai, Hoang Le, Yuzhen Niu *(Portland State University)*, Yu-Chi Lai *(National Taiwan University of Science and Technology)*, Feng Liu *(Portland State University)*

- **An Approach to Automatic Creation of Cinemagraphs** 1153
  Mei-Chen Yeh, Po-Yi Li *(National Taiwan Normal University)*
- **Human-Computer Dance Interaction with Realtime Accelerometer Control** 1157
  Takuya Yasunaga, Atsushi Nakazawa, Haruo Takemura *(Osaka University)*
- **Robust AAM-Based Audio-Visual Speech Recognition Against Face Direction Changes** 1161
  Yuto Komai, Nan Yang, Tetsuya Takiguchi, Yasuo Ariki *(Kobe University)*
- **A Study on Making Camera Trajectory from Panorama Watching Manipulation** 1165
  Daisuke Ochi, Hideaki Kimata, Hajime Noto, Akira Kojima *(Nippon Telegraph and Telephone Corporation)*
- **Drive Video Summarization Based on Double Articulation Structure of Driving Behavior** 1169
  Kazuhito Takenaka, Takashi Bando *(Denso Corporation)*,
  Shogo Nagasaka, Tadahiro Taniguchi *(Ritsumeikan University)*
- **Interactive Multimodal Social Robot for Improving Quality of Care of Elderly in Australian Nursing Homes** 1173
  Rajiv Khosla, Mei-Tai Chu, Reza Kachouie *(La Trobe University)*,
  Keiji Yamada, Fujita Yoshihiro, Tomoharu Yamaguchi *(NEC Corporation)*
- **Plug&Touch: A Mobile Interaction Solution for Large Display via Vision-Based Hand Gesture Detection** 1177
  Lei Xu, Yikai Fang, Kongqiao Wang, Jiangwei Li *(Nokia Research Center)*
- **Ulcer Detection in Wireless Capsule Endoscopy Video** 1181
  Yingju Chen, Jeongkyu Lee *(University of Bridgeport)*
- **Critical Gameplay: Designing Games to Critique Convention** 1185
  Lindsay D. Grace *(Miami University)*
- **Smooth and Efficient Crowd Transformation** 1189
  Mingliang Xu, Yunpeng Wu, Yangdong Ye *(Zhengzhou University)*
- **Augmented Reality Card Game Based on User-Specific Information Control** 1193
  Seiko Myojin, Arata Sato, Nobutaka Shimada *(Ritsumeikan University)*
- **Indoor and Outdoor Profiling of Users in Multimedia Installations** 1197
  Gianpaolo D'Amico, Alberto Del Bimbo, Andrea Ferracani, Lea Landucci, Daniele Pezzatini *(University of Florence)*
- **Digiti Sonus: An Interactive Fingerprint Sonification** 1201
  Yoon Chung Han *(University of California, Santa Barbara)*, Byeong-jun Han *(Korea University)*
- **Extending the Lifelog to Non-Human Subjects: Ambient Storytelling for Human-Object Relationships** 1205
  Joshua McVeigh-Schultz, Jen Stein, Jeff Watson, Scott Fisher *(University of Southern California)*

Brave New Ideas Program

Session Chairs: Alejandro Jaimes *(Yahoo! Research)* and Tat-seng Chua *(National University of Singapore)*

- **Situation Recognition: An Evolving Problem for Heterogeneous Dynamic Big Multimedia Data** 1209
  Vivek K. Singh, Mingyan Gao, Ramesh Jain *(University of California, Irvine)*
- **Distributional Semantics with Eyes: Using Image Analysis to Improve Computational Representations of Word Meaning** 1219
  Elia Bruni, Jasper Uijlings, Marco Baroni, Nicu Sebe *(University of Trento)*
- **Towards Indexing Representative Images on The Web** 1229
  Xin-Jing Wang *(Microsoft Research Asia)*, Zheng Xu *(University of Science and Technology of China)*,
  Lei Zhang *(Microsoft Research Asia)*, Ce Liu *(Micrososft Research New England)*,
  Yong Rui *(Microsoft Research Asia)*
- **Intent and Its Discontents: The User at the Wheel of the Online Video Search Engine** 1239
  Alan Hanjalic, Christoph Kofler, Martha Larson *(Delft University of Technology)*

