



IS&T

# REPORTER

"THE WINDOW ON IMAGING"

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## Electronic Imaging Symposium 2014

### BEST STUDENT PAPER AWARDS

#### Digital Photography X

##### Stereo vision based depth of field rendering on a mobile device

Qiaosong Wang, Zhan Yu, Christopher Rasmussen, and Jingyi Yu, University of Delaware (USA)

**Abstract:** The Depth of Field (DoF) effect is a useful tool in photography and cinematography because of its aesthetic values. However, capturing and displaying dynamic DoF effect was until recently a quality unique to expensive and bulky movie cameras. In this paper, we propose a computational approach to generate realistic DoF effects for mobile devices such as tablets. We first calibrate the rear-facing stereo cameras and rectify stereo image pairs through FCam API, then generate a low-res disparity map using graph cuts stereo matching and subsequently up-sample it via joint bilateral upsampling. Next we generate a synthetic light field by warping the raw color image to nearby viewpoints according to corresponding values in the upsampled high resolution disparity map. Finally, we render dynamic DoF effect on the tablet screen with light field rendering. The user can easily capture and generate desired DoF effects with arbitrary aperture sizes or focal depths using the tablet only with no additional hardware or software required. The system has been tested in a variety of environments with satisfactory results.

#### Document Recognition and Retrieval XXI

##### Scalable ranked retrieval using document images

Rajiv Jain, Douglas W. Oard, and David Doermann, University of Maryland (USA)

**Abstract:** Despite the explosion of text on the Internet, hard copy documents that have been scanned as images still play a significant role for some tasks. The best method to perform ranked retrieval on a large corpus of document images, however, remains an open research question. The most common approach has been to perform text retrieval using terms generated by optical character recognition. This paper, by contrast, examines whether a scalable segmentation-free image retrieval algorithm,

## Boumann and Bovik Honored at EI



Photo courtesy of Al Bovik website.



Photo: Meigen Rabbani.

Left: Professor Alan Bovik received his IS&T Honorary Membership award at EI. Honorary Membership is the highest award bestowed by the Society. A past EI plenary speaker, Dr. Bovik directs the Laboratory for Image and Video Engineering at The University of Texas at Austin. Right: Symposium Co-Chair Sheila Hemami presents the 2014 Electronic Imaging Scientist of the Year award to Professor Charles A. Bouman of Purdue University. This year Prof. Bouman gave a plenary address titled "Integrated Imaging: Creating Images from the Tight Integration of Algorithms, Computation and Sensors."

which matches sub-images containing text or graphical objects, can provide additional benefit in satisfying a user's information needs on a large, real world dataset. Results on 7 million scanned pages from the CDIP v1.0 test collection show that content based image retrieval finds a substantial number of documents that text retrieval misses, and that when used as a basis for relevance feedback can yield improvements in retrieval effectiveness.

[papers continue on page 10](#)

To view the full papers of these abstracts for no fee go to [www.imaging.org/ist/publications/reporter/index.cfm](http://www.imaging.org/ist/publications/reporter/index.cfm)

\* These papers were presented within the conference noted at the IS&T/SPIE Electronic Imaging Symposium, held Feb. 2-6, 2014, in San Francisco, CA.

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<b>EI2014</b>	
Attendees*:	926
Oral Papers:	524
Interactive Papers:	127
Short Courses:	14
Exhibitors:	10
Dates:	February 2-6, 2014
Location:	San Francisco, California
*includes Short Course only and guests	

attended (I attended all of them) and, in my opinion, added a lot of perspective to the research topics presented earlier. The last day's session was followed by a museum visit to the Exploratorium; a hands-on museum of science, art, and human perception.

A unique illustration from HVEI that captured my imagination was the series of word clouds that Bernice Rogowitz and Thrasyvoulos Pappas had created to explore the history of HVEI throughout the past 26 years. This inspired me to build a word cloud from all the titles from this year's EI Symposium. Clearly, the word image takes center stage, followed by all the usual suspects. It is interesting how video and mobile have grown; surveillance is elbowing itself in, etc. I let you have fun surfing the cloud, and exploring your area of interest within it.

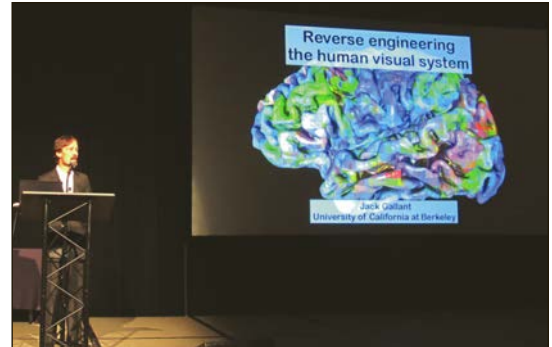
**Plenary and Keynote Speakers**

Aside from personal technical interests, I found the two Symposium plenary talks scheduled for Tuesday and Wednesday mornings, along with the Symposium-wide keynotes given in conjunction with individual conferences throughout the week, among the most informative events of the EI Symposium.

In the time-honored tradition of the EI Symposium, two engaging plenary speakers were scheduled for Tuesday and Wednesday mornings, with presentations that expanded the areas of traditional imaging and image processing. Jack Gallant's fascinating talk entitled "Using fMRI To Reverse Engineer the Human Visual System," contained some of the most stimulating slides and animations of the visual cortex that I had seen on this topic. He explained how his group at Berkeley uses a



Right: Charles A. Bouman (Purdue University) presenting the Wednesday plenary, "Integrated Imaging: Creating Images from the Tight Integration of Algorithms, Computation, and Sensors." Below: Jack Gallant (University of California at Berkeley) presenting the Tuesday morning plenary, "Using fMRI to Reverse Engineer the Human Visual System."



data-driven system identification approach to accomplish this task. For those wishing to learn more, the link to The Gallant lab @ UC Berkeley is <http://gallantlab.org>.

