BEST STUDENT PAPERS

Electronic Imaging Symposium 2013

Digital Photography IX Conference

Evaluation of a High Dynamic Range Video Camera with Non-Regular Sensor

Michael Schöberl[1,2], Joachim Keinert[1], Matthias Ziegler[1], Jürgen Seiler[2], Marco Niehaus[3], Gerald Schuller[3], André Kaup[2], and Siegfried Foessel[1]; [1]Fraunhofer Institute for Integrated Circuits IIS, [2]University of Erlangen-Nuremberg, and [3]Ilmenau University of Technology (Germany)

Abstract: Although there is steady progress in sensor technology, imaging with a high dynamic range (HDR) is still difficult for motion imaging with high image quality. This paper presents our new approach for video acquisition with high dynamic range. The principle is based on optical attenuation of some of the pixels of an existing image sensor. This well-known method traditionally trades spatial resolution for an increase in dynamic range. In contrast to existing work, we use a non-regular pattern of optical ND filters for attenuation. This allows for an image reconstruction that is able to recover high resolution images. The reconstruction is based on the assumption that natural images can be represented nearly sparse in transform domains, which allows for recovery of scenes with high detail. The proposed combination of non-regular sampling and image reconstruction leads to a system with an increase in dynamic range without sacrificing spatial resolution. In this paper, a further evaluation is presented on the achievable image quality. In our prototype we found that crosstalk is present and significant. The discussion thus shows the limits of the proposed imaging system.

To view the full papers of these abstracts for no fee go to www.imaging.org/ist/publications/reporter/index.cfm

* *These papers were presented with the conference noted at the IS&T/SPIE Electronic Imaging Symposium, held Feb. 3-7, 2013, in Burlingame, CA.*

The Royal Library's Photography Collection in Copenhagen, Denmark was the site of the presentation of the final HP Image Permanence Award to Yoshi Shibahara (center). IS&T President Alan Hodgson, (3M UK PLC, third from right) made the presentation during the TC42 Plenary Host Reception. Others pictured (from left) are Executive VP Geoff Woolfe, Past President Rob Buckley, Executive Director Suzanne Grinnan, and European Chapter Co-Director Dietmar Wueller. Shibahara was given his award "for significant contributions to furthering the understanding of how modern print materials respond to forces of decay such as light, pollution, and humidity." See IS&T's 2013 Honors and Awards booklet for a full listing of recipients.

Image Quality and System Performance X Conference

Acceptable Bit-rates for Human Face Identification from CCTV Imagery

Anastasia Tsifouti[1,2], Sophie Triantaphillidou[2], Efthimia Bilissi[2], Mohamed-Chaker Larabi[3]; [1]Centre for Applied Science and Technology (UK), [2]University of Westminster (UK), and [3]University of Poitiers (France)

Abstract: The objective of this investigation is to produce recommendations for acceptable bit-rates of CCTV footage of people onboard London buses. The majority of CCTV recorders on buses use a proprietary format based on the H.264/AVC video coding standard, exploiting both spatial and temporal redundancy. Low bit-rates are favored in the CCTV

INSIDE THIS ISSUE

Photo: Nicolas Bonnier.

Highlights From IS&T/SPIE Electronic Imaging 2013 Symposium

By Mojgan Rabbani, Xerox Corporation

The 25th annual IS&T/SPIE Electronic Imaging Symposium (EI) held its quarter of century meeting at the Hyatt Regency San Francisco Airport Hotel in Burlingame, California, Feb 3-7, 2013. The symposium steering committee led by Symposium Chair Gaurav Sharma (University of Rochester) attracted an international multi disciplinary community of scientists representing academia, industry, and government. The 1000+ participants came from across the world.

Sharma worked closely with Symposium Co-chair Sergio Goma (Qualcomm Inc.), Short Course Chair Choon-Woo Kim (Inha University), Technical Advisor Andrew J. Woods (Curtin University, Australia), Past Symposium Chair Majid Rabbani (Eastman Kodak Co.) and hundreds of conference committee chairs and members to produce a symposium consisting of 589 oral presentations, 103 poster presentations, and 18 short courses.

The symposium seven main technology clusters, each made up of two to four technical conferences for total of 23 conferences. The seven clusters are: (i) 3D imaging, Interaction, and Metrology, (ii) Visualization, Perception, and Color, (iii)

Photo: Diana Gonzalez.

Participants enjoyed some stereoscopic gaming in the NVIDIA/Tekamaki 3D Video Game Theater. It featured a large curved screen and three projectors that provided a horizontal 150° field of view.

Image Processing, (iv) Image Capture, (v) Computer Vision, (vi) Media Processing and Communication, and (vii) Mobile Imaging.

It had been a few years since I had last participated in the EI Symposium and I found it more exciting and vigorous than I remembered. The symposium has been taking the initiative to expand into new areas of research related to electronic imaging, while being faithful to its strong base. For example, this year Video Surveillance and Transportation Imaging Application

was a new conference in the Computer Vision cluster, contrasting with the significant milestone of a quarter century achieved for the Human Vision and Electronic Imaging (HVEI) Conference. At times I had difficulty choosing which session to attend; like a kid in a candy store, I wanted it all!