Technical Demo Session 1

Session Chair: Hirokazu Kato *(NAIST)*

- **Face Replacement with Large-Pose Differences** 1249
  Yuan Lin *(Tsinghua University)*, Qian Lin, Feng Tang *(HP Labs)*, Shengjin Wang *(Tsinghua University)*
- **TouchPaper: Making Print Interactive** 1251
  Feng Tang, Hao Tang, Daniel R. Tretter, Qian Lin *(Hewlett-Packard Laboratories)*
- **QuickToon: A Real-Time Video Stylization and Sharing System on General Processors** 1253
  Hongsheng Yang, Huanliang Sun, Jiangbo Lu *(Advanced Digital Sciences Center)*
- **Sketch2Tag: Automatic Hand-Drawn Sketch Recognition** 1255
  Zhenbang Sun *(Shanghai Jiao Tong University)*, Changhu Wang *(Microsoft Research Asia)*, Liqing Zhang *(Shanghai Jiao Tong University)*, Lei Zhang *(Microsoft Research Asia)*
- **A Rapid Flower/Leaf Recognition System** 1257
  Xianbiao Qi *(Beijing University of Posts and Telecommunications)*, Rong Xiao, Lei Zhang *(Microsoft Research Asia)*, Chun-Guang Li, Jun Guo *(Beijing University of Posts and Telecommunications)*
- **A Tool for Automatic Cinemagraphs** 1259
  Mei-Chen Yeh, Po-Yi Li *(National Taiwan Normal University)*
- **Actions Speak Louder than Words: Searching Human Action Video Based on Body Movement** 1261
  Yan-Ching Lin *(Academia Sinica)*, Min-Chun Hu *(Academia Sinica & National Cheng Kung University)*, Wen-Huang Cheng, Yung-Huan Hsieh, Hong-Ming Chen *(Academia Sinica)*
- **Action Tutor: Real-Time Exemplar-based Sequential Movement Assessment with Kinect Sensor** 1263
  Chi-Wen Chen *(National Taiwan University)*, Min-Chun Hu, Wen-Huang Cheng *(Academia Sinica)*, Che-Han Chang, Jui-Hsin Lai, Ja-Ling Wu *(National Taiwan University)*
- **Jiku Live: A Live Zoomable Video Streaming System** 1265
  Arash Shafiei, Ngo Quang Minh Khiem, Guntur Ravindra, Mukesh Saini, Cong Pang, Wei Tsang Ooi *(National University of Singapore)*
- **Smart VideoCooKing: A Multimedia Cooking Recipe Browsing Application on Portable Devices** 1267
  Keisuke Doman, Cheng Ying Kuai *(Nagoya University)*, Tomokazu Takahashi *(Gakuen University)*, Ichiro Ide, Hiroshi Murase *(Nagoya University)*
- **Through the Looking Glass: Mirror Worlds for Augmented Awareness & Capability** 1269
  Don Kimber *(FX Palo Alto Laboratory, Inc.)*, Jun Shingu *(Fuji Xerox)*, Jim Vaughan, David Arendash, David Lee, Maribeth Back *(FX Palo Alto Laboratory, Inc.)*, Shingo Uchihashi *(Fuji Xerox)*
- **LikeLines: Collecting Timecode-Level Feedback for Web Videos Through User Interactions** 1271
  Raynor Vliegendhart, Martha Larson, Alan Hanjalic *(Delft University of Technology)*
- **Exploring and Browsing Photos Through Characteristic Geographic Tag Regions** 1273
  Bart Thomee, Adam Rae *(Yahoo! Research)*
- **Rapid Object Search Engine for Contextual Advertisement** 1275
  Yuning Jiang, Junsong Yuan, Jingjing Meng *(Nanyang Technological University)*
- **Multi-View Video Contents Viewing System by Synchronized Multi-view Streaming Architecture** 1277
  Takafumi Marutani, Kenji Mase, Toshiaki Fujii *(Nagoya University)*, Tetsuya Kawamoto *(Chukyo TV Broadcasting Co. Ltd.)*
- **X-Large Virtual Workspaces for Projector Phones Through Peephole Interaction** 1279
  Bonifaz Kaufmann, Martin Hitz *(Alpen-Adria-Universität Klagenfurt)*
- **Demo: Virtual Director for Live Event Broadcast** 1281
  Rene Kaiser, Wolfgang Weiss *(Joanneum Research)*, Malte Borsum, Axel Kochale *(Technicolor)*, Marco Masetti, Valentina Zampichelli *(Softeco Sismat)*

- **Fly-through Heijo Palace Site: Historical Tourism System Using Augmented Telepresence** 1283
  Fumio Okura, Masayuki Kanbara, Naokazu Yokoya *(Nara Institute of Science and Technology)*
- **Mobile Multimedia Presentation in Self-Forming Mobile Device Groups: Ad-Hoc Networks in Practice** 1285
  Kevin Collins, Noel E. O'Connor, Gabriel Miro Muntean *(Dublin City University)*
- **Eyeke: What You Hear Is What You See** 1287
  Takeshi Okunaka, Yoshinobu Tonomura *(Ryukoku University)*
- **System for Creating Slideshows Based on People and Their Emotions** 1289
  Vassilios Vonikakis, Stefan Winkler
  (Advanced Digital Sciences Center & University of Illinois at Urbana-Champaign)
- **gTravel: A Global Social Travel System** 1291
  Richong Zhang, Xiaohui Guo, Hailong Sun, Jinpeng Huai, Xudong Liu *(Beihang University)*