Charles Bouman (also the recipient of the 2014 EI Scientist of the year award) presented "Integrated Imaging: Creating Images from the Tight Integration of Algorithms, Computation and Sensors." Integrated Imaging aims at blending novel and often counter-intuitive sensor design with algorithms that exploit the availability of enormous quantities of data and computation. Bouman presented examples of the state-of-the-art integrated imaging systems tackled by his group at Purdue University based on computed tomography (CT), transmission electron microscopy (TEM), synchrotron beam imaging, optical sensing, and scanning electron microscopy (SEM).

In addition to the Symposium plenary talks, many conferences held their own keynote presentations (see list on page 4). These provided an excellent opportunity to learn about the recent advances in a popular topic without being an expert in the field.



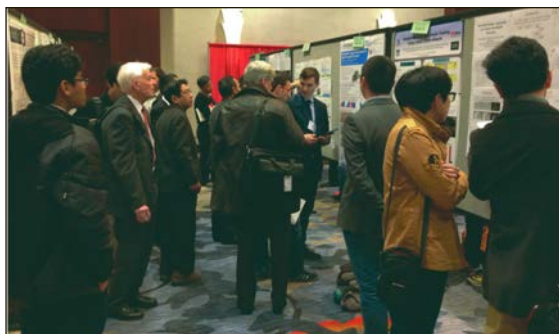
The DIGIMARC team demonstrating their invisible digital watermarking that achieved a new Guinness world record.



Symposium participants enjoying the 3D theatre, while SD&A Conference Chair Andrew Woods makes a virtual appearance from Australia. 2014 marked the 25th Stereoscopic Displays and Applications Conference. Members of the committee were presented with certificates acknowledging this milestone.

### EI 2014 Conference Keynotes

- **HVEI:** “The science of social interactions on the web,” Ed. H. Chi, Google (USA)
- **HVEI:** “Seven challenges for image quality research,” Damon M. Chandler, Oklahoma State University (USA)
- **HVEI:** “Images shared in social media: a window into human sentiment and emotion,” Shih-Fu Chang, Columbia University (USA)
- **HVEI:** “Digital coloring books,” Patrick Hanrahan, Stanford University (USA)
- **HVEI:** “Perceiving, measuring, and modeling 3D material appearance,” Christopher W. Tyler, Smith-Kettlewell Eye Research Institute (USA)
- **Image Quality and System Performance XI:** “Perceptual tools for quality-aware video networks,” Alan C. Bovik, The University of Texas at Austin (USA)
- **Media Watermarking, Security, and Forensics 2014:** “Photo forensics from shadows and shading,” Hany Farid, Dartmouth College (USA)
- **Media Watermarking, Security, and Forensics 2014:** “Digital wallet and mobile payment,” Sunil K. Jain, Intel Corporation (USA)
- **Media Watermarking, Security, and Forensics 2013:** “Piracy conversion: the role of content protection and forensics,” Richard Atkinson, Adobe Systems Inc. (USA)
- **SD&A:** “Compressive displays: combining optical fabrication, computational processing, and perceptual tricks to build the displays of the future,” Gordon Wetzstein, MIT Media Lab (USA)
- **SD&A:** “Preservation and exhibition of historical 3D movies, Jeff Joseph,” World 3D Film Expo (USA)
- **Visual Information Processing and Communication V:** “HSA overview and how it impacts image processing,” Philip Rogers, AMD (USA)
- **Visualization and Data Analysis:** “What makes cybersecurity visualizations different from other types of visualization,” Pak Chung Wong, Pacific Northwest National Laboratory (USA)
- **Visualization and Data Analysis:** “Just-in-time visual analytics and discovery,” Eser Kandogan, IBM Almaden Research Center (USA)



The Interactive Paper and Demonstration Session allows for networking on a variety of levels. This year’s event was complemented by an Industry Exhibit.

I attended two informative HVEI conference keynotes: “Perceiving, measuring, and modeling 3D material appearance,” by Chris Tyler (Kettlewell Eye Research Institute), and “The science of social interactions on the web,” by Ed Chi (Google). I also attended two of the three keynotes in the Media Watermarking, Security, and Forensics conference and really enjoyed the presentation by Hany Farid (Dartmouth College), “Photo forensics from shadows and shading.”

On a side note, I also found the three 15-minute demo sessions offered by the Media Watermarking, Security, and Forensics conference quite interesting. One of them addressed an application of robust invisible digital watermarking that embedded the UPC symbol of a product in the entire packaging area, thus relieving the cashier from having to find and directly scan the UPC symbol and thereby significantly speeding up the check out process. The demo showed a video of how Digimarc, using this technology, achieved a new Guinness world record for the fastest time to scan and bag 50 items in 48 seconds as compared to the previous record of 75 seconds (<http://vimeo.com/84078592>).

### Short Courses

Technical short courses have always been one the strongest components of the EI conference and are an efficient way of coming up to speed in a certain technology area. Registration at the conference is



Photos: Megjan Rebbani



not required for taking a short course and 25 attendees took advantage of this opportunity. Course attendees can receive CEUs to fulfill continuing education requirements.

EI 2014 featured 14 short courses that spanned a broad range of fundamental and current topics in electronic imaging. Short course registrations were strong and slightly surpassed 2013 in terms of number of registrations per conference attendee despite the fact that fewer courses were offered in 2014. A few popular past courses not offered in 2013 were back on stage. Among them were the “Joint Design of Optics and Image Processing for Imaging Systems,” by David Stork, “Perceptual Metrics for Image and Video Quality in a Broader Context: From Perceptual Trans-



parency to Structural Equivalence,” by Pappas and Hemami, and “Perception, Cognition, and Next Generation Imaging,” by Rogowitz. Also, Battiato’s course was offered with a new focus entitled “Image and Video Forensics: Recent Trends and Challenges.”

## Other Conference Highlights

### Hands-on Demonstrations

The symposium demonstration session is an attractive, hands-on showcase of hardware, software, display, and research products, all related to the topics covered by EI. It has traditionally showcased the largest and most diverse collection of stereoscopic research and products in one location—and this year was no exception.

### Interactive Presentations

The Interactive Paper Sessions were also offered for 80 minutes on Tuesday and Wednesday. The authors were available to answer questions and engage in in-depth discussions about their research.

