

Image and depth retrieval from single monocular image with various PSFs

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Motivation

- Depth estimation has important applications in fields such as autonomous systems, computer vision, and biological imaging.
- Recovery of all-in-focus images is desirable to extract full information of the scene and useful for post processing.
- We present a qualitative and quantitative comparison of passive approaches to:
 - Construct a depth map from an image
 - Recover an all-in-focus image

Related Work

Several techniques exist for passive depth information extraction and/or all-in-focus image recovery:

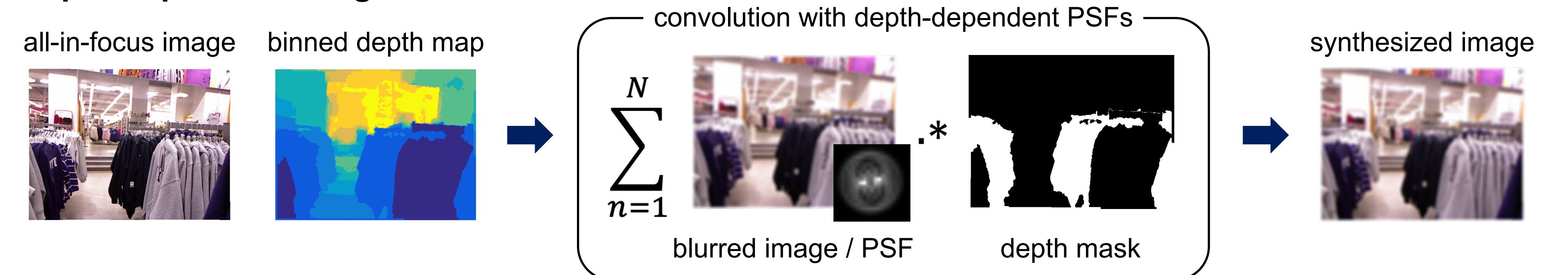
- Depth from focal gradients utilizing the limited depth of field from optical elements [1]
- Coded aperture to further improve distinction between different defocus and depth scales [2]
- Spatially rotating point spread functions (PSF) that vary with depth, such as the double helix PSF [3]

References

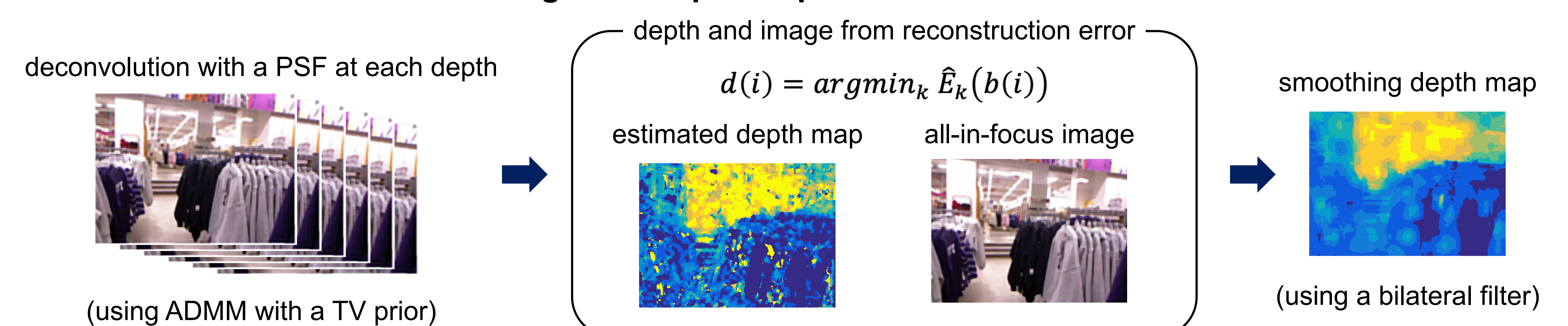
- [1] Pentland. "A new sense for depth of field." *IEEE transactions on pattern analysis and machine intelligence* 4 (1987): 523-531.
- [2] Levin, Fergus, Durand, and Freeman. "Image and depth from a conventional camera with a coded aperture." *ACM transactions on graphics (TOG)* 26, no. 3 (2007): 70-es.
- [3] Greengard, Schechner, and Piestun. "Depth from diffracted rotation." *Optics letters* 31, no. 2 (2006): 181-183.

Flow chart for image and depth retrieval

Depth-dependent image formation



Reconstruction of all-in-focus image and depth map



Experimental Results

