Intelligent meta-lens imaging and sensing

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Meta-lens is an emerging optical device which composed of artificial nanostructures can freely manipulate the phase and amplitude of light. Meta-lenses show excellent performance and novel applications to meet the optical demands [1-6]. The fascinating advantages of meta-lenses are their novel properties, flat, ultra thin, lighter weight, small size, high efficiency, better performance, broadband operation, lower energy consumption, data volume reduction, and CMOS compatibility for mass production. We demonstrate an intelligent depth-sensing system prototype applicable for diverse scenes, a switchable stereo vision system that adopts a 60 × 60 achromatic meta-lens array to measure depth over a 30-cm range with the support of deep learning [7]. As shown in Figure 1, this system combines a light field camera and a structured light system to adapt to all light levels. The design, application, and experimental verification of the intelligent depth-sensing meta-device are reported in this talk. The meta-lens array can act as multiple imaging lenses to collect light field information. It can also work with a light source as an active optical device to project a structured light. The meta-lens array could serve as the core functional component of a light-field imaging system under bright conditions or a structured-light projection system in the dark. The depth information of both ways can be analyzed and extracted by the convolutional neural network. This work provides a new avenue for the applications such as autonomous driving, machine vision, human-computer interaction, augmented reality, biometric identification, etc.

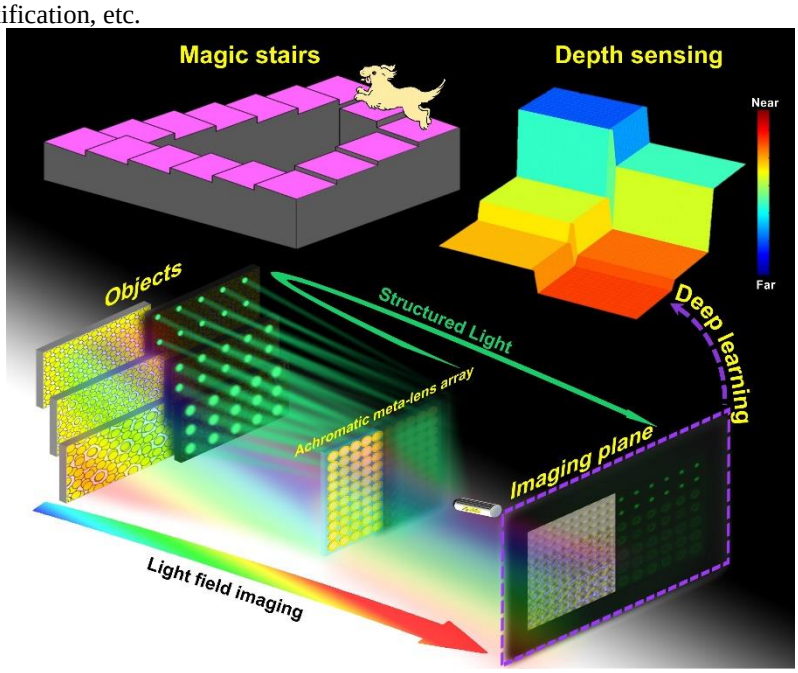

Figure 1 Intelligent meta-lens array for imaging and sensing.

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