### Industry Exhibit

This year, the EI Symposium launched an annual industry exhibit focused on mobile imaging and its applications. This event provided a unique opportunity to meet company representatives working in this and other related EI spaces and to become familiar with their products and services while meeting prospective employers.

### JEI Paper Presentations

For the second year, the 2014 Symposium featured a number of presentations by authors whose papers appeared in the *Journal of Electronic Imaging* (JEI). These papers were prominently highlighted in the EI program by the “JEI logo” and were integrated into the appropriate topical conference programs throughout the symposium. As a courtesy to conference attendees, re-prints of these papers were included within the conference proceedings. “The approach is designed to benefit both the JEI paper authors and the EI audience,” commented JEI Editor Gaurav Sharma, who helped formulate this approach. “The authors get to share and

The HVEI conference ends each day with an open discussion among all the days speakers and participants. Valued by many for the additional interaction and networking this activity brings, the format remains a perennial favorite.

highlight their work before the EI audience; EI attendees get to hear a firsthand account of the work and to ask questions. This approach also serves an important need for some members of our EI community who would prefer to have their work be directly featured in a rigorously-reviewed journal.”

### Networking Into the Night

Finally, the all-conference reception, which provides a relaxing venue for meeting colleagues and expanding one’s professional network, was held as a beverage and dessert event on Wednesday evening.

### Conference Award Presentations

Traditionally, the Symposium and Society awards are presented before the plenary sessions on Tuesday and Wednesday mornings. IS&T presented some of its 2013 awards on Tuesday, including Honorary Membership—the highest award of the Society—to Alan Bovik (The University of Texas at Austin) for his impact in shaping the direction and advancement of the field of perceptual image processing. 2013 IS&T Fellows recognized at EI were Sos Agaian, Francisco Imai, and Gaurav Sharma. Senior Member was given to Ricardo Motta and Thrasyvoulos Pappas, and Service Awards to John Merritt and Robert Stevenson.

Wednesday morning marked the recognition of the Symposium awards. The most noteworthy is the Electronic Imaging Scientist of the Year award, granted to a member of the greater electronic imaging community who has demonstrated excellence and commanded respect of his/her peers by making significant contributions to the field of electronic imaging via research, publication, and/or service. The 2014 Electronic Imaging Scientist of the Year Award was presented by Symposium Co-chair Sheila



Photo: Magjien Rabbani.

Hemami to Professor Charles A. Bouman (Purdue University).

Several conferences awarded their best paper and/or best student paper awards, the abstracts of which are found beginning on page 1. Full papers can be downloaded from [imaging.org](http://imaging.org).

### San Francisco to Host EI 2015

EI 2015 will be located in the Hilton San Francisco in Union Square Feb 8 th-12th, 2015. The 2015 Symposium Chair is Sheila Hemami (Northeastern University, USA) and the Symposium Co-chair is Choon-Woo Kim (Inha University). Majid Rabbani (Eastman Kodak Co.) is the short course chair. Similar to 2014, the EI Symposium will run concurrent with the Photonics West Conference, held at the San Francisco Moscone Center, only a few blocks from the Hilton. EI attendees are able to attend the extensive and diverse set of Exhibits at Photonics West, benefiting from relevant short courses, and expanding their professional network. ▲

## Electronic Imaging 2015 CALL FOR PAPERS

**Abstract deadline: 28 July 2014**

### TECHNICAL AREAS:

- 3D Imaging, Interaction, Metrology
- Visualization, Perception, Color
- Image Capture
- Image Processing
- Mobile Imaging
- Computer Vision
- Media Processing & Communication

[www.electronicimaging.org](http://www.electronicimaging.org)

# The Standards Roundup: Imaging and Graphic Arts

by Ann L. McCarthy, IS&T Standards Coordinator

## Imaging Standards News

This *Imaging Standards News* is focused on both US national and international standards applicable to photographic imaging, including analog, digital and print concerns. IS&T imaging standards encompass the capture, communication, and display of a photographer's desired image content, the advancement and maintenance of analog photographic imaging technologies, and the preservation of physical imaging materials; all practices essential to everyday enjoyment of photography and to our photographic heritage.

### ISO/TC 42: Working Groups

TC 42 and its contributing experts are conducting current projects within the following working groups and joint working groups. In each of these areas, experts are welcome to contribute through their corresponding national committees. For meeting details for the working groups listed below, please contact the Secretariat, isotc42@ansi.org.

#### Working Groups with current projects within TC 42

- WG 3, *Sensitometry, image measurement and viewing*; next meeting in Philadelphia, USA, Sept. 4-6, 2014, hosted by the IS&T NIP/Digital Fabrication Conference.
- WG 5, *Physical properties and image permanence of photographic materials*; next meeting in Philadelphia, USA, Sept. 4-6, 2014, hosted by the IS&T NIP/Digital Fabrication Conference.
- WG 18, *Electronic still picture imaging*; next meeting in San Diego, CA, June 24-27, 2014, hosted by Qualcomm Inc., then Sept. 22-24, 2014, in Cologne, Germany, hosted by Image Engineering GmbH & Co. KG.

#### Working Groups with current projects, joint with other ISO and IEC committees:

- WG 8, Joint with TC 6, *Photographic film and paper products – Dimensions*; next meeting in Philadelphia, USA, Sept. 4-6, 2014, hosted by the IS&T NIP/Digital Fabrication Conference.
- JWG 20, Joint with IEC, *Digital Still Cameras*; next meeting in San Diego, CA, June 24-27, 2014, hosted by Qualcomm Inc., then Sept. 22-24, 2014, in Cologne, Germany, hosted by Image Engineering GmbH & Co. KG.
- JWG 23, Joint with TC 130 and CIE, *Extended colour encodings for digital image storage, manipulation and interchange*; next meeting in San Diego, CA, June 24-27, 2014, hosted by Qualcomm Inc., then Sept. 22-24, 2014, in Cologne, Germany, hosted by Image Engineering GmbH & Co. KG.
- WG 25, TC 42/WG 18 joint with TC 130, *Use of XMP for*

*digital photography*; next meeting in San Diego, CA, June 24-27, 2014, hosted by Qualcomm Inc., then Sept. 22-24, 2014, in Cologne, Germany, hosted by Image Engineering GmbH & Co. KG.