While the opportunities to present one's research and hear from others are the obvious benefits of a conference, I particularly enjoyed the networking opportunities and the great hallway debates and exchange of ideas.

Plenary and Keynote Speakers

There were two engaging plenary talks on expanding the area of capturing the world in photos. Sabine Susstrunk (Ecole Polytechnique Fédérale de Lausanne, Switzerland) presented "Another Look at Signals and Images." In the talk she shared her group's research on how to take advantage of side information to improve system performance and enable new functionalities in computational photography

PLENARY LINKS

Another Look at Signals and Images, by Sabine Susstrunk:
http://ivrg.epfl.ch/people/susstrunk

A Trillion Photos, by Steve Seitz:
http://homes.cs.washington.edu/~seitz/

Photos: Andrew Woods

Above left: Sabine Süsstrunk discussed how to take advantage of side information to improve system performance and enable new functionalities in computational photography and computer vision. Above right: Steve Seitz's presentation showed how images from photo-sharing sites could be used to construct a virtual model of famous sites in Rome.

and computer vision. Süsstrunk shared new results of adding semantics when capturing an image in addition to capturing auxiliary signals such as an infrared channel. Her superior presentation skills and numerous examples held the audience captive and engaged.

The second plenary by Steve Seitz (University of Washington) focused on how to take advantage of the trillion photos that are captured each year by consumers and placed on photosharing sites. "A Trillion Photos" explored ways of transforming the massive, unorganized photo collection into reconstructions and visualizations of the world's most famous sites. After a recap of his previous work on Microsoft's Photosynth project that involved the amazing reconstruction of Rome in a day using photos found on photo sharing sites, he present the results of new work on modeling places and people from large photo collections that is being conducted by his research group at the University of Washington and the product group that he directs at Google. Seitz's

The Demonstration Session is a vibrant part of the EI Symposium. Each year speakers are invited to showcase supplementary visuals that future explain research presented in their papers.

Photo: Diana Gonzalez.

24TH SD&A FEATURES 3D IMAGING TECHNOLOGIES AND APPLICATIONS

This year's SD&A Conference was the 24th such gathering, a major component of the Electronic Imaging Symposium (EI) held each year. The 2013 Symposium took place during the first week of February at the Hyatt Regency San Francisco Airport Hotel in Burlingame, CA. EI is organized and managed cooperatively by IS&T and SPIE.

Characterized as the world's premier conference for 3D innovation, this year's SD&A Conference featured a remarkable variety of 3D imaging technologies and applications, as well as research on human perception of depth in the viewing of images. Both the papers and the 3D Theater sessions demonstrated significant advances in 3D research and development. Participants came from many countries—about a third each from North America, Europe, and Asia. Speakers presented 57 technical oral papers, and 18 interacive papers.

A new prize for the most effective use of 3D in a technical presentation was awarded to Keynote speaker Jim Defillipis, who illustrated his presentation, "Coverage of the London 2012 Olympic Games in 3D," with a documentary showing the 3D camera rigs being used to record the Olympic events. The coverage, which provided 275 hours of 3D programming, involved three mobile and six single camera field production units. To this audience the illustration of advanced camera equipment in action was almost as spectacular as the performances of the Olympic athletes who were being recorded.

The first evening's popular 3D Theatre presented a sequence of selections of 3D video from many countries on an 18-foot (diagonal) stereoscopic projection screen. The award for Best of Show 3D, Live Action went to Site-Eye Time-Lapse Films for "Ninety-Three Million Miles" (UK, directed by Brian

McClave and Gavin Peacock), and the award for Best of Show, Computer Graphics went to Toon Box Entertainment, Ltd. (Canada) and Redrover Co., Ltd. (South Korea) for "Nuts and Robbers."

The Demonstration Session, presented the second evening showcased a wide range of 3D equipment and technology. A prize for the best demonstration was awarded to John Toeppen and Jason Buchheim for their spectacular display "Gigapixel Immersive Stereoscopic Panoramas."

An exhibit area adjoining the lecture rooms included a 3D video game theater by NVIDIA Corp. and Tekamaki LLC. Their demonstration featured a large curved screen and three projectors that provided a horizontal 150° field of view to demonstrate a variety of stereoscopic games. Stereo photographer, Terry Wilson, exhibited a fine display of phantograms, including both her own work and that of several other artists who had participated in the First Inter-Galactic Phantogram Exhibition, held in 2012 and sponsored by Barry Rothstein.

A forum held on the third day moderated by Gregg Favalora discussed the effectiveness of depth representation in 3D cinema. Panelists were Eric Kurland (stereographer, 3-DIY, USA), Jenny Read (vision scientist, Newcastle University, UK), Paul Judkins (director of technical film products, IMAX Corp., Canada), and Phil McNally (stereoscopy supervisor, Dreamworks Animation, USA).

