Introduction to the Special Section on 3DTV

AS EXPERIENCED many times in history, the interest in 3-D video is again rising. It looks like not only the researchers, but also industry and general public consider 3-D visual systems as the next big step in visual communications.

Research in related fields covers diverse areas since capture, end-to-end delivery and display of 3-D video inherently involves collaboration of many disciplines. There are various techniques to capture 3-D scene information. Similarly, there are many different techniques for displaying it. Future 3DTV systems are likely to have completely decoupled capture and display operations. In other words, in the ideal case, the capture unit will not consider the details of the display technique, and in a similar way, the display unit will display the 3-D video data without considering how it is captured. Therefore, an abstract intermediate representation (and probably a temporary or permanent storage) of the captured data is needed to achieve such a decoupled capture and display operation. Transport of 3-D video data through available channels is another issue. Therefore, research whose focus is 3DTV encompasses video processing, video streaming, signal processing, computer graphics, optics, electronics, and other related fields.

The ultimate 3-D display must generate the same optical environment to the observer as in the original scene. In other words, the complete physical properties of light that fills the 3-D space, where the original 3-D scene embedded in it, will be duplicated somewhere else and maybe at a different time. If the physically reconstructed light is the same as the original, the observer looking at the reconstructed light will surely see the same thing as if looking at the original. Recording of physical properties of space filling light, and then reconstructing it, is the foundation of holographic displays. And such a goal brings with it a rich set of signal processing problems associated with light propagation. Such holographic displays are not feasible today, beyond limited laboratory prototypes, with the current underlying technologies, but the developments during the next decade may bring such displays into reality as a consumer item. Near future 3DTV systems are likely to be based on nonholographic multiview video techniques with autostereoscopic multiview displays.

The set of six papers that we invited to this part of the Special Section present extensive reviews of the state-of-the-art in functional building blocks of 3DTV systems. The first paper focuses on capturing of 3-D video, and presents a survey of alternate techniques for this purpose. The second paper is on abstract representation of 3-D video data. The third paper presents an overview of specific issues associated with the transport of 3-D video data over the internet. Signal processing issues associated with basics of holographic 3DTV displays constitute the content of the fourth paper; not only the current state-of-the-art is presented, but also a survey of signal processing tools which has the potential of successfully handling the holographic 3DTV related problems are presented. Finally, the sixth paper presents a survey on different display techniques for 3-D video.

We believe that the presented collection of six papers will be used extensively by researchers in the 3DTV field. Furthermore, these papers collectively form a rich and complete set of starting step for those researcher who are planning to enter the field.

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