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Dealing with glare

HDR (High Dynamic Range) is a technology, or rather a system, for dealing with glare. We say system because HDR impacts on video capture, processing and display, but where quality and visibility are critical considerations this new development could be a real opportunity.

Suppose you have an application where visibility of video content is of absolute importance – surveillance in high security in a maximum security wing of a prison, for example – glare from sunlight or car headlights can be a real issue. Glare robs the video content of detail, rendering the image useless for the user's intended purpose.

At the other extreme, deep shadow can be just as inconvenient. Look at the problems that broadcast cameras have with covering a football match, where one half of the pitch is brightly lit and the other half in shadow. Even Hollywood, apparently, has problems with the limited ability of traditional cameras to capture light and shade.

The human eye can see detail where the regions of an image vary by 1:104 at any given eye adaption level. This is a much higher level than traditional camera technologies can capture, with anything that falls outside this gamut under or over-exposed.

Developments

Visual technologies capable of capturing images outside this gamut are labelled HDR. To date, the only way to get around the dynamic range problem is to generate the missing image data with CGI or other post-production technique. Resulting data is stored with a higher bit-depth per pixel than that conventionally applied.

Now, a development by the WMG Digital Laboratory at the University of Warwick could see HDR images captured by a purpose made camera and displayed on monitors designed for the purpose. Demonstrations were held in December of a prototype system. The HDR camera has the equivalent of 20 f-stops, at full HD resolution and at 30 fps.

The researchers at the University of Warwick quickly encountered a problem – the huge data files that HDR produces. These approximate to 30 GB plus for each minute of video. The HDR project was then extended to develop a full video system, embracing video capture, compression and storage through to display..

Professor Alan Chalmers of WMG's Visualisation Research group at the University of Warwick explained:

"We have put together unique compression software with a high performance HDR camera and HDR displays that will revolutionise the use of HDR in a range of applications. The impact will be enormous, for example, the ability to clearly see the football when it is kicked from the shadow of the stadium into sunshine, or surveillance cameras which can detect detail even in extreme lighting conditions."

"We have also recently successfully trialled its use to

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assist and document surgery together with the thoracic surgery team and the multi-media group at Heartlands Hospital. HDR is able to accurately capture for the first time the wide range of lighting present in an operation from the dark body cavities through to the bright highlights on the shiny medical instruments."

Prospects

"The natural world presents us with a wide range of colours and intensities. In addition, a scene may be constantly changing with, for example, significant differences in lighting levels going from outside to inside or simply as the sun goes behind some clouds etc. A human eye can cope with those rapid changes and variety but a traditional camera is only capable of capturing a limited range of lighting in any scene. The actual range it can cope with depends on the exposure and f-stop setting of the camera. Anything outside that limited range is either under- or over-exposed."

"HDR imagery offers a more representative description of real world lighting by storing data with a higher bit-depth per pixel than more conventional images. Although HDR imagery for static images has been around for 15 years, it has not been possible to capture HDR video until now. However such HDR images are typically painstakingly created in computer graphics or generated from a number of static images, often merging only 4 exposures at different stops to build an HDR image."

"Our new HDR camera technology and software enables us to capture and display dynamic HDR images, covering at least 20 f-stops, at full high-definition resolution, and at 30 frames-per-second."

As an interesting aside, Professor Chalmers said: "Furthermore, HDR can complement 3D technology by providing depth perception without the need to wear 3D glasses."

For those interested in finding out more, Professor Chalmers can be contacted on: Alan.Chalmers@warwick.ac.uk .

WMG' complete HDR solution – from camera to display.