Technical Demo Session 2

Session Chair: Qi Tian *(University of Texas at San Antonio)*

- **Interactive Music Video Application for Smartphones Based on Free-Viewpoint Video and Audio Rendering** 1293
  Toshiharu Horiuchi, Hiroshi Sankoh, Tsuneo Kato, Sei Naito *(KDDI R&D Laboratories, Inc.)*
- **Abnormal Behavior Recognition System for ATM Monitoring by RGB-D Camera** 1295
  Fan Liu, Jinhui Tang *(Nanjing University of Science and Technology)*,
  Ruizhen Zhao *(Beijing Jiaotong University)*, Zhenmin Tang *(Nanjing University of Science and Technology)*
- **Interactive Photomosaic System Using GPU** 1297
  Makoto Fujisawa, Toshiyuki Amano, Takafumi Taketomi, Goshiro Yamamoto, Yuki Uranishi, Jun Miyazaki
  (Nara Institute of Science and Technology)
- **PhacePhinder: Harnessing Social Networks to Build Social Face Databases for Mobile Devices** 1299
  Mark Bloess, Heung-Nam Kim, Abdulmotaleb El Saddik *(University of Ottawa)*
- **Real-Time Multiple Object Instances Detection** 1301
  Chengli Xie, Jinqiao Wang, Yifan Zhang, Hanqing Lu *(Chinese Academy of Sciences)*
- **One Shot Learning Gesture Recognition with Kinect Sensor** 1303
  Di Wu, Fan Zhu, Ling Shao *(The University of Sheffield)*, Hui Zhang *(United International College)*
- **Interactive Exploration of Large Remote Image Databases** 1305
  William Plant *(Aston University)*, Gerald Schaefer *(Loughborough University)*
- **Scenario-Driven Interactive Panorama Video Delivery: Promptly Watch and Share Enjoyable Parts of an Event** 1307
  Daisuke Ochi, Hideaki Kimata, Hajime Noto, Akira Kojima *(Nippon Telegraph and Telephone Corporation)*
- **MOGAT: A Cloud-Based Mobile Game System with Auditory Training for Children with Cochlear Implants** 1309
  Yinsheng Zhou, Toni-Jan Keith P. Monserrat, Ye Wang *(National University of Singapore)*
- **A Domain-Specific Music Search Engine for Gait Training** 1311
  Zhonghua Li, Ye Wang *(National University of Singapore)*
- **A Daily, Activity-Aware, Mobile Music Recommender System** 1313
  Xinxi Wang, David Rosenblum, Ye Wang *(National University of Singapore)*
- **Use of Invisible Noise Signals to Prevent Privacy Invasion Through Face Recognition from Camera Images** 1315
  Takayuki Yamada *(Graduate University for Advanced Studies)*, Seiichi Gohshi *(Kogakuin University)*,
  Isao Echizen *(National Institute of Informatics)*
- **DVS: A Dynamic Multi-Video Summarization System of Sensor-Rich Videos in Geo-Space** 1317
  Ying Zhang, Roger Zimmermann *(National University of Singapore)*

- **Motch: An Automatic Motion Type Characterization System for Sensor-Rich Videos** 1319
  Guanfeng Wang, Beomjoo Seo, Roger Zimmermann *(National University of Singapore)*
- **Hummi-Com: Humming-based Music Composition System** 1321
  Tetsuro Kitahara, Syohei Kimura, Yuu Suzuki, Tomofumi Suzuki *(Nihon University)*

