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Recent progress in computer holography: Color and monochrome 3D imaging by large-scale computer-generated holograms

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Computer holography is the technique to create holographic 3D images by using a computer. The created holograms, called computer-generated hologram (CGH), can reconstruct 3D images of non-physical objects as well as physical objects, unlike traditional optical holography. Unfortunately, creating high-quality CGHs had been impossible for a long time because of the gigantic space-band product required for realizing a large viewing and screen size. We developed several techniques that make it possible to calculate and fabricate large-scale CGHs, called high-definition CGHs, which are composed of billions or sometimes tens of billion pixels [1]. The high-definition CGHs that reconstruct spatial 3D images of a deep scene with natural motion parallax are being comparable to that in traditional optical holography. In fact, the CGHs give great impact of strong sensation of depth to viewers.

The latest high-definition CGHs are reaching a scale of 0.1 trillion pixels. Figure 1 (a) shows a very large-scale CGH named ‘Sailing Warship II’. This CGH, calculated using the switch-back technique [2], is composed of 67.5 billion pixels and can reconstruct a very complex 3D scene without any 0-th order light and conjugate image. Specular curved surfaces are also possible to be reconstructed [3].

Recently, we successfully created full-color high-definition CGH by employing RGB color filters used for color LCD panels [4]. This technique is not only used for reconstructing CG-model objects but also real-existing physical objects. The reconstructed object shown in Fig.1 (b) is a physical object, whose light was captured by digital holography using an image sensor. This technique is called full-color digitized holography [5].

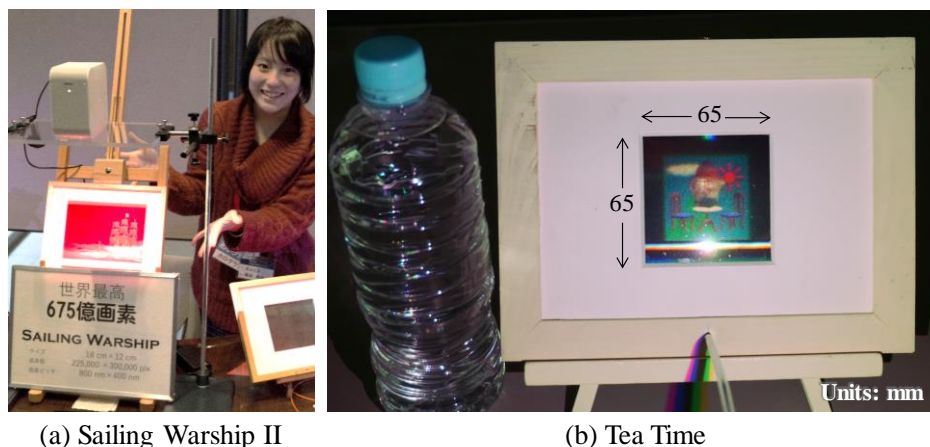


Fig. 1. Several latest large-scale computer-generated holograms.

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