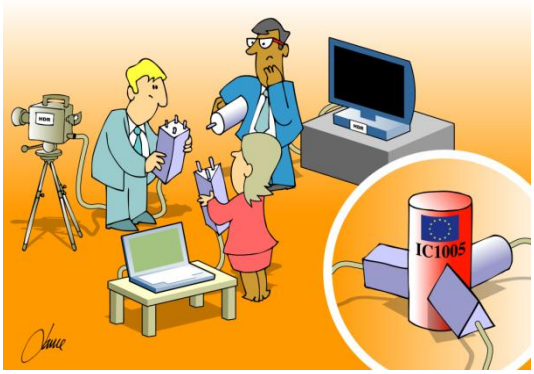
COST IC1005
THE DIGITAL CAPTURE, STORAGE, TRANSMISSION AND DISPLAY OF REAL-WORLD LIGHTING

March 2014

Newsletter 03



HDRi Meeting in Sarajevo

The members of HDRi Cost Action celebrated a meeting in Sarajevo in March. The meeting with more than 20 different country representative included very interesting discussions about the general uptake of HDR video technologies and the importance of open standards for this purpose.

The HDRi group prepared a set of common definitions related to High Dynamic Range video concepts and agreed the general message the Cost Action representatives would present at NAB in Las Vegas in April 2014.

HDRi 2014: Second International Conference and SME Workshop on HDR imaging

The Sarajevo Film Academy and the University Sarajevo School of Science and Technology hosted the second conference on HDR imaging organized by the HDRi COST Action.

The program comprised 2 keynote papers:

- Brian Karr, Advanced Imaging Lab, Kennedy Space Centre, USA
- Elmedin Selmanović, International Burch University, Bosnia and Herzegovina

6 high quality paper presentations, two commercial updates (SIM2 & goHDR) and 3 panels where presented:

- Panel 1: Is HDR video compression needed?
- Panel 2: Is tone mapping for HDR video a solved problem?
- Panel 3: Will standardisation make a difference?

http://www.ic1005-hdri.com/HDRi_2014.pdf

Framework for evaluation of deghosting algorithms for HDR imaging

At the International University of Sarajevo research is being carried out by Kanita Karaduzovic-Hadziabdic, as part of her PhD thesis supervised by Jasminka Hasic Telalovic on developing a framework for evaluation of deghosting algorithms for multi-exposure high dynamic range imaging. Within this framework, a criteria for evaluation of these algorithms is being developed. In order to perform a comprehensive evaluation, there is an ongoing work on the HDR dataset that contains scenes with motion.

This dataset is categorized into different types of scenes, where each scene poses a challenge for the evaluated algorithm. This categorization has been subject of discussion during the workgroup meeting at the recent Second International Conference and SME Workshop on HDR imaging (HDRi 2014). As part of the evaluation state-of-the-art algorithms have been investigated based on the proposed criteria. Image below shows HDR images processed by four deghosting algorithms of eight representative scenes. The mentioned scene categories and the HDR dataset can be found at:

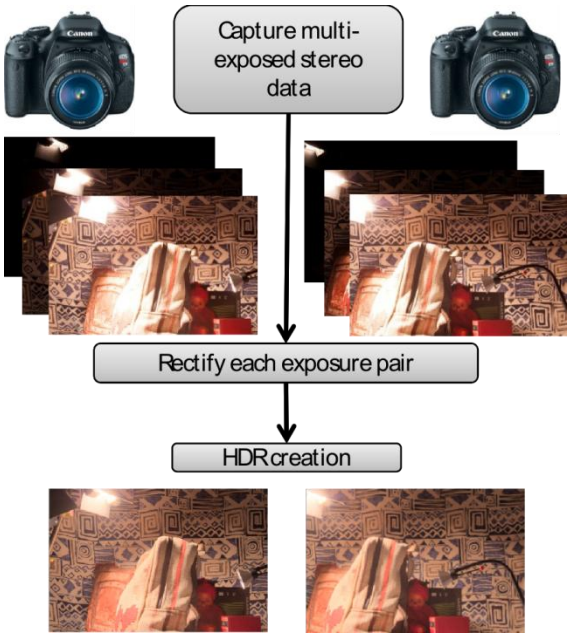
http://projects.ius.edu.ba/ComputerGraphics/HDR

Expert evaluation of deghosting algorithms for multi-exposure high dynamic range imaging
K. Karaduzovic-Hadziabdic, J. Hasic Telalovic and R. Mantiuk

HDR Meets Stereo analysis

COST participant TU Vienna is working on the 3D reconstruction of HDR scenes by tailoring state-of-the-art stereo matching techniques to the peculiarities of HDR scenes. In conventional stereo analysis, saturated or underexposed areas pose special challenges to the stereo matching process, which relies on the identification of corresponding scene points between the left and right stereo view.