- JWG 26, Joint with TC 46/SC 11 and TC 171, *Imaging system capability qualification for archival recording and approval*; next meeting in June 2015, Tokyo, Japan, with ISO/TC 42.

### News from current ISO/TC 42 Projects

Recent progress in standards development is reported for the following projects and action items:

- ISO 18935:2005, *Imaging materials – Colour images on paper prints – Determination of indoor water resistance of printed colour images*, was confirmed by SR in June of last year. WG 5/TG 3 is undertaking a revision to incorporate an edge penetration test, with other updates.
- ISO 18940-1, *Specification for Indoor Stability of Reflection Colour Prints (Part 1: Consumer Home)*, is currently in PWI stage. PWD 2 has been circulated and efforts at the ISO/TC 42/WG5 May 2014 London meeting will be focused on reaching fundamental agreement so that an NP ballot can be prepared. The US has proposed a round robin to evaluate choice of target, stress level to use (fixed load approach), and other aspects not previously tested. Japan has proposed a three-level reporting structure, with the first version of ISO 18940-1 to address Level 1, defining test methods, test conditions, and to allow reporting fundamental test results in graph form. Levels 2 and 3 would then provide endpoint criteria, and translation to a rating system, respectively. The aforementioned fixed load approach, an approach to testing that involves fixed exposures and reporting the degradation amount (rather than testing to an endpoint), is not supported by a large segment of the industry. On the other hand, determination of endpoint criteria suitable for each use case has been a longstanding challenge.
- ISO 18930:2011, *Imaging materials – Pictorial colour reflection prints – Methods for evaluating image stability under outdoor conditions*, contains a four segment testing cycle intended to simulate the degrading effects of daylight, night, rain, and condensation. A new Technical Report in support of this standard is planned from ISO/TC 42/WG5, to include publication of the round-robin test results used to validate the standard. The round-robin was conducted at nine worldwide outdoor locations, and included investigation of lab-to-lab and replicate reproducibility. A presentation of the Technical Report material is planned for the IS&T 2014 NIP/Digital Fabrication Conference.
- The NP ballots for ISO/NP 18948-1, *Imaging materials –*

## Update on International Standards for Printed Electronics: IEC TC 119

The IEC TC 119 Plenary meeting was held in Cambridge, UK, 17th – 19th March 2014. It was followed by a one day meeting, on the 20th, on the topic of “Manufacturing for Printed Electronics” which many of the delegates attended. This event was co-sponsored by the IS&T.

### Highlights from the Plenary meeting

- Working Group 1 (Terminology) now has 18 members. During the meeting, WG1 worked on the terminology that will become vocabulary standard IEC 62905. This important standard will collect and define the terms that are used to communicate Printed Electronics concepts in TC 119 documents.
- Working Group 2 (Materials) is the largest group within TC 119 with 34 members. This working group is currently developing documents covering conductive inks and substrates for printed electronics, as part of a group of stan-

dards that will become IEC 62899. Additional topics are under consideration that may well become official work items in the near future.

- Working Group 3 (Equipment) has 24 members and is developing documents to cover both impact and non-impact fabrication. The documents that will become the IEC 62903 series of standards look at the dimensions of both the features and the printing plates themselves. There is also work underway documenting the evaluation of inkjet head jetting speed that will become IEC 62904.
- Working Group 4 (Printability) has 23 members and is working on the interesting and complex area of the measurement of pattern width. This is an area where knowledge gained from printing standards and microdensitometry may prove useful. There are currently two ballots open for voting in National Committees that are expected to lead to the formation of a Quality Assurance Working Group in the near future.

*Photo books – Requirements for long-term permanence – Part 1*, and ISO/NP 18948-2, *Imaging materials – Photo books – Requirements for long-term permanence – Part 2*, have been approved with both projects being registered with WD documents. These projects will be developed in ISO/TC 42/WG5 and the Project Leader is Stuart Gordon (USA).

- The NP ballot for ISO/NP 19567, *Photography – Digital cameras – Low contrast fine detail measurements*, has been approved. This project will be developed in ISO/TC 42/WG 18 with Co-Project Leaders D. Wueller (Germany) and S. Sakaue (Japan). The challenge in preserving fine image detail through digital camera image capture and image processing has increased as image sensor pixel area has decreased. While the decrease in signal to noise ratio has been compensated by noise reduction processing after image capture, low contrast fine detail in images can be confounded with noise in such processing. This standard will specify the measurement of digital camera reproduction (capture and preservation) of low contrast fine detail, thereby providing an assessment tool useful in comparing various system signal-to-noise and noise reduction processing outcomes.

### IS&T IT2 Changing Leadership

Within the US ISO/TC 42 community, Image Technology Committee 2 (IT2) carries responsibility for traditional photography standards. Philip Wychorski, Orion Standards LLC, has led the committee for a number of years. IS&T expresses deep appreciation for the technical leadership and thoughtful standards process oversight Wychorski has provided throughout his tenure. In early 2014, Wychorski elected to resign his Chair position in IT2. As a result, on March 26, 2014, the IS&T SMB appointed Jack Holm, formerly the Vice-Chair, as Chair of IT2.

## Graphic Arts Standards News

**G**raphic Arts Standards News covers US national and international standards applicable to ISO Technical Committee 130 (Graphic Technology), which develops international standards for the graphic arts industry. This standards news is brought to you in collaboration with NPES, The Association for Suppliers of Printing, Publishing and Converting Technologies. NPES serves as the Secretariat for the US TAG to ISO TC 130 (Graphic Technology). The Secretariat for ISO/TC 130 is held by China. The 29th meeting of ISO/TC 130 will take place Nov. 14-20, 2014 in Beijing, China.