In summary, the 2013 SD&A Conference was a very stimulating event. Plans are already under way for 2014 and the celebration of SDA's 25th year. The EI Symposium will take place February 2-6 at the Hilton San Francisco Union Square.

—by Vivian Walworth

> ## SDA "MUST SEE" LINKS
>
> - **Illustrated summary of the 3D Theater Session presentations:**
>   www.stereoscopic.org/3dcinema.org
>
> - **Recap of the demonstration session/exhibits:**
>   www.stereoscopic.org.
>
> - **Full SD&A Conference proceedings**:
>   www.stereoscopic.org/proc/index.html#2013

energetic delivery—along with his amazing examples—captured the audience's imagination and stimulated a lot of creative thinking.

In addition to the Symposium plenaries, many conferences held their own keynote presentations, the titles for which appear at left.

Short Courses

Technical courses have always been one of the strongest components of EI and are an efficient way of coming up to speed in a certain technology area. Registration at the conference is not required for taking a short course and ~25% of the short course attendees took advantage of this opportunity. The course attendees receive CEUs to fulfill continuing education requirements.

EI 2013 featured 18 short courses in fundamental and current topics in electronic imaging including: 3D imaging interaction and metrology, computer vision, image capture, and image processing. Five new courses were added this year: Head Mounted Displays for Augmented Reality Applications, Document and Image Analysis on Android Devices, HDR Imaging in Cameras, Displays and Human Vision, The EMVA1288 Standard, and Theory and Methods of Lightfield Photography.

Other Conference Highlights

3D Theatre

The 3D Theatre has become a tradition for the Stereoscopic Displays and Applications (SD&A) conference and has been a great hit with the EI audience. It showcases the wide variety of 3D content that is being produced and exhibited around the world. All 3D footage is shown in high-quality, polarized 3D, on a large-screen. This year's event, hosted by Andrew J. Woods (Curtin Univ., Australia) was no exception.

Stratos Project

Another evening presentation that drew a large audience featured an insider look be-

The 3D Theater, showcasing "cutting-edge" clips from some of the best uses of the technology from the past year is the highlight of the Symposium for attendees from all the conferences. Best of Show awards were given this year to "Ninety-Three Million Miles" (Live Action) and "Nuts and Robbers" (Computer Graphics).

hind the Stratos Project; its goals, challenges, and lessons learned. The project enabled Felix Baumgrartner to skydive from more than 120,000 feet, breaking the speed of sound in a freefall in addition to a number of world records. This incredible example of human achievement was documented by a group of optical imaging scientists who worked for more than two years to develop the necessary systems and equipment. This monumental leap was captured by 35 cameras to provide a full picture of what this endeavor means for the future of scientific exploration.

Online Education Panel

During the past couple of years, discussions of online education and the ways in which it will and will not change higher education have captured the attention of the media, the public, and also of educators and university administrators. Terms originating in the online education universe, such as massive open online courses (MOOCs), inverted classrooms, and open courseware, have become part of the vernacular within a short span of time and 2012 ended with *The New York Times* declaring it "The Year of the MOOC".

A unique panel discussion moderated by Professor Bernd Girod (Stanford University) provided insight into the opportunities and challenges in the rapidly growing area of online learning. The panel's distinguished guests were: Andrew Ng, professor at Stanford University and a co-founder of the famous free online course

website, Coursera (http://ai.stanford.edu/~ang/); Candace Thille, director of the Open Learning Initiative at CMU (http://oli.cmu.edu/get-to-know-oli/learn-more-about-oli/leadership-and-staff/candace-thille/); Umesh Vazirani, director of the Berkeley Quantum Computation Center, and Jeremy Johnson, president undergraduate programs, 2U (http://2u.com/teamnew/jeremy-johnson/).

Demonstrations and Interactive Papers

The attractive, hands-on demonstration of hardware, software, display, and research products related to all the topics covered by EI is an exciting part of the conference. The Demonstration Session has traditionally showcased the largest and most diverse collection of stereoscopic research and products in one location—and this year was no exception. Attendees saw the latest research in action, compared commercial products, asked questions of technically knowledgeable demonstrators, and even made purchasing decisions about a range of EI products.

The Interactive Paper Session drew a large crowd. Here authors display their work in the form of posters and are available to answer questions and engage in in-depth discussions about their work.

Conference Award Presentations

A number of conference and Society awards were presented during the symposium, as found at right. The 12 Best Student Paper awards presented this year are highlighted in this issue of *The Reporter*.

