

3D TV

Wojciech Matusik

Hanspeter Pfister*

Mitsubishi Electric Research Laboratories, Cambridge, MA.

Three-dimensional TV is expected to be the next revolution in the history of television. It has only recently become feasible to deal with the high processing and bandwidth requirements for real-time acquisition, transmission, and display of high-resolution 3D TV content.

We propose a complete end-to-end 3D TV system – our system performs real-time acquisition, transmission, and 3D display of dynamic scenes. In our system image acquisition consists of an array of hardware-synchronized cameras that capture multiple views of the scene. In order to deal with the high processing and bandwidth requirements, the system uses a fully distributed architecture with clusters of PCs. A multi-projector 3D display with horizontal parallax achieves large, high-resolution output images. The system is scalable in the number of acquired, transmitted, and displayed real-time video streams.

Our system uses existing broadband protocols and compression standards for immediate, real-world 3D TV experiments and market studies. This system can plug into today's digital TV broadcast infrastructure and co-exist in perfect harmony with regular TV. Today, digital broadcast networks carry hundreds of channels and presumably a thousand or more channels after the introduction of MPEG-4. This makes it plausible that a number of them will be dedicated to 3D TV. Similar to HDTV, the introduction of 3D TV can proceed gradually, with one 3D channel at first and more to follow, depending on market demand.

Furthermore, our system demonstrates that 3D TV offers a richer, more immersive experience than regular TV. It increases entertainment value and realism without the encumbrance of special glasses. Our system makes the following novel contributions:

Distributed architecture: In contrast to previous work in multi-view video coding we use a distributed architecture for acquisition, compression, transmission, and image display.

Multiview video rendering: A new algorithm efficiently renders novel views from multiple dynamic video streams.

Scalable system: The system is completely scalable in the number of acquired, transmitted, and displayed views.

High-resolution 3D display: This is the first display that provides horizontal parallax with 16 independent perspective views per pixel at 1024×768 resolution.

Computational alignment for 3D displays: Image alignment and intensity adjustment of the 3D multiview display are completely automatic using a camera in the loop.

Matusik and Pfister [2004] present a more detailed description of this research.

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References

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*[matusik,pfister]@merl.com



Figure 1: Our 3D TV system with a rear-projection display (first row) and a front-projection display (second row). Images of a scene from the viewer's side of the display (third and fourth row).