### ISO/TC 130: Working Groups

TC 130 is organized into working groups with convener and assistant convener responsibilities assigned to national bodies. The US serves as the convener of four working groups. In each of these areas, experts are welcome to contribute through their corresponding national committees. For details pertaining to TC 130 Working Groups, please contact the ISO/TC 130 US TAG Secretariat at [www.npes.org/programs/standardsworkroom/tc130theustag.aspx](http://www.npes.org/programs/standardsworkroom/tc130theustag.aspx). Outside of the US, contact the TC 130 Secretariat through your national standards organization.

### Joint CGATS/USTAG/IDEAlliance PPC Activities

Within the US, positions and contributions for ISO/TC 130 are coordinated through joint meetings of CGATS (Committee for Graphic Arts Technology Standards), the ISO/TC 130/US TAG, and the Print Properties & Colorimetrics (PPC) Committee, a working group of the IDEAlliance.

CGATS received ANSI accreditation in 1989 and provides a direct linkage between the graphic arts industry in the U.S. and ANSI standardization of specifications to support progress that in-



dustry. CGATS topics cover the range of the graphic arts industry, including plates, digital data exchange, process control, and ink and color characterization for packaging. NPES (The Association for Suppliers of Printing, Publishing and Converting Technologies) provides support and administration services for CGATS.

The ISO/TC 130/US TAG provides US contributions, through ANSI, for the development of ISO/TC 130 international standards. The overlapping membership and close collaboration between ISO/TC 130/US TAG and CGATS enables careful coordination of US and international standards.

Participation in CGATS committees and in the ISO/TC 130/US TAG is open to anyone having an interest. Membership information is available at <http://www.npes.org/programs/standardsworkroom/standardsupdate.aspx>.

The Print Properties & Colorimetrics (PPC) Committee is responsible for gathering information from industry and for evaluation of technologies and workflows for printing, proofing. This committee oversees proofing and digital press certification programs and the ongoing development of the G7 Specification. Its parent organization, IDEAlliance, is a global not-for-profit membership organization that has worked to enhance the efficiency and operability of the end-to-end digital media supply chain since 1966. More information is available at [www.idealliance.org/groups/committees/print-properties-and-colorimetrics-committee](http://www.idealliance.org/groups/committees/print-properties-and-colorimetrics-committee).

The next joint CGATS/USTAG/IDEAlliance PPC meeting is in Rochester, NY, USA, Oct. 13th - 15th, 2014.

### News from current ISO/TC 130 Projects

For your information the following ISO standard has been published recently and is available for purchase from ISO, ANSI and other national bodies. This standard can also be purchased from NPES.

- ISO 15397:2014 (Ed. 1), *Graphic technology – Communication of graphic paper properties*, published 03 Feb 2014. This standardization project was led by Luc M. Lanat (France). ISO 15397 seeks to improve communication between the graphic papermaking and printing industries in support of quality printing. To accomplish this, the standard defines the paper properties, including several color properties, to be communicated by paper manufacturers (by reference to the original standard) for use with the relevant printing technologies and workflows. ISO 15397 relies on paper standardization work from ISO/TC 6 (Paper, board, and pulps) and prescribes the applicability of those standards to rotogravure, cold-set web offset, heat-set web offset, sheet-fed offset, and flexographic printing processes, and to proofing substrates.

Recent progress in standards development is reported for the following projects and action items:

- The DIS ballot for ISO/DIS 12646 (Ed 3), *Graphic technology – Displays for colour proofing – Characteristics*, was approved with no negative votes and a range of editorial comments. The project editor is preparing the resolution of comments.

- A proposed standard, ISO 16612-3, *Use of PDF/X-4 for content substitution*, was discussed at the March 2014 meeting of ISO/TC 130/WG 2/TF 3. A group has worked to develop this proposal for live variable data printing in which the composition occurs during the printing process. Requirements for merging and rendering at high speed will be included, and consideration is being given to including security printing concerns in an informative annex.
- From ISO/TC 130/WG 3, N 1558 *Guidance on Converting CIELAB Tolerances for Graphic Reproduction*, is provided for information, authored by Danny Rich (USA), with collaboration among members of ISO/TC 130 and CIE Division 1 Light and Color. This work is in response to an action item to provide guidance for converting tolerances in CIELAB 1976 to CIEDE2000.

“The use of the CIELAB 1976 uniform colour space for setting and reporting product colour tolerances is being deprecated. Newer tolerance metrics, such ISO FDIS 11664-6, *Colorimetry – Part 6: CIEDE2000 Colour-difference formula*, are based on more recent visual observations of small and moderate size colour differences, the type of differences encountered in industrially important coloured products.”

In summary, a CIEDE2000 tolerance should be about 0.67 of the CIELAB tolerance in order to capture a similar visually acceptable volume of colour space.

- ISO/TC 130/JWG 14, a joint project with ISO/IEC JTC 1/SC 28 concerning Print Quality Measurement Methods, is developing a series of standards, initially Technical Specifications, to define measurement methods for visual image quality attributes of printed matter. Three categories of attributes have been assigned as: a) color, tone, and surface finish, b) uniformity, and c) detail rendition. Inclusion of ISO/TC 42, particularly WG 5 image permanence, is being considered with Jürgen Jung (Belgium), convenor of ISO/TC 42/WG 5. Phil Green (UK) is developing a recommendation pertaining to computing and analyzing color gamut based on work in CIE TC1-53. A range of topics are in discussion pursuant to the goal of a comprehensive print quality assessment standard.
- ISO/TC 130/WG 3 has initiated a study group to investigate incorporating spot color requirements into TC 130 standards (including in the areas of WG 3/TF 3, WG 13, WG 4, and WG 2). ISO 5, ISO 12646, ISO 13655, ISO 14861 and ISO 15076 are among those identified to be affected in addition to the standards dealing directly with printing process control. Note that ISO 13655, *Graphic technology – Spectral measurement and colorimetric computation for graphic arts images*, is currently under revision to incorporate addition package printing requirements.
- In ISO/TC 130/WG 13 (Printing Conformity Assessment Requirements), the WD of 16761-1, *Graphic Technology – Printing workflows Definition, Requirements and testing con-*



*ditions* – *Commercial printing*, has been circulated and the WG plans to initiate the NWI and CD ballot in May 2014. This standard will address all commercial printing processes with and without spot colors that do not blend with process inks. The introduction clause of the standard provides a useful visual of a reference universal printing workflow.