Technical Demo Session 3

Session Chair: Hirokazu Kato *(NAIST)*

- **Browse-to-Search** 1323
  Shiyang Lu *(The University of Sydney)*, Tao Mei, Jingdong Wang *(Microsoft Research Asia)*, Jian Zhang *(University of Technology)*, Zhiyong Wang, David Dagan Feng *(The University of Sydney)*, Jian-Tao Sun, Shipeng Li *(Microsoft Research Asia)*
- **Scalable Similar Image Search by Joint Indices** 1325
  Jing Wang *(Peking University)*, Jingdong Wang *(Microsoft Research Asia)*, Xian-Sheng Hua *(Microsoft Bing)*, Shipeng Li *(Microsoft Research Asia)*
- **Color Filter for Image Search** 1327
  Peng Wang *(Peking University)*, Dongqing Zhang *(Shanghai Jiao Tong University)*, Jingdong Wang *(Microsoft Research Asia)*, Zhong Wu, Xian-Sheng Hua *(Microsoft Bing)*, Shipeng Li *(Microsoft Research Asia)*
- **StoViz : Story Visualization of TV Series** 1329
  Philippe Ercolessi *(University Paul Sabatier)*, Hervé Bredin *(LIMSI - CNRS)*, Christine Sénac *(University Paul Sabatier)*
- **3DME: 3D Media Express from RGB-D Images** 1331
  Tam V. Nguyen, Lusong Li, Jun Tan, Shuicheng Yan *(National University of Singapore)*
- **"Hi, Magic Closet, Tell Me What to Wear!"** 1333
  Si Liu, Tam V. Nguyen, Jiashi Feng *(National University of Singapore)*, Meng Wang *(Hefei University of Technology)*, Shuicheng Yan *(National University of Singapore)*
- **Street-to-Shop: Cross-Scenario Clothing Retrieval via Parts Alignment and Auxiliary Set** 1335
  Si Liu *(National University of Singapore & Chinese Academy of Sciences)*, Zheng Song *(National University of Singapore)*, Meng Wang *(Hefei University of Technology)*, Changsheng Xu, Hanqing Lu *(Chinese Academy of Sciences)*, Shuicheng Yan *(National University of Singapore)*
- **Searching for Diversified Landmarks by Photo** 1337
  Junfeng Ye, Jia Chen, Zejia Chen, Yihe Zhu *(Shanghai Jiao Tong University)*, Shenghua Bao, Zhong Su *(IBM China Research Laboratory)*, Yong Yu *(Shanghai Jiao Tong University)*
- **Attribute Feedback** 1339
  Hanwang Zhang, Zheng-Jun Zha, Jingwen Bian, Yue Gao, Huanbo Luan, Tat-Seng Chua *(National University of Singapore)*
- **Personal Photo Indexing** 1341
  Ivan Tankoyeu, Julian Stöttinger, Javier Paniagua, Fausto Giunchiglia *(Universtiy of Trento)*
- **Guess What You Draw: Interactive Contour-based Image Retrieval on a Million-Scale Database** 1343
  Rong Zhou, Liuli Chen, Liqing Zhang *(Shanghai Jiao Tong University)*
- **FashionAsk: Pushing Community Answers to Your Fingertips** 1345
  Wei Zhang, Lei Pang, Chong-Wah Ngo *(City University of Hong Kong)*
- **A Fast Video Event Recognition System and Its Application to Video Search** 1347
  Yu-Gang Jiang, Qi Dai, Yingbin Zheng, Xiangyang Xue *(Fudan University)*, Jie Liu, Dong Wang *(Huawei Technologies)*
- **Social and Automatic Annotation of Videos for Semantic Profiling and Content Discovery** 1349
  Marco Bertini, Alberto Del Bimbo, Andrea Ferracani, Daniele Pezzatini *(Università degli Studi di Firenze)*

Multimedia Grand Challenge

Session Chairs: Marcel Worring *(University of Amsterdam)* and Yushi Jing *(Google Research)*