San Francisco to Host EI 2014

EI 2014 will be held at the Hilton San Francisco Union Square, February 2–6, the same week as Photonics West. Conference chairs are Sergio Goma (Qualcomm) and Sheila Hemami (Cornell). EI attendees will be able to visit the PW exhibit, which is held at the Moscone Center (~6 blocks from the Hilton), while PW attendees will benefit from EI's relevant short course and technical papers. The EI 2014 Steering Committee is currently studying many radical changes to expand the scope and attendance of EI. ▲

Süsstrunk Recieves Prestigious Electronic Imaging Scientist of the Year Award;
Many Society and Symposium Awards Presented at EI 2013

- **EI Scientist of the Year:** Given to a member of the EI community who has demonstrated excellence and commanded the respect of peers by making significant contributions to the field of electronic imaging via research, publication, and/or service. The EI 2013 award was presented by Symposium Chair, Gaurav Sharma, to Professor Sabine Susstrunk of EPFL in Switzerland.

Sabine Süsstrunk (EPFL) with EI 2013 Symposium Chair Gaurav Sharma.

- EI 2013 marked the **25th Anniversary of HVEI**, one of the most successful and best attended conferences in the history of EI. The conference co-chairs, Bernice Rogowitz (original founder), Thrasos Pappas (co-chair for the last 17 years), and Huib de Ritter, were recognized for their contributions to this conference.
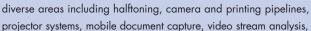

HVEI founding chair Bernice Rogowitz, Huib de Ritter, and Thrasos Pappas were presented with plaques honoring the conference's milestone 25th year by Gaurav Sharma (above); John Merritt with Sharma (below).

The EI 2013 Steering Committee presented John Merritt with a Certificate of Appreciation in recognition of teaching the Stereoscopic Displays short course at the EI Symposium for 25 consecutive years.

- IS&T Fellowship was bestowed on Quin Lin (Hewlett-Packard Laboratories) for seminal contributions to the science, engineering, and technology development in diverse areas including halftoning, camera and printing pipelines, projector systems, mobile document capture, video stream analysis, indexing and classification, and automated document and video composition.

Quin Lin, above, and Raja Bala, right were honored by IS&T.

Raja Bala (Xerox Corp.) was honored for his services on the IS&T Board of Directors as Vice President of Publications.

- Three SPIE Fellows received their awards: Venu Govarindaju (Univ. of Buffalo), Edmund Lam (Univ. of Hong Kong), and Guarav Sharma (Univ. of Rochester).

Majid Rabbani (right) present EI Symposium Chair Guarav Sharma (Univ. of Rochester) with SPIE Fellowship for significant and lasting contributions to color and digital imaging, spanning both academia and industry.

Standards Update

by David Q. McDowell, Editor

This issue of *Standards Update* is a potpourri of a number of ANSI and International standards activities.

I want to express my appreciation to Alan Hodgson (ahodgson@mmm.com) of 3M UK PLC for contributing the update of the work of IEC TC 119, Printed Electronics (see box, right). Others who wish to report on the activities of their standards groups are urged to provide input.

ANSI Committee for Graphic Arts Technologies Standards (CGATS)

I don't often write about ANSI CGATS these days, because much of its current work is in support of the ISO TC 130 activities. However, recently CGATS, working with IDEAlliance, has published a 2-part ANSI Standard.

Within TC 130 there is an ongoing debate concerning the use of color characterization data to define printing aims instead of the traditional use of process control data. The US strongly believes that color characterization data is the best way to define printing requirements between the print specifier (buyer) and print producer. When the US experts tried to introduce this approach in TC 130 they were rebuffed, primarily by the European National Body groups.

Since the current ISO printing standards, which are based on process control aims (color of the solids and densitometric tone value increase), do not represent the current practice in the US, CGATS was left with no alternative but to create US printing Standards.

CGATS 21-1:2013, *Graphic technology — Printing from digital data across multiple technologies — Part 1: Principles,* establishes the framework and principals associated with using color characterization data as the definition of the aims for printing. Color characterization data is defined to be the expected relationship

between input CMYK data and the corresponding printed color on the substrate used. It is independent of the printing process and substrate (other than substrate color). Where the data input is other than actual CMYK, the proper inclusion of ICC profiles allows something called virtual CMYK data to be created. That is data in any color space encoding with sufficient metadata (profiles etc) to create a unique CHMK data.

Because the color of the substrate seldom matches the substrate color in the data set, a procedure is included allow the data set to be modified for moderate changes in substrate (usually paper) color.

CGATS 21-2:2013, *Graphic technology — Printing from digital data across multiple technologies — Part 2: Reference characterization data-2013,* defines a family of seven characterized reference printing conditions (CRPC) that include printing gamuts that range from newsprint to an extra large gamut that exceeds all but the largest gamut printing in use today.

This family of characterization data sets is expected to meet the printing definition needs of that vast majority of printing done in the US today. Clearly there are special situations where the intended printing is the subject of one-on-one negotiations between the print preparer and printer. These CRPCs are not intended to meet these kinds of situations, but are intended for use where multiple printers are printing the same work and/or there is minimal customization of the printing definition.