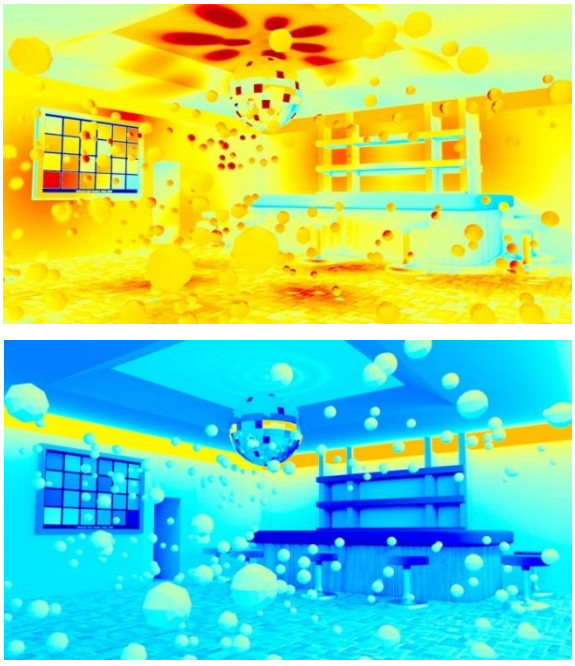
Our goal is to develop improved stereo matching techniques that take advantage of the high dynamic range scene content in order to produce high-quality stereo results even in challenging regions such as homogeneous areas, shadows or over-exposed image regions. We carry out matching experiments on HDR and tone-mapped images in order to better understand how stereo matching algorithms should be designed to exploit the full potential of HDR scenes.



Margrit Gelautz
Vienna University of Technology

HDRI member: IRISA

Our work on HDR imaging deals with the generation of CG HDR video content and its display on traditional monitors using Tone Mapping Operators (TMOs). More precisely, we focus on the temporal coherency/consistency of tone mapped video content. Preserving temporal coherency, when tone mapping video sequences, greatly enhances their subjective quality and increases the efficiency of subsequent processing involved in the digital imagery pipeline (such as compression, tracking, etc.). Generating HDR content allows to test many cases for which tone mapping fails. In particular, we design HDR sequences to illustrate different types of temporal brightness artifacts that occur when applying TMOs to HDR video sequences. The occurrence of temporal artifacts is one of the limitations of current TMOs, which prevents their widespread implementation in current consumer electronics devices. We provide solutions built on state of the art to reduce temporal artifacts and hence preserving temporal coherency.



Example of CG HDR video content (displayed in false color luminance) that generates temporal artifacts when a TMO is applied

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Review: HDR image and video encoding is over 20 years old

High dynamic range image and video encoding is currently being vividly discussed at the MPEG and JPEG meetings and proposals for new standards are being made. However, it may come as a surprise that the technology is over 20 years old. The first HDR image format containing “real pixels” was proposed by Greg Ward in 1991 [1,2]. By taking advantage of the correlation between red green and blue channels, the format employed a shared exponent and a separate per-channel mantissa in its pseudo-floating point pixel coding. The format is still commonly used for images today. The logLuv encoding, which introduced logarithmic and CIE u’v’ perceptually uniform encoding, was proposed by the same author in 1998 [3]. And the first paper on HDR JPEG compression, authored by Greg Ward and Maryann Simmons, was published in 2004 [4].

The group at the Max-Planck-Institute published the first paper on HDR video compression in 2004 at SIGGRAPH [5]. The encoding improved on Greg Ward’s logLuv proposal by introducing the perceptually aligned encoding of luminance. The method took advantage of the fact that the lower absolute luminance levels are less distinguishable by the human eye and, therefore, can be quantized more coarsely. The video codec was based on the H.264/AVC standard with the 12-bit luma encoding, though the authors found that between 10-11 bits are sufficient to encode the luminance range from 10^{-4} cd/m^2 to 10^{8} cd/m^2 if perceptual luma encoding is used. One additional modification was encoding of sharp contrast edges, which reduced ringing artifacts due to the quantization of the DCT coefficients. The picture presented in this section shows a screen-shot of the first HDR video player. It shows a frame captured by the experimental Silicon Vision Lars III HDR monochrome video camera with a “virtual neutral-density filter” overlaid on the part of the frame to show the bright flashlight and specular reflections. The same group published in 2006 another HDR video encoding, which offered backward compatibility with the SDR H.264 [6].

More than 20 years since he original research papers were published, markets and the commercial sector seem to be ready for the adoption of HDR file formats. Yet, the direction the different groups of interest and the standardization bodies will take is unclear. The early proposals aimed at preserving all colors visible to the human eye, aligning the encoding with the visual perception instead of the ever-changing technology and storing the visual data in a device independent format. The newly discussed proposals for standardization may in fact limit these ambitious goals and store only as little information as the displays are expected to reproduce in a near future. It would seem that it takes long time and many small steps to incorporate far-reaching research into everyday technology.

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[1] Ward, Greg. "Real pixels." *Graphics Gems II* (1991): 80-83.
[2] http://en.wikipedia.org/wiki/RGBE_image_format
[3] http://www.anyhere.com/gward/pixformat/tiffluv.html
[4] http://en.wikipedia.org/wiki/JPEG-HDR
[5] http://www.mpi-inf.mpg.de/resources/hdrvideo/
[6] http://www.mpi-inf.mpg.de/resources/hdr/hdrmpeg/