- **Visual-Based Transmedia Events Detection** 1351
  Alexis Joly, Julien Champ *(INRIA Zenith)*, Pierre Letessier *(INRA/INA)*,
  Nicolas Hervé, Olivier Buisson, Marie-Luce Viaud *(INA)*
- **Technicolor Challenge: An Event Classification Framework by Probabilistic Context Modeling of Multimodal Features** 1353
  Hsuan-Sheng Chen, Wen-Jiin Tsai *(National Chiao-Tung University)*
- **TWIPIX: A Web Magazine Curated from Social Media** 1355
  Romil Bansal, Radhika Kumaran, Diwakar Mahajan, Arpit Khurdiya, Lipika Dey, Hiranmay Ghosh
  (Tata Consultancy Services)
- **Multimedia News Digger on Emerging Topics from Social Streams** 1357
  Bing-Kun Bao *(Chinese Academy of Sciences & China -Singapore Institute of Digital Media)*,
  Weiqing Min, Jitao Sang, Changsheng Xu *(Chinese Academy of Sciences)*
- **Analyzing Social Media via Event Facets** 1359
  Zhiyu Wang, Peng Cui *(Tsinghua University)*, Lexing Xie *(Australian National University and NICTA)*,
  Hao Chen, Wenwu Zhu, Shiqiang Yang *(Tsinghua University)*
- **Automatic Cinemagraphs for Ranking Beautiful Scenes** 1361
  Yin-Tzu Chan, Hao-Chen Hsu, Po-Yi Li, Mei-Chen Yeh *(National Taiwan Normal University)*
- **"Where is the Interestingness?" Retrieving Appealing Video Scenes by Learning Flickr-based Graded Judgments** 1363
  Miriam Redi, Bernard Merialdo *(EURECOM)*
- **Scaring or Pleasing: Exploit Emotional Impact of an Image** 1365
  Bing Li *(Chinese Academy of Sciences)*, Songhe Feng *(Beijing Jiaotong University)*,
  Weihua Xiong, Weiming Hu *(Chinese Academy of Sciences)*
- **Classification of Photos Based on Good Feelings: ACM MM 2012 Multimedia Grand Challenge Submission** 1367
  Mathias Lux, Mario Taschwer *(Klagenfurt University)*, Oge Marques *(Florida Atlantic University)*
- **Understanding the Emotional Impact of Images** 1369
  Xiaohui Wang, Jia Jia, Peiyun Hu, Sen Wu, Jie Tang, Lianhong Cai *(Tsinghua University)*
- **Emotion-Based Sequence of Family Photos** 1371
  Vassilios Vonikakis, Stefan Winkler
  (Advanced Digital Sciences Center & University of Illinois at Urbana-Champaign)
- **Evaluating User's Energy Consumption Using Kinect Based Skeleton Tracking** 1373
  Zhenbao Liu, Sicong Tang, Hongliang Qin, Shuhui Bu *(Northwestern Polytechnical University)*
- **Analysis of Dance Movements Using Gaussian Processes** 1375
  Antoine Liutkus, Angélique Dremeau *(Telecom ParisTech)*,
  Dimitrios Alexiadis *(Hellas, Information Technologies Institute)*, Slim Essid *(Telecom ParisTech)*,
  Petros Daras *(Hellas, Information Technologies Institute)*
- **Automatic Music Soundtrack Generation for Outdoor Videos from Contextual Sensor Information** 1377
  Yi Yu, Zhijie Shen, Roger Zimmermann *(National University of Singapore)*
- **The Acousticvisual Emotion Guassians Model for Automatic Generation of Music Video** 1379
  Ju-Chiang Wang *(Academia Sinica & National Taiwan University)*, Yi-Hsuan Yang *(Academia Sinica)*,
  I-Hong Jhuo *(National Taiwan University)*, Yen-Yu Lin, Hsin-Min Wang *(Academia Sinica)*
- **Automatic Music Video Generation: Cross Matching of Music and Image** 1381
  Xixuan Wu *(Chinese Academy of Sciences & The Chinese University of Hong Kong)*,
  Bing Xu *(The Chinese University of Hong Kong)*, Yu Qiao *(Chinese Academy of Sciences)*,
  Xiaoou Tang *(Chinese Academy of Sciences & The Chinese University of Hong Kong)*
- **MuseSync: Standing on the Shoulders of Hollywood** 1383
  Cynthia C. S. Liem *(Delft University of Technology)*, Alessio Bazzica *(University of Firenze)*,
  Alan Hanjalic *(Delft University of Technology)*

Doctoral Symposium Session 1: Best Paper Session

Session Chairs: Chong-Wah Ngo *(City University of Hong Kong)*
and Keiji Yanai *(University of Electro-Communication)*

- **People Search and Activity Mining in Large-Scale Community-Contributed Photos** 1385
  Yan-Ying Chen *(National Taiwan University)*
- **Upper Body Gestures in Lecture Videos: Indexing and Correlating to Pedagogical Significance** 1389
  John R. Zhang *(Columbia University)*
- **Modeling Video Viewing Behaviors for Viewer State Estimation** 1393
  Ryo Yonetani *(Kyoto University)*
- **Challenges in Supporting Non-Linear and Non-Continuous Media Access in P2P Systems** 1397
  Zhen Wei Zhao *(National University of Singapore)*

Doctoral Symposium 2: Oral Paper Session

Session Chairs: Chong-Wah Ngo *(City University of Hong Kong)*
and Keiji Yanai *(University of Electro-Communication)*

- **3D Photo Browsing for Future Mobile Devices** 1401
  Shahrouz Yousefi *(Umeå University)*
- **Making Use of Eye Tracking Information in Image Collection Creation and Region Annotation** 1405
  Tina Walber *(University of Koblenz-Landau)*
- **Investigating 3D Model and Part Information for Improving Content-Based and Attribute-Based Object Retrieval** 1409
  Yen-Liang Lin *(National Taiwan University)*
- **An Adaptive Framework for Scalable Multi-View Video Coding or the H.264/AVC Standard** 1413
  Hoda Roodaki *(University of Tehran)*
- **Distributed Video Coding with Improved Side Information Refinement and Parallelized Architecture Design** 1417
  Yun-Chung Shen *(National Taiwan University)*

