**ROBUST MULTI-EXPOSURE IMAGE FUSION: A STRUCTURAL PATCH DECOMPOSITION APPROACH**

**ABSTRACT**

We propose a simple yet effective structural patch decomposition approach for multi-exposure image fusion (MEF) that is robust to ghosting effect. We decompose an image patch into three conceptually independent components: signal strength, signal structure, and mean intensity. Upon fusing these three components separately, we reconstruct a desired patch and place it back into the fused image. This novel patch decomposition approach benefits MEF in many aspects. First, as opposed to most pixel-wise MEF methods, the proposed algorithm does not require post-processing steps to improve visual quality or to reduce spatial artifacts. Second, it handles RGB color channels jointly, and thus produces fused images with more vivid color appearance. Third and most importantly, the direction of the signal structure component in the patch vector space provides ideal information for ghost removal. It allows us to reliably and efficiently reject inconsistent object motions with respect to a chosen reference image without performing computationally expensive motion estimation. We compare the proposed algorithm with 12 MEF methods on 21 static scenes and 12 deghosting schemes on 19 dynamic scenes (with camera and object motion). Extensive experimental results demonstrate that the proposed algorithm not only outperforms previous MEF algorithms on static scenes but also consistently produces high quality fused images with little ghosting artifacts for dynamic scenes. Moreover, it maintains a lower computational cost compared with the state of-the-art deghosting schemes.1

**Index Terms—** Multi-exposure image fusion, high dynamic range imaging, structural patch decomposition, deghosting.