



HD²R

Creating Images with Higher Dynamic Range and Richer Colors for Cinemas and Living Rooms

HDR (High Dynamic Range) video images offer a higher contrast and color depth than is possible in today's SDR (Standard Dynamic Range) video. The resulting images may feature areas that are both darker and brighter than conventional images and still have realistic detail. No wonder HDR is seen as the next step forward in video, one of the promising viewing modes that will offer viewers a better, more realistic experience.

The world over, movie production houses, TV broadcasters and A/V outlets are ready to jump on the HDR bandwagon. However, the equipment to produce and display HDR content is still largely lacking. Also, a move to HDR is not so obvious for cinemas, as higher brightness requires powerful and expensive laser sources. In addition, the perceived dynamic range of a projected image depends not only on the projector, but also e.g. on the interior design of the theatre.

"The main goal of the HD²R project was to study HDR and learn from its challenges and opportunities," says Peter Schelkens, research lead of HD²R and professor at ETRO, an imec research group at VUB. "This included looking at the shooting of HDR video, passing HDR through all steps of postproduction including e.g. color grading, testing user viewing experiences of HDR/SDR video, and creating guidelines for best HDR viewing in theatres."

The project consortium was made up of research groups with experience in A/V technology, image & video coding and user experience testing, and a number of industrial partners from the A/V value chain. "These companies are all looking to get involved in the global HDR landscape, so they saw the project as a unique learning and co-creation opportunity," says Dirk Maes, project lead and senior research engineer at Barco. "As a leader in digital cinema, Barco is studying how to best introduce HDR capabilities in its projectors, in a way that offers most advantages for the viewers. VRT, a public broadcast company, is looking how

HDR can be introduced in the whole production chain, and how it can be mixed and matched with existing SDR video. Grass Valley is a camera producer ready to design HDR cameras. Grid and Limecraft are two companies that want to get involved in HDR postproduction. And last, Barco Silex is a subsidiary of Barco working on hardware cores for video compression and decompression."

THE OUTCOMES

1. Production of a short movie in HDR

The partners managed to produce a HDR movie, explicitly including shots that are beyond the limits of the traditional dynamic range. The whole trajectory from shooting the scenes, over postproduction (e.g. color grading), to displaying was followed. Especially the postproduction proved challenging, because it required linking postproduction software to HDR displays with nonstandard software interfaces. Eventually, the resulting movie was also used in the end user tests.

2. Development of algorithms to expand video to HDR

One of the challenges in moving towards HDR video will be managing the transition to it, e.g. displaying all the legacy material with 8-bit color depth on the new displays that allow for 10+ bit color depths. The HD²R project developed the algorithms needed to expand SDR video to HDR. This ability will also be key in a production environment that needs to handle both SDR and HDR material.

3. User perception tests

HD²R set up perception tests to determine the actual dynamic range that people may perceive when watching a movie in a cinema.

In another test, the researchers evaluated the user perception for the HDR movie that was produced in the project and compared different renderings, i.e. as HDR, as SDR, and as SDR expanded to HDR. The result showed a consistent preference for the HDR viewing experience, but also the upscaled SDR got a markedly better score than simple SDR.

4. Guidelines for the design of movie theatres and HDR projectors

The project partners have studied how the design of a movie theatre and the characteristics of the projectors will influence the viewing experience. The reflectivity of floors and walls, e.g., but also the emergency lighting, or even light reflection on white shirts of the audience may influence the maximal contrast that can be perceived. This resulted in a set of guidelines for HDR movie theatres and projectors to ensure that the HDR experience can be maximized.

NEXT STEPS

Peter Schelkens: "All project partners, both the research groups and the companies will take the result of this research further. Most of the companies, in particular, will use the results in their future HDR products and services. Barco, for example, is further examining how it can modify its laser projection technology to allow for more extreme levels of black and bright. Grass Valley develops a camera that can deliver simultaneous SDR and HDR output. VRT is looking to transition its production workflow from SDR to SDR+ and finally to HDR in the coming years. Grid plans to upgrade its postproduction process and tools to surf the HDR wave and Barco Silex aims at equipping its coding solutions with HDR support. Last, Limecraft is in the process of creating postproduction software that supports various HDR formats and camera signals."

HD²R project partners:



BarcoSilex



Vlaanderen
is ondernemen

The HD²R project was co-funded by imec (iMinds), with project support from Agentschap Innoveren & Ondernemen.

FACTS

NAME	HD ² R
OBJECTIVE	Creating Images with Higher Dynamic Range and Richer Colors for Cinemas and Living Rooms
TECHNOLOGIES USED	High sensitivity camera sensors, dual output post-production, MPEG and JPEG compression, Quasar image processing for SDR to HDR conversion, laser projection
TYPE	imec.icon project
DURATION	01/10/2015 - 30/09/2017
PROJECT LEAD	Dirk Maes, Barco
RESEARCH LEAD	Peter Schelkens, ETRO, an imec research group at VUB
BUDGET	2,224,936 euro
PROJECT PARTNERS	Barco, Barco Silex, Grass Valley Nederland, Grid, Limecraft, VRT
IMEC RESEARCH GROUPS	ETRO, an imec research group at VUB IPI, an imec research group at UGent MICT, an imec research group at UGent IDLab, an imec research group at UGent



WHAT IS AN IMEC.ICON PROJECT?

The imec.icon research program equals demand-driven, cooperative research. The driving force behind imec.icon projects are multidisciplinary teams of imec researchers, industry partners and / or social-profit organizations. Together, they lay the foundation of digital solutions which find their way into the product portfolios of the participating partners.

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