Doctoral Symposium 3: Poster Session

Session Chairs: Chong-Wah Ngo *(City University of Hong Kong)*
and Keiji Yanai *(University of Electro-Communication)*

- **Collective Search and Recommendation in Social Media** 1421
  Jitao Sang *(Chinese Academy of Sciences)*
- **Semantic Awareness for Automatic Image Interpretation** 1425
  Albrecht Lindner *(École Polytechnique Fédérale de Lausanne)*
- **Trajectory Signature for Action Recognition in Video** 1429
  Nicolas Ballas *(CEA/Mines-ParisTech)*, Bertrand Delezoide *(CEA Saclay)*, Françoise Prêteux *(Mines-ParisTech)*
- **Interactive Data-Driven Search and Discovery of Temporal Behavior Patterns from Media Streams** 1433
  Chreston Miller *(Virginia Tech)*
- **Spacetime Freeview Generation Using Image-Based Rendering, Relighting, and Augmented Telepresence** 1437
  Fumio Okura *(Nara Institute of Science and Technology)*
- **What You See Is What You Should Get** 1441
  Velibor Adzic *(Florida Atlantic University)*
- **3D Multimedia Signal Processing** 1445
  Yu-Hsun Lin *(National Taiwan University)*

- **Open Source Software Competition** .....
  Session Chair: Masanori Sano *(Japan Broadcasting Corporation)*
- **Bob: A Free Signal Processing and Machine Learning Toolbox for Researchers** 1449
  André Anjos, Laurent El Shafey, Roy Wallace, Manuel Günther, Chris McCool, Sébastien Marcel *(Idiap Research Institute)*
- **DisplayCast: A High Performance Screen Sharing System for Intranets** 1453
  Surendar Chandra, Lawrence A. Rowe *(FX Palo Alto Laboratory Inc.)*
- **UltraGrid: Low-Latency High-Quality Video Transmissions on Commodity Hardware** ... 1457
  Petr Holub, Jiří Matela, Martin Pulec, Martin Šrom *(CESNET z.s.p.o.)*
- **Video Hyperlinking: Libraries and Tools for Threading and Visualizing Large Video Collection** 1461
  Lei Pang, Wei Zhang *(City University of Hong Kong)*, Hung-Khoon Tan *(University Tunku Abdul Rahman)*, Chong-Wah Ngo *(City University of Hong Kong)*
- **XKin – eXtendable Hand Pose and Gesture Recognition Library for Kinect** 1465
  Fabrizio Pedersoli, Nicola Adami, Sergio Benini, Riccardo Leonardi *(University of Brescia)*
- **A Toolset for the Authoring, Simulation, and Rendering of Sensory Experiences** 1469
  Markus Waltl, Benjamin Rainer, Christian Timmerer, Hermann Hellwagner *(Alpen-Adria-Universität Klagenfurt)*

Video Program

Session Chair: Tao Mei *(Microsoft Research Asia)*

- **A Real-Time System for Capturing HDR Videos** 1473
  Benjamin Guthier, Stephan Kopf, Wolfgang Effelsberg *(University of Mannheim)*
- **High Dynamic Range (HDR) Video Image Processing for Digital Glass** 1477
  Raymond Chun Hing Lo, Steve Mann, Jason Huang, Valmiki Rampersad, Tao Ai *(University of Toronto)*
- **Immersive Multiplayer Tennis with Microsoft Kinect and Body Sensor Networks** 1481
  Suraj Raghuraman, Karthik Venkatraman, Zhanyu Wang, Jian Wu, Jacob Clements, Reza Lotfian, Balakrishnan Prabhakaran, Xiaohu Guo, Roozbeh Jafari *(University of Texas at Dallas)*, Klara Nahrstedt *(University of Illinois at Urbana-Champaign)*

Multimedia Art Exhibition

Session Chairs: Tomoe Moriyama *(Museum of Contemporary Art Tokyo)* and Hideyuki Ando *(Osaka University)*