Clearly modifications to these CRPCs will be needed in the future as will additional CRPCs. However, because these are standardized data, printing contracts and printing specification will be based on them and therefore they must continue to exist for many years. New CRPCs will be published as necessary in additional Parts of CGATS 21 in future years. This allows CGATS to plan for both future change and preserve references that will be important for the business of printing.

TC 42 Plenary

The 23rd Plenary Meeting of ISO TC 42 (Photography) took place June 3–7, 2013 in Copenhagen, Denmark.

Nine Working Groups (WG) met in conjunction with the Plenary. These are WG 3 (Sensitometry, image measurement and viewing), WG 5 (Physical properties and image permanence of photographic materials), WG 8 (Joint TC 42-TC 6 Photographic film and paper products - Dimensions), WG 18 (Electronic still picture imaging), JWG 20 (Digital still cameras), JWG 22 (Colour management), WG 23 (Extended colour encodings for digital image storage, manipulation and interchange), JWG 25 (Use of XMP for digital photography), and JWG 26 (Imaging system capability qualification for archival recording and approval).

Recently published TC 42 standards

Since mid-year 2012 TC 42 has published the following:

- *ISO 12234 1:2012 (Ed. 3) Electronic still picture imaging — Removable memory — Part 1: Basic removable memory model*
- *ISO/TS 22028 3:2012 (Ed. 2) Photography and graphic technology — Extended colour encodings for digital image storage, manipulation and interchange — Part 3: Reference input medium metric RGB colour image encoding (RIMM RGB)*
- *ISO/TR 17321 2:2012 (Ed. 1) Graphic technology and photography — Colour characterization of digital still cameras (DSCs) — Part 2: Considerations for determining scene analysis transforms*
- *ISO/TS 22028 4:2012 (Ed. 1) P hotography and graphic technology — Extended colour encodings for digital image storage, manipulation and interchange — Part 4: European Colour Initiative RGB colour image encoding [eciRGB (2008)]*
- *ISO 17321 1:2012 (Ed. 2) Graphic technology and photography — Colour characterization of digital still cameras (DSCs) — Part 1: Stimuli, metrology and test procedures*
- *ISO 18907:2013 (Ed. 2) Imaging*

International Standards for Printed Electronics: The Formation of IEC TC 119

This is an introductory article describing a new initiative for standardization in the field of printed electronics. Here I aim to provide a snapshot of the short history of IEC TC 119; in future articles I will provide details as the work develops.

International Standards are produced through two main organizations: the International Standards Organization (ISO) and the International Electrotechnical Commission (IEC). The IEC is responsible for all systems pertaining to electrical or electronic items so Printed Electronics falls under their remit. Although IEC has overall responsibility for the production of these standards, the actual development work done in technical committees (TC). New TCs are voted in place by a group called the IEC Standardization Management Board (SMB).

IEC TC 119 is only 18 months old. What follows is a snapshot of the process, which explains some of its structure.

In April 2011, the organization responsible for National Standards in South Korea submitted a proposal to IEC to form this TC. In June 2011, the IEC SMB circulated a proposal for a Printed Electronics TC to nations that participate in standards. These nations were asked to vote on the proposal and to indicate interest in participation. In addition, the Korean National Standards body volunteered to take on the TC's Secretariat role.

The vote was positive and in September 2011 IEC TC 119 was formally established. Ten nations had chosen to participate at that point eight more to observe the process. The ten nations are China (CN), Germany (DE), Great Britain (GB), Italy (IT), Finland (FI), Japan (JP), South Korea (KR), the Russian Federation (RU), Sweden (SE), and the United States (US). There is still time to lobby your National Organization if you feel that your country should be participating!

Participation in the writing of Printed Electronics standards brings various benefits. In addition to advancing knowledge of the content of the documents, participation provides substantial unique networking opportunities and the chance to have your views heard in the writing of these documents. There are large formal events where the entire TC assembles. The first of these took place in Seoul in May 2012 and we last met in San Diego in February 2013. In addition, there are smaller informal meetings that take place at trade shows and conferences.

The Scope of TC 119 has been agreed by the IEC and now reads "*Standardization of terminology, materials, processes, equipments, products, and health/safety/environment in the field of printed electronics.*" As such this overlaps strongly with some of the business interests and research directions of IS&T members and constituents. TC 119 welcomes your participation.

Work is currently under way to develop standards, particularly in the areas of functional materials and substrates. I look forward to working with you as this process proceeds and I plan to report on this in future issues of *The Reporter*.

