A Transferable Real-World Dataset for Face Recognition in Lensless Imaging Systems

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Introduction

Lensless imaging systems are renowned for their compactness, lightweight design, and cost-effectiveness. By replacing traditional lenses with amplitude or phase masks placed close to the sensor, these systems modulate incoming light uniquely. However, the lack of comprehensive real-world datasets limits their application in face recognition tasks. In this study, we aim to address this gap by using the PhlatCam [1] to capture human face images, thereby creating a dataset intended to improve person identification across different lensless imaging systems.

Materials & Methods

Our study comprises two main steps. First, we utilize the PhlatCam to capture and reconstruct face images of multiple participants in real time. To ensure diversity, we vary lighting conditions, viewing angles, and backgrounds in both indoor and outdoor settings, providing greater diversity than previous datasets [2]. Each participant contributes 188 images, resulting in a substantial dataset. Second, we train a face verification network using this dataset to validate an improved face recognition pipeline. We propose that this dataset can be transferable when training other lensless camera models, including different types of lensless imaging systems [1][3].

Results

We demonstrate that a large real-world dataset is essential for training lensless cameras to perform effectively in practical applications, as it captures artifacts unique to real-world environments. This is evidenced by quantitatively comparing simulated datasets and real-world captured datasets, as well as evaluating accuracy performance when tested on real-world data. Our results indicate that the dataset exhibits transferability across other lensless cameras, alleviating the need to collect large datasets for future models.

Discussion

Our dataset offers significant utility in the lensless imaging field for various applications and can serve as a pre-training dataset for lensless imaging systems. While recent work has focused on photorealistic reconstruction [4][5], our dataset enables exploration in photorealistic reconstruction that includes real-world noise and artifacts.

References

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