- **Optically Coupled Oscillators (OCOs) -- LED Fireflies** 1485
  Munehisa Sekikawa *(The University of Tokyo)*, Akinori Tsuji *(The University of Tokushima)*, Keiko Kimoto *(FIRST, JST)*, Ikkyu Aihara *(RIKEN Brain Science Institute)*, Daisuke Ito, Tetsushi Ueta *(The University of Tokushima)*, Kazuyuki Aihara *(The University of Tokyo)*, Hiroshi Kawakami *(FIRST, JST)*
- **ThinkingGarden** 1487
  Yoshiaki Mima, Ken-ichi Kimura, Hidekatsu Yanagi *(Future University Hakodate)*
- **Empathetic Heartbeat** 1489
  Hideyuki Ando *(Osaka University)*, Junji Watanabe *(Nippon Telegraph and Telephone Company)*, Masahiko Sato *(TOPICS Corporation Ltd.)*
- **Participatory Art Cards & Archive System for Public Exhibition: A Case Study Through Ars Wild Card** 1491
  Hideaki Ogawa, Emiko Ogawa, Manuela Naveau, Christopher Lindinger, Roland Haring, Matthew Gardiner, Martina Mara, Horst Hörtner *(Ars Electronica Futurelab)*
- **The Silent Power - Applications of Research in Medical X-ray Combining with Photography and Digital Graphic Design** 1493
  Shih-Ting Tsai, Ming-Hsiu Mia Chen *(Tatung University)*, Chi-Cheng Chang, Yu-Hung Kuo *(National Taiwan Normal University)*, Miranda Lawry *(University of Newcastle)*, Yi-Shu Ting *(Chang Gung Memorial Hospital)*
- **Interactive Art "Maelstrom&Vortex": The Body's Speed – A Race Between Digital and Analog Speeds** 1495
  He-Lin Luo, Yi-Ping Hung *(National Taiwan University)*

- **Passage+** 1497
  Makato Shirose, Masahito Hirose, Kentato Oku, Masato Koide, Naoya Hirai
  (IMAGICA DIGITALSCAPE Co., Ltd.)
- **"Yu bi Yomu": Interactive Reading of Dynamic Text** 1499
  Kazushi Maruya *(Nippon Telegraph and Telephone Corporation)*, Miki Uetsuki *(Hakodate Junior College)*, Hideyuki Ando *(Osaka University)*, Junji Watanabe *(Nippon Telegraph and Telephone Corporation)*
- **The New Dunites** 1501
  Andres Burbano, Danny Bazo, Şölen K. DiCicco, Angus Forbes *(University of California, Santa Barbara)*

Workshops

Session Chairs: Jiebo Luo *(University of Rochester)* and Svetha Venkatesh *(Deakin University)*

- **International Workshop on Socially-Aware Multimedia (SAM'12)** 1503
  Pablo Cesar *(Centrum Wiskunde & Informatica)*, David A. Shamma *(Yahoo! Research)*, Doug Williams *(BT Research & Technology)*, Cees G.M. Snoek *(University of Amsterdam)*
- **ACM Multimedia 2012 Workshop on Crowdsourcing for Multimedia** 1505
  Kuan-Ta Chen *(Academia Sinica)*, Wei-Ta Chu *(National Chung Cheng University)*, Martha Larson *(Delft University of Technology)*, Wei Tsang Ooi *(National University of Singapore)*
- **Multimedia Analysis for Ecological Data** 1507
  Concetto Spampinato *(University of Catania)*, Vasileios Mezaris *(Centre for Research and Technology Hellas)*, Jacco van Ossenbruggen *(Centrum Wiskunde & Informatica)*
- **2nd International ACM Workshop on Music Information Retrieval with User-Centered and Multimodal Strategies (MIRUM)** 1509
  Cynthia C. S. Liem *(Delft University of Technology)*, Meinard Müller *(Bonn University & MPI Informatik)*, Steven K. Tjoa *(iZotope, Inc.)*, George Tzanetakis *(University of Victoria)*
- **GeoMM'12: ACM International Workshop on Geotagging and Its Applications in Multimedia** 1511
  Liangliang Cao *(IBM T.J. Watson Research Center)*, Gerald Friedland *(International Computer Science)*, Martha Larson *(Delft University of Technology)*
- **AMVA'12: ACM International Workshop on Audio and Multimedia Methods for Large-Scale Video Analysis** 1513
  Gerald Friedland *(International Computer Science Institute)*, Dan Ellis *(Columbia University)*, Florian Metze *(Carnegie Mellon University)*
- **ACM International Workshop on Cloud-Based Multimedia Applications and Services for E-Health (CBMAS-EH 2012)** 1515
  M. Shamim Hossain *(King Saud University)*, Abdulmotaleb El Saddik *(University of Ottawa)*
- **Overview of the ACM Multimedia 2012 Workshop on Multimedia for Cooking and Eating Activities (CEA'12)** 1517
  Mutsuo Sano *(Osaka Institute of Technology)*, Ichiro Ide *(Nagoya University)*, Yoko Yamakata *(Kyoto University)*
- **1st International ACM Workshop on User Experience in e-Learning and Augmented Technologies in Education** 1519
  David Fonseca *(La Salle, Universitat Ramon Llull)*, Xenophon Zabulis *(Foundation for Research and Technology)*, Naeem Ramzan *(Queen Mary University of London)*, Arianit Kurti *(Linnaeus University)*, Salvatore Flavio Pileggi *(Universidad Politécnica de Valencia)*, Heedong Ko *(Image Media Research Center)*
- **Personalized Access to Cultural Heritage: Multimedia by the Crowd, for the Crowd (PATCH 2012 @ ACM Multimedia)** 1521
  Johan Oomen *(Netherlands Institute for Sound and Vision)*, Lora Aroyo *(VU University Amsterdam)*, Stéphane Marchand-Maillet *(University of Geneva)*, Jeremy Douglass *(University of California, San Diego)*
- **The Second ACM International Workshop on Interactive Multimedia on Mobile and Portable Devices** 1523
  Ling Shao *(The University of Sheffield)*, Caifeng Shan *(Philips Research)*, Minoru Etoh *(NTT DoCoMo)*