—*Alan Hodgson, Chair IEC TC 119*

- *materials — Photographic films and papers — Wedge test for brittleness*
- *ISO 18914:2013 (Ed. 2) Imaging materials — Photographic film and papers — Method for determining the resistance of photographic emulsions to wet abrasion*
- *ISO 18924:2013 (Ed. 2) Imaging materials — Test method for Arrhenius type predictions*
- *ISO 18925:2013 (Ed. 3) Imaging materials — Optical disc media — Storage practices*
- *ISO 18928:2013 (Ed. 3) Imaging materials — Unprocessed photographic films and papers — Storage practices*
- *ISO 15781:2013 (Ed. 1) Photography — Digital cameras — Measuring shooting time lag, shutter release time lag, shooting rate, and start up time*
- *ISO 2721:2013 (Ed. 2) Photography — Cameras — Automatic controls of exposure*

- *ISO 18927:2013 (Ed. 3) Imaging materials — Recordable compact disc systems — Method for estimating the life expectancy based on the effects of temperature and relative humidity*
- *ISO 22028 2:2013 (Ed. 1) Photography and graphic technology — Extended colour encodings for digital image storage, manipulation and interchange — Part 2: Reference output medium metric RGB colour image encoding (ROMM RGB)*

TC 130 Working Group Meetings

The working groups of TC 130 (Graphic technology) will be meeting in Shenzhen, China May 19 through 24, 2013. All WGs of TC 130 will be meeting except for WG5 (Ergonomics - Safety).

Recently published TC 130 Standards

Since mid-year 2012 TC 130 has published the following:

- *ISO 12647-6:2012 Graphic technology — Process control for the production of half-tone colour separations, proofs and production prints — Part 6: Flexographic printing*
- *ISO 12647-8:2012 Graphic technology — Process control for the production of half-tone colour separations, proof and production prints — Part 8: Validation print processes working directly from digital data ISO 14298:2013 Graphic technology — Management of security printing processes*
- *ISO 16684-1:2012 Graphic technology — Extensible metadata platform (XMP) specification — Part 1: Data model, serialization and core properties*

For suggestions for (or input to) future updates, or standards questions in general, please contact the editor at dmcdowell@npes.org.

industry but they compromise the image usefulness of the recorded imagery. In this context usefulness is defined by the presence of enough facial information remaining in the compressed image to allow a specialist to identify a person. The investigation includes four steps: 1) Collection of representative video footage. 2) The grouping of video scenes based on content attributes. 3) Psychophysical investigations to identify key scenes, which are most affected by compression. 4) Testing of recording systems using the key scenes and further psychophysical investigations. The results are highly dependent upon scene content. For example, very dark and very bright scenes were the most challenging to compress, requiring higher bit-rates to maintain useful information. The acceptable bit-rates are also found to be dependent upon the specific CCTV system used to compress the footage, presenting challenges in drawing conclusions about universal 'average' bit-rates.

Image Quality and System Performance Conference Chairs Peter Burns and Sophie Triantaphillidou with the two Best Student paper authors Anastasia Tsifouti (Centre for Applied Science and Technology and University of Westminster, UK) and Raluca Vlad (GIPSA-lab,France).

Three Factors that Influence the Overall Quality of the Stereoscopic 3D Content: Image Quality, Comfort and Realism

Raluca Vlad, Patricia Ladret and Anne Guérin, GIPSA-lab (France)

Abstract: In today's context, where 3D content is more abundant than ever and its acceptance by the public is probably definitive, there are many discussions on controlling and improving the 3D quality. But what does this notion represent precisely? How can it be formalized and standardized? How can it be correctly evaluated? A great number of studies have investigated these matters and many interesting approaches have been proposed. Despite this, no universal 3D quality model has been accepted so far that would allow a uniform across studies assessment of the overall quality of 3D content, as it is perceived by the human observers.

In this paper, we are making a step forward in the development of a 3D quality model, by presenting the results of an exploratory study in which we started from the premise that the overall 3D perceived quality is a multidimensional concept that can be explained by the physical characteristics of the 3D content. We investigated the spontaneous impressions of the participants while watching varied 3D content, we analyzed the key notions that appeared in their discourse and identified correlations between their judgments and the characteristics of our database.

The test proved to be rich in results. Among its conclusions, we consider of highest importance the fact that we could thus determine three different perceptual attributes—image quality, comfort and realism—that could constitute a first simplistic model for assessing the perceived 3D quality.

Document Recognition and Retrieval XX Conference

Evaluating Supervised Topic Models in the Presence of OCR Errors

Daniel Walker, Eric Ringger, and Kevin Seppi, Brigham Young Univ. (USA)

Abstract: Supervised topic models are promising tools for text analytics that simultaneously model topical patterns in document collections and relationships between those topics and document metadata, such as timestamps. We examine empirically the effect of OCR noise on the ability of supervised topic models to produce high quality output through a series of experiments in which we evaluate three supervised topic models and a naive baseline on synthetic OCR data having various levels of degradation and on real OCR data from two different decades. The evaluation includes experiments with and without feature selection. Our results suggest that supervised topic models are no better, or at least not much better in terms of their robustness to OCR errors, than unsupervised topic models and that feature selection has the mixed result of improving topic quality while harming metadata prediction quality. For users of topic modeling methods on OCR data, supervised topic models do not yet solve the problem of finding better topics than the original unsupervised topic models.