### American National Standards News

The US government is one of the largest users of standards within the US and as in other countries government participation in and support of standards development activities are of the utmost importance. Early in 2014, a Federal Register Notice was issued by the US Office of Management and Budget (OMB) describing and requesting comments on Proposed Revisions to OMB Circular No. A-119 which addresses a number of topics associated with standards and conformance, including: standards development organization (SDO) processes, intellectual property, and conformity assessment.

For SDOs, the proposed revisions introduce a new category of US Standards called Voluntary Non-Consensus Standards (VNCSs). While continuing preference for voluntary consensus standards (VCSs) over government-unique standards (GUs), the proposed revisions state that VNCSs may be used in certain circumstances. The proposed revisions further impact SDO processes, defining openness to mean that interested parties are provided “meaningful opportunities to participate at all stages of standards development,” changing the definition of “due

process” to include “full access to the views and objections of other participants,” and adding “may be defined” in the definition of consensus.

ANSI staff has drafted a contribution to the OMB based on the input it received from ANSI members with support for the “multiple-path approach” to standardization, e.g., American National Standards developed by an ANSI-accredited SDO, voluntary consensus standards developed by an SDO or consortium, and voluntary non-consensus standards developed by a consortium. In addition, the ANSI contribution seeks clarification on a number of specific and rather fundamental points raised by the Proposed Revisions. We can anticipate that as the OMB responds to ANSI and other contributions and then finalizes the Revision, the ANSI Essential Requirements will be revised. ANSI news on this topic is available at: [www.ansi.org/news\\_publications/news\\_story.aspx?menuid=7&articleid=3944](http://www.ansi.org/news_publications/news_story.aspx?menuid=7&articleid=3944).

*For questions about the activities of TC 42, for suggestions for (or input to) future updates, or standards questions in general, please contact the IS&T Standards Coordinator at [standards@imaging.org](mailto:standards@imaging.org).*

### Announcing 2015 UN International Year of Light

A resolution declaring 2015 the International Year of Light was passed in the United Nations General Assembly in December 2013. The resolution was energized by the realization among scientists and technologists working in the fields of photonics and light sciences that while their work underlies so much of the fundamental technology of the 21st century, layperson understanding and appreciation of these endeavors has not permeated world cultures. The UN resolution was co-sponsored by 35 countries and will inspire educational, philanthropic, and social activities through a number of local, national and international industry and standards organizations around the world. The International Year of Light will celebrate the science of light, light-based technologies, light in nature, and the influence of light on human cultures.

The European Physical Society ([www.eps.org/?page=event\\_iyol](http://www.eps.org/?page=event_iyol)) and The Optical Society ([www.osa.org/en-us/about\\_osa/international\\_year\\_of\\_light/](http://www.osa.org/en-us/about_osa/international_year_of_light/)) have posted information for 2015 IYL activities. The CIE Board of Administration supports this endeavor and invites CIE members to take part and contribute to this challenge, working within their national committees.

**IS&T Honors and Awards celebrate the achievements and service of members of the imaging community. We encourage you to nominate colleagues for these prestigious tributes. To do so, visit [www.imaging.org/ist/Membership/honors.cfm](http://www.imaging.org/ist/Membership/honors.cfm).**

### IS&T REPORTER

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IS&T focuses on all aspects of imaging, with particular emphasis on digital printing, electronic imaging, image perception, photo fulfillment, color imaging, image preservation, digital fabrication, and the physics and chemistry of imaging processes. For more information, visit [imaging.org](http://imaging.org). IS&T publishes the *Journal of Imaging Science & Technology* and *Journal of Electronic Imaging* (with SPIE).

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papers continued from page 1

**Image Quality and Systems Performance****A computational texture masking model for natural images based on adjacent visual channel inhibition**

Yucheng Liu and Jan P. Allebach, Purdue University (USA)

**Abstract:** Masking is a perceptual effect in which contents of the image reduce the ability of the observer to see the target signals hidden in the image. Characterization of masking effects plays an important role in modern image quality assessment (IQA) algorithms. In this work, we attribute the reduced sensitivity to the inhibition imposed by adjacent visual channels. In our model, each visual channel is excited by the contrast difference between the reference and distorted image in the corresponding channel and suppressed by the activities of the mask in adjacent channels. The model parameters are fitted to the results of a psychophysical experiment conducted with a set of different natural texture masks. Cross-validation is performed to demonstrate the model's performance in predicting the target detection threshold. The results of this work could be applied to improve the performance of current HVS-based IQA algorithms.

**Image Sensors and Imaging Systems 2014****Pixel structure with 10 nsec fully charge transfer time for the 20M frame per second burst CMOS image sensor**K. Miyauchi,<sup>1</sup> T. Takeda,<sup>1</sup> K. Hanzawa,<sup>1</sup> Y. Tochigi,<sup>1</sup> S. Sakai,<sup>1</sup> R. Kuroda,<sup>1</sup> H. Tominaga,<sup>2</sup> R. Hirose,<sup>2</sup> K. Takubo,<sup>2</sup> Y. Kondo,<sup>2</sup> and S. Sugawa<sup>1</sup>; <sup>1</sup>Tohoku University and <sup>2</sup>SHIMADZU Corporation (Japan)

**Abstract:** In this paper, we demonstrate the technologies related to the pixel structure achieving the fully charge transfer time of less than 10 nsec for the 20M frame per second burst CMOS image sensor. In this image sensor, the size of the photodiode (PD) is  $30.0 \mu\text{m}^{\text{H}} \times 21.3 \mu\text{m}^{\text{V}}$  in the  $32.0 \mu\text{m}^{\text{H}} \times 32.0 \mu\text{m}^{\text{V}}$  pixel. In the pixel, the floating diffusion (FD) and the transfer-gate-electrode (TG) are placed at the bottom center of the PD. The n-layer for the PD consists of the semicircular regions centered on the FD and the sector-shaped portions extending from the edges of the semicircular regions. To generate an electric field greater than the average of 400 V/cm toward the FD direction in the entire PD region, the n-layer width of the sector-shaped portions becomes narrower from the proximal-end to the distal-end. By using the PD structure, which includes the above mentioned n-layer shape and the PD dopant profile with the condition of three times n-type dopant implantation, we achieved to collect 96 % of the charges generated in the PD at the FD within 10 nsec. An ultra-high speed CMOS image sensor with the abovementioned pixel structure has been fabricated. Through the experiments, we confirmed three key characteristics as follows; the image lag was below the measurement limit, the electron transit time in the PD was less than 10 nsec, and the entire PD region had equivalent sensitivity.

