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PERFORMANCE ANALYSIS OF COMPUTATIONAL IMAGING

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ABSTRACT

For centuries, cameras were designed to closely mimic the human visual system. Over the last decade, due to the rapid increase in computational power, researchers in the computer vision, graphics and optics community have begun to focus their attention on new types of imaging systems that utilize computations as an integral part of the imaging process. Computational cameras uses a combination of optics and software to produce images by optically encoding information that later decoded using signal processing. Over the last decade, a number of Computational Imaging (CI) systems have been proposed for tasks such as motion deblurring, defocus deblurring and multispectral imaging. These techniques increase the amount of light reaching the sensor via multiplexing and then undo the deleterious effects of multiplexing by appropriate reconstruction algorithms. While computational techniques can be used to increase optical efficiency, this comes at a cost. The cost incurred is noise amplification caused by the decoding process. Thus, to measure the real utility of a computational approach, we must weigh the benefit of increased optical efficiency against the cost of amplified noise. A complete treatment must take into account an accurate noise model. In some cases, the benefit may not outweigh the cost, and thus a computational approach has no value. This paper concludes with a discussion on these scenarios.

KEYWORDS: Computational Imaging, Computational Photography, Defocus De blurring, Motion Deblurring, Multiplexing