Semi-structured Document Image Matching and Recognition

Olivier Augereau, Nicholas Journet, and Jean-Philippe Domenger, Université de Bordeaux (France)

Abstract: This article presents a method to recognize and to localize semi-structured documents such as ID cards, tickets, invoices, etc. Standard object recognition methods based on interest points work well on natural images but fail on document images because of repetitive patterns like text. In this article, we propose an adaptation of object recognition for image documents. The advantages of our method is that it does not use character recognition or segmentation and it is robust to rotation, scale, illumination, blur, noise and local distortions. Furthermore, tests show that an average precision of 97.2% and recall of 94.6% is obtained for matching 7 different kinds of documents in a database of 2155 documents.

Visualization and Data Analysis 2013 Conference
Visual Analysis of Situationally Aware Building Evacuations

Jack Guest, Todd Eaglin, Kalpathi Subramanian, and William Ribarsky, The University of North Carolina at Charlotte (USA)

Abstract: Rapid evacuation of large urban structures (campus buildings, arenas, stadiums, etc.) is a complex operation and of prime interest to emergency responders and planners. Although

there is a considerable body of work in evacuation algorithms and methods, most of these are impractical to use in real-world scenarios (non real-time, for instance) or have difficulty handling scenarios with dynamically changing conditions. Our goal in this work is towards developing computer visualizations and real-time visual analytic tools for building evacuations, in order to provide situational awareness and decision support to first responders and emergency planners. We have augmented traditional evacuation algorithms in the following important ways, (1) facilitate real-time complex user interaction with first responder teams, as information is received during an emergency, (2) visual reporting tools for spatial occupancy, temporal cues, and procedural recommendations are provided automatically and at adjustable levels, and (3) multiscale building models, heuristic evacuation models, and unique graph manipulation techniques for producing near real-time situational awareness. We describe our system, methods and their application using campus buildings as an example. We also report the results of evaluating our system in collaboration with our campus police and safety personnel, via a table-top exercise consisting of 3 different scenarios, and their resulting assessment of the system.

Three-dimensional Volume Analysis of Vasculature in Engineered Tissues

Mohammed Yousefhussien[1], Kelley Garvin[2], Diane Dalecki[2], Eli Saber[1], and Maria Helguer[1]; [1]Rochester Institute of Technology and [2]University of Rochester (USA)

Abstract: Three-dimensional textural and volumetric image analysis holds great potential in understanding the image data produced by multi-photon microscopy. In this paper, an algorithm that quantitatively analyzes the texture and the morphology of vasculature in engineered tissues is proposed. The investigated 3D artificial tissues consist of Human Umbilical Vein Endothelial Cells (HUVEC) embedded in collagen exposed to two regimes of ultrasound standing wave fields under different pressure conditions. Textural features were evaluated using the normalized Gray-Scale Co-occurrence Matrix (GLCM) combined with Gray-Level Run Length Matrix (GLRLM) analysis. To minimize error resulting from any possible volume rotation and to provide a comprehensive textural analysis, an averaged version of nine GLCM and GLRLM orientations is used. To evaluate volumetric features, an automatic threshold using the gray level mean value is utilized. Results show that our analysis is able to differentiate among the exposed samples, due to morphological changes induced by the standing wave fields. Furthermore, we demonstrate that providing more textural parameters than what is currently being reported in the literature enhances the quantitative understanding of the heterogeneity of artificial tissues.

Multi-focus and Multi-window Techniques for Interactive Network Exploration

Priya Krishnan Sundararajan, Ole J. Mengshoel, and Ted Selker, Carnegie Mellon University (USA)

Abstract: Networks analysts often need to compare nodes in different parts of a network. When zoomed to fit a computer screen, the detailed structure and node labels of even a moderately-sized network (say, with 500 nodes) can become invisible or difficult to read. Still, the coarse network structure typically remains visible, and helps orient an analyst's zooming, scrolling, and panning operations. These operations are very useful when studying details and reading node labels, but in the process of zooming in on one network region, an analyst may lose track of details elsewhere. To address such problems, we present in this paper multi-focus and multi-window techniques that improve interactive exploration of networks. Based on an analyst's selection of focus nodes, our techniques partition and selectively zoom in on network details, including node labels, close to the focus nodes. Detailed data associated with the zoomed-in nodes can thus be more easily accessed and inspected. The approach enables a user to simultaneously focus on and analyze multiple node neighborhoods while keeping the full network structure in view. We demonstrate our technique by showing how it supports interactive debugging of a Bayesian network model of an electrical power system. In addition, we show that it can simplify visual analysis of an electrical power network as well as a medical Bayesian network.