**BEST PAPER AWARDS****Digital Photography X****The color of water: Using underwater photography to estimate water quality**

John Breneman IV, Henryk Blasinski, and Joyce Farrell, Stanford University (USA)

**Abstract:** We describe a model for underwater illumination that is based on how light is absorbed and scattered by water, phytoplankton and other organic and inorganic matter in the water. To test the model, we built a color rig using a commercial point-and-shoot camera in an underwater housing and a calibrated color target. We used the measured spectral reflectance of the calibration color target and the measured spectral sensitivity of the camera to estimate the spectral power of the illuminant at the surface of the water. We then used this information, along with spectral basis functions describing light absorbance by water, phytoplankton, non-algal particles (NAP) and colored dissolved organic matter (CDOM), to estimate the spectral power of the illuminant and the amount of scattered light at each depth. Our results lead to insights about color correction, as well as the limitations of consumer digital cameras for monitoring water quality.

**Image Processing: Machine Vision Applications VII****Depth and all-in-focus images obtained by multi-line-scan light-field approach**Svorad Stolec,<sup>1,2</sup> Reinhold Huber-Mörk,<sup>1</sup> Branislav Holländer,<sup>1</sup> and Daniel Soukup<sup>1</sup>; <sup>1</sup>AIT Austrian Institute of Technology GmbH (Austria) and <sup>2</sup>Institute of Measurement Science, Slovak Academy of Sciences (Slovakia)

**Abstract:** We present a light-field multi-line-scan image acquisition and processing system intended for the 2.5/3-D inspection of fine surface structures, such as small parts, security print, etc. in an industrial environment. The system consists of an area-scan camera, that allows for a small number of sensor lines to be extracted at high frame rates, and a mechanism for transporting the inspected object at a constant speed. During the acquisition, the object is moved orthogonally to the camera's optical axis as well as the orientation of the sensor lines. In each time step, a predefined subset of lines is read out from the sensor and stored. Afterward, by collecting all corresponding lines acquired over time, a 3-D light field is generated, which consists of multiple views of the object observed from different viewing angles while transported w.r.t. the acquisition device. This structure allows for the construction of so-called epipolar plane images (EPIs) and subsequent EPI-based analysis in order to achieve two main goals: (i) the reliable estimation of a dense depth model and (ii) the construction of an all-in-focus intensity image. Beside specifics of our hardware setup, we also provide a detailed description of algorithmic solutions for the mentioned tasks. Two alternative methods for EPI-based analysis are compared based on artificial and real-world data.

## Image Sensors and Imaging Systems 2014

### Smart imaging for power-efficient extraction of Viola-Jones local descriptors

J. Fernández-Berni,<sup>1</sup> R. Carmona-Galán,<sup>1</sup> R. del Río,<sup>1</sup> Juan A. Leñero-Bardallo,<sup>1</sup> M. Suárez-Cambre,<sup>2</sup> and A. Rodríguez-Vázquez<sup>1</sup>; <sup>1</sup>Universidad de Sevilla and <sup>2</sup>University of Santiago de Compostela (Spain)

**Abstract:** In computer vision, local descriptors permit to summarize relevant visual cues through feature vectors. These vectors constitute inputs for trained classifiers which in turn enable different high-level vision tasks. While local descriptors certainly alleviate the computation load of subsequent processing stages by preventing them from handling raw images, they still have to deal with individual pixels. Feature vector extraction can thus become a major limitation for conventional embedded vision hardware. In this paper, we present a power-efficient sensing processing array conceived to provide the computation of integral images at different scales. These images are intermediate representations that speed up feature extraction. In particular, the mixed-signal array operation is tailored for extraction of Haar-like features. These features feed the cascade of classifiers at the core of the Viola-Jones framework. The processing lattice has been designed for the standard UMC 0.18 $\mu$ m 1P6M CMOS process. In addition to integral image computation, the array can be reprogrammed to deliver other early vision tasks: concurrent rectangular area sum, block-wise HDR imaging, Gaussian pyramids and image pre-warping for subsequent reduced kernel filtering.

## Visualization and Data Analysis 2014 (multiple awards)

### Visual abstraction of complex motion patterns

Halldór Janetzko, Dominik Jäckle, Oliver Deussen, and Daniel A. Keim, University of Konstanz (Germany)

**Abstract:** Today's tracking devices allow high spatial and temporal resolutions and due to their decreasing size also an ever increasing number of application scenarios. However, understanding motion over time is quite difficult as soon as the resulting trajectories are getting complex. Simply plotting the data may obscure important patterns since trajectories over long time periods often include many revisits of the same place which creates a high degree of over-plotting. Furthermore, important details are often hidden due to a combination of large-scale transitions with local and small-scale movement patterns. We present a visualization and abstraction technique for such complex motion data. By analyzing the motion patterns and displaying them with visual abstraction techniques a synergy of aggregation and simplification is reached. The capabilities of the method are shown in real-world applications for tracked animals and discussed with experts from biology. Our proposed abstraction techniques reduce visual clutter and help analysts to understand the movement patterns that are hidden in raw spatiotemporal data.

