

Computer Science Honours Project Proposal

Printing High Dynamic Range Images

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Problem Statement

High dynamic range (HDR) images offer a greater range of intensity levels than most digital cameras and electronic displays and is said to be the future of imaging, as expressed by Ward in [6] as well as Meyer in [2] where he says, “In the coming decade, HDR digital imaging technology will arrive, and change how we take, manipulate, store, use and display images forever.” Displaying these images electronically requires very expensive equipment and printing them was said to be impossible by a distinguished researcher at a recent computer graphics conference.

This project looks at devising a method of printing HDR images with greater quality by coming up with alternate printing methods and trying to overcome the limited dynamic range of a single piece of ordinary paper.

Most related research is in the field of displaying HDR images on low dynamic output devices by means of a tonal mapping. Ward [5] talks of ways of storing the full colour range of a photograph, rather than just what can be displayed on a particular display, and only then mapping the full range of colours to the limited range of the display. Different methods of display of these images are discussed in [3] and [4]. These, along with other techniques such as radiance maps [1], will contribute towards methods of approach.

Intended Approach

Although I'm not certain of any strategies at this stage, some ideas have come to mind about how to print HDR images. Since HDR images have such a broad range of colour, it seems like multiple layers will be needed when printing. Therefore, one approach would be to print using some sort of transparent paper, and shining a light at an appropriate angle. Another approach could be to print using different layers of ink – each layer a different type of ink. A final idea at this stage would be lining up and projecting several images, but the severely limited range of a projector.

In terms of evaluating the results, methods of comparing will need to be devised. The basis of this will be by comparing an ordinary photo print of an HDR image and each of the proposed methods of printing, both by me and using objective witnesses.

First semester	Proposed dates:
1st term	
Understand how HDR images are captured and work in general	16 March
Research other efforts at printing HDR images	3 April
Devise ways to print and how to test printing of HDR images	3 April
2nd term	
Test different ways of printing and devise new ways	Whole term
Literature Review Due	26 June
Second semester	
3rd term	
Finish writing up comparison of printing methods	28 August
4th term	
Fix corrections in paper suggested by supervisor	18 September

Considerations

One of the main considerations will be to develop a method of comparing results. I will have to come up with a way of determining whether or not an image produced using one printing technique is indeed producing a better quality output than another technique.

Expected Output

Ideally, a printed HDR image, whose quality is better than that of an ordinary photograph, will be produced at the end of this research.

Possible Extensions

This project could be extended to print even higher quality images. As well as this, perhaps the knowledge gained in trying to print HDR images could be used to display these images on electronic devices.

References

- [1] Debevec, P., Malik, J., *Recovering High Dynamic Range Radiance Maps from Photographs*. In SIGGRAPH 97, August 1997.
- [2] Meyer, J., *The Future of Digital Imaging - High Dynamic Range Photography*. <http://www.cybergain.com/tech/hdr/> February 2004 [Accessed 27 February 2009].
- [3] Seetzen, H., Heidrich, W., Stuezlinger, W., Ward, G., Whitehead, L., Trentacoste, M., Ghosh, A., Vorozcovs, A., "High Dynamic Range Display Systems," *ACM Trans. Graph. (special issue SIGGRAPH 2004)*, August 2004.
- [4] Ward, Greg, "A General Approach to Backwards-Compatible Delivery of High Dynamic Range Images and Video," Proceedings of the Fourteenth Color Imaging Conference, November 2006.
- [5] Ward, Gregory, "High Dynamic Range Imaging," Proceedings of the Ninth Color Imaging Conference, November 2001.
- [6] Ward, Greg, "The Hopeful Future of High Dynamic Range Imaging," Proceedings of the 2007 Society of Information Display Symposium, May 2007