Visibility-Difference Entropy for Automatic Transfer Function Generation

Philipp Schlegel and Renato Pajarola, University of Zürich (Switzerland)

Abstract: Direct volume rendering allows for interactive exploration of volumetric data and has become an important tool in many visualization domains. But the insight and information that can be obtained are dependent on the transfer function defining the transparency of voxels. Constructing good transfer functions is one of the most time consuming and cumbersome tasks in volume visualization. We present a novel general purpose method for automatically generating an initial set of best transfer function candidates. The generated transfer functions reveal the major structural features within the volume and allow for an efficient initial visual analysis, serving as a basis for further interactive exploration in particular of originally

unknown data. The basic idea is to introduce a metric as a measure of the goodness of a transfer function which indicates the information that can be gained from rendered images by interactive visualization. In contrast to prior methods, our approach does not require a user feedback-loop, operates exclusively in image space and takes the characteristics of interactive data exploration into account. We show how our new transfer function generation method can uncover the major structures of an unknown dataset within only a few minutes.

The following are from previous year's conferences, but honored at EI 2013:

Human Vision and Electronic Imaging XVI Conference

On the Perception of Bandlimited Phase Distortion in Natural Scenes

Kedarnath P. Vilankar, Logesh Vasu, and Damon M. Chandler, Oklahoma State University (USA)

Abstract: It is widely believed that the phase spectrum of an image contributes much more to the image's visual appearance than the magnitude spectrum. Several researchers have also shown that this phase information can be computed indirectly from local magnitude information, a theory which is consistent with the physiological evidence that complex cells respond to local magnitude (and are insensitive to local phase). Recent studies have shown that tasks such as image recognition and categorization can be performed using only local magnitude information. These findings suggest that the human visual system (HVS) uses local magnitude to infer global phase (image-wide phase spectrum) and thereby determine the image's appearance. However, from a signal-processing perspective, both local magnitude and local phase are related to global phase. Moreover, in terms of image quality, distorting the local phase can result in a severely degraded image. These latter facts suggest that the HVS uses both local magnitude and local phase to determine an image's appearance. We conducted an experiment to quantify the contributions of local magnitude and local phase toward image appearance as a function of spatial frequency. Hybrid images were created via a complex wavelet transform in which the low frequency magnitude, low frequency phase, high frequency magnitude, and high frequency phase were taken from 2-4 different images. Subjects were then asked to rate how much each of the 2-4 images contributed to the appearance of the hybrid image. We found that local magnitude is indeed an important factor for image appearance; however, local phase can play an equally important role, and in some cases, local phase can dominate the image's appearance. We discuss the implication of these results in terms of image quality and visual coding.

Parametric Quality Assessment of Synthesized Textures

Darshan Siddalinga Swamy, Kellen J. Butler, and Damon M. Chandler, Oklahoma State University; and Sheila S. Hemami, Cornell University (USA)

Abstract: In this paper, we present the results of a study designed to investigate the visual factors which contribute to the perceived quality of synthesized textures. A psychophysical experiment was performed in which subjects rated the quality of textures synthesized from a variety of modern texture-synthesis algorithms. The ratings were given in terms of how well each synthesized texture represented a sample from the same material from which the original texture was obtained. The results revealed that the most detrimental artifact was lack of structural details. Other pronounced artifacts included: (1) misalignment of the texture patterns; (2) blurring introduced in the texture patterns; and (3) repeating the same patch again and again (tiling). Based on these results, we present an analysis of the efficacy of various measureable parameters at predicting the ratings. We show how a linear combination of the parameters from a parametric texture-synthesis algorithm demonstrates better performance at predicting the ratings compared to traditional quality-assessment algorithms.

Human Vision and Electronic Imaging XVII Conference

Apparent Stereo: The Cornsweet Illusion Can Enhance Perceived Depth

Piotr Didyk[1], Tobias Ritschel[1,2,3], Elmar Eisemann[2], Karol Myszkowski[1], and Hans-Peter Seidel[1]; [1]MPI Informatik (Germany), [2]Télécom ParisTech/CNRS (France), and [3]Intel Visual Computing Institut (Germany)

Abstract: It is both a technical and an artistic challenge to depict three-dimensional content using stereo equipment and a flat two-dimensional screen. On the one hand, the content needs to fit within the limits of a given display technology and at the same time achieve a comfortable viewing experience. Given the technological advances of 3D equipment, especially the latter increases in importance. Modifications to stereo content become necessary that aim at flattening or even removing binocular disparity to adjust the 3D content to match the comfort zone in which the clash between accommodation and vergence stays acceptable. However, applying such modifications can lead to a reduction of crucial depth details. One promising direction is backward-compatible stereo, for which the disparity is low enough that overlaid stereo pairs seem almost identical. It builds upon the Craik-O'Brien-Cornsweet effect, a visual illusion, which uses so-called Cornsweet profiles to produce a local contrast that leads to a perceived brightness increase. Similarly, Cornsweet profiles in disparity can lead to an illusion of depth. Applying them skillfully at depth discontinuities allows for a reduction of the overall disparity range to ensure a comfortable yet convincing stereo experience. The present work extends the previous idea by showing that Cornsweet profiles can also be used to enhance the 3D impression. This operation can help in regions where the disparity range was compressed, but also to emphasize parts of a scene. A user study measures the performance of backward-compatible stereo and our disparity enhancement. ▲