Tutorials

Session Chairs: Susanne Boll *(University of Oldenburg)* and Changsheng Xu *(Chinese Academy of Sciences)*

- **Message from the Tutorial Chairs** 1525
  Susanne Boll *(University of Oldenburg)*, Changsheng Xu *(Chinese Academy of Sciences)*
- **Interacting with Image Collections: Visualisation and Browsing of Image Repositories** 1527
  Gerald Schaefer *(Loughborough University)*
- **Privacy Concerns in Multimedia and Their Solutions** 1529
  Gerald Friedland *(International Computer Science Institute)*
- **Dimensional and Continuous Analysis of Emotions for Multimedia Applications** 1531
  Hatice Gunes *(Queen Mary University of London)*, Björn Schuller *(Joanneum Research)*
- **Dynamic Adaptive Streaming over HTTP: From Content Creation to Consumption** 1533
  Christian Timmerer *(Alpen-Adria-Universität Klagenfurt)*, Carsten Griwodz *(Simula Research Laboratory)*
- **Multimedia Recommendation** 1535
  Jialie Shen *(Singapore Management University)*, Meng Wang *(Hefei University of Technology)*, Shuicheng Yan *(National University of Singapore)*, Peng Cui *(Tsinghua University)*
- **A Human-Centered Perspective on Multimedia Data Science** 1537
  Alejandro Jaimes *(Yahoo! Research)*

Author Index 1539

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Reviews For Paper

Track	TD:Technical Demos
Paper ID	1163
Title	Browse-to-Search

Masked Reviewer ID: Assigned_Reviewer_1
Review:

Question	
Overall Rating	Definitely Accept - I would protest if it is not accepted; clearly ACM MM standards
Novelty / Originality	Moderately original
Suitability for technical demo sessions	Very suitable
Presentation of the paper	Very clear
Comments to authors	This demo proposed an application to enable users to naturally search products of interest when they browse a web page, and make their even causal purchase intent easily satisfied. The work is interesting and solid. Some relevant work should be referred to, such as "Inferring semantic concepts from community-contributed images and noisy tags".

Masked Reviewer ID: Assigned_Reviewer_2
Review:

Question	
Overall Rating	Definitely Accept - I would protest if it is not accepted; clearly ACM MM standards
Novelty / Originality	Moderately original
Suitability for technical demo sessions	Very suitable
Presentation of the paper	Clear enough
Comments to authors	This demonstration developed a very useful system for interactive online shopping application. The system is built based on visual search technologies with many good merits, such as natural-gesture inputs, in session search, browsing and comparison. The idea is novel and the paper is well written. The system is evaluated both objectively and subjectively and the experimental results validate its effectiveness and efficiency. One minor problem: It is not clear which method is adopted as the baseline (in Section 4, paragraph 2, line 4).

Jian Zhang

From: Conference Management Toolkit <cmt@microsoft.com>
Sent: Wednesday, 11 July 2012 2:15 PM
To: shiyang@it.usyd.edu.au
Subject: ACM Multimedia 2012 Technical Demo Notification - Paper #1163

Dear Shiyang Lu:

Thank you for submitting your technical demo paper to ACM Multimedia 2012. We are pleased to inform you that your paper 1163 - "Browse-to-Search" has been ACCEPTED for publication in the Proceedings of ACM MULTIMEDIA 2012 as a Technical Demo Paper.

Once accepted, we expect one of the authors of the accepted paper to present at ACM Multimedia 2012. Each paper presented at the conference requires one of the authors to register at the conference paying the regular registration fee (not the student fee). Papers submitted without registration will not be included in the Conference Program and in the Conference Proceedings. You will receive a separate email regarding registration details.

The reviews are available at CMT: https://cmt.research.microsoft.com/ACMMM2012. Please login with your CMT username.

Please note that the deadline for submitting final camera ready version is *July 30, 2012*.

Regards,

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