### Relating interesting quantitative time series patterns with text events and text features

Franz Wanner, Tobias Schreck, Wolfgang Jentner, Lyubka Sharalieva, and Daniel A. Keim, University of Konstanz (Germany)

**Abstract:** In many application areas, the key to successful data analysis is the integrated analysis of heterogeneous data. One example is the financial domain, where time-dependent and highly frequent quantitative data (e.g., trading volume and price information) and textual data (e.g., economic and political news reports) need to be considered jointly. Data analysis tools need to support an integrated analysis, which allows studying the relationships between textual news documents and quantitative properties of the stock market price series. In this paper, we describe a workflow and tool that allows a flexible formation of hypotheses about text features and their combinations, which reflect quantitative phenomena observed in stock data. To support such an analysis, we combine the analysis steps of frequent quantitative and text-oriented data using an existing a-priori method. First, based on heuristics we extract interesting intervals and patterns in large time series data. The visual analysis supports the analyst in exploring parameter combinations and their results. The identified time series patterns are then input for the second analysis step, in which all identified intervals of interest are analyzed for frequent patterns co-occurring with financial news. An a-priori method supports the discovery of such sequential temporal patterns. Then, various text features like the degree of sentence nesting, noun phrase complexity, the vocabulary richness, etc. are extracted from the news to obtain meta patterns. Meta-patterns are defined by a specific combination of text features which significantly differ from the text features of the remaining news data. Our approach combines a portfolio of visualization and analysis techniques, including time-, cluster- and sequence visualization and analysis functionality. We provide two case studies, showing the effectiveness of our combined quantitative and textual analysis workflow. The workflow can also be generalized to other application domains such as data analysis of smart grids, cyber physical systems or the security of critical infrastructure, where the data consists of a combination of quantitative and textual time series data.

### Visualization of off-screen data on tablets using context-providing bar graphs and scatter plots

Peter S. Games and Alark Joshi, Boise State University (USA)

**Abstract:** Visualizing data on tablets is challenging due to the relatively small screen size and limited user interaction capabilities. Standard data visualization apps provide support for pinch-and-zoom and scrolling operations, but do not provide context for data that is off-screen. When exploring data on tablets, the user must be able to focus on a region of interest and quickly find interesting patterns in the data. We present visualization tech-



niques that facilitate seamless interaction with the region of interest on a tablet using context-providing bar graphs and scatter plots. Through aggregation, fisheye-style, and overview+detail representations, we provide context to the users as they explore a region of interest. We evaluated the efficacy of our techniques with the standard, interactive bar graph and scatter plot applications on a tablet, and found that one of our bargraph visualizations - Fisheye-style Focus+Context visualization (BG2) resulted in the fewest errors, least frustration and took the least amount of time. Similarly, one of our scatter plot visualizations - User Driven Overview+Detail (SP3) -resulted in the fewest errors, least frustration and took the least amount of time. Overall, users preferred the context-providing techniques over traditional bar graphs and scatter plots, that include pinch-and-zoom and fling-based scrolling capabilities.

### User-driven sampling strategies in image exploitation

Neal Harvey and Reid Porter, Los Alamos National Laboratory (USA)

**Abstract:** Visual analytics and interactive machine learning both try to leverage the complementary strengths of humans and machines to solve complex data exploitation tasks. These fields overlap most significantly when training is involved: the visualization or machine learning tool improves over time by exploiting observations of the human-computer interaction. This paper focuses on one aspect of the human-computer interaction that we call user-driven sampling strategies. Unlike relevance feedback and active learning sampling strategies, where the computer selects which data to label at each iteration, we investigate situations where the user selects which data is to be labeled at each iteration. User-driven sampling strategies can emerge in many visual analytics applications but they have not been fully developed in machine learning. User-driven sampling strategies suggest new theoretical and practical research questions for both visualization science and machine learning. In this paper we identify and quantify the potential benefits of these strategies in a practical image analysis application. We find user-driven sampling strategies can sometimes provide significant performance gains by steering tools towards local minima that have lower error than tools trained with all of the data. In preliminary experiments we find these performance gains are particularly pronounced when the user is experienced with the tool and application domain.



**International Symposium  
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Accepted papers due: November 10

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Las Vegas, Nevada

[www.imaging.org/ist/conferences/tdpf](http://www.imaging.org/ist/conferences/tdpf)

### Configurable IP-space maps for large-scale, multi-source network data visual analysis and correlation

Scott Miserendino, Corey Maynard, and William Freeman, Northrop Grumman Corporation (USA)

**Abstract:** The need to scale visualization of cyber (IP-space) data sets and analytic results as well as to support a variety of data sources and missions have proved challenging requirements for the development of a cyber common operating picture. Typical methods of visualizing IP-space data require unreliable domain conversions such as IP geolocation, network topology that is difficult to discover, or data sets that can only display one at a time. In this work, we introduce a generalized version of hierarchical network maps called configurable IP-space maps that can simultaneously visualize multiple layers of IP-based data at global scale. IP-space maps allow users to interactively explore the cyber domain from multiple perspectives. A web-based implementation of the concept is described, highlighting a novel repurposing of existing geospatial mapping tools for the cyber domain. Benefits of the configurable IP-space map concept to cyber data set analysis using spatial statistics are discussed. IP-space map structure is found to have a strong effect on data clustering behavior, hinting at the ability to automatically determine concentrations of network events within an organizational hierarchy. ▲

## UPCOMING IS&T EVENTS

September 7 - 11, 2014; Philadelphia, Pennsylvania  
**NIP30/Digital Fabrication 2014** General Chair: Branka Lozo

November 3 - 7, 2014; Boston, Massachusetts  
**22nd Color and Imaging Conference (CIC22) and  
2nd International Congress of the International Academy of Digital  
Pathology (IADP)** General Chairs: Jennifer Gille and Yukaku  
Yagi

January 4 - 5, 2015; Las Vegas, Nevada  
**Technologies for Digital Photo Fulfillment**  
Symposium Chair: Joseph LaBarca

February 8 - 12, 2015; San Francisco, California  
**Electronic Imaging 2015** Symposium Chairs: Sheila Hemami  
and Choon-Woo Kim

May 2015; Los Angeles, CA  
**Archiving 2015** General Chair: David Walls

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