CS1290: Computational Long Exposure Photography

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Abstract

For our capstone for CS1290 Computational Photography, we implemented the paper *Computational Long Exposure Mobile Photography* by Tabellion et al. which describes a method for generating long exposure photos from a burst photos taken on a mobile device.

Introduction

Long exposure photography can be used to capture beautiful imagery of moving elements in a scene with motion-blur. Traditionally, these images are captured on a tripod-mounted camera using neutral-density (ND) filters. The tripod is used to keep the camera still to ensure static areas of the scene remain sharp, while the ND filter is used to avoid over-exposure of the image as the shutter speed decreases.

However, capturing long exposure photos on mobile devices poses several challenges. Hand-held captures can introduce unintended motion blur due to shaking hands or sweeping motions of the camera to follow a moving subject. It can also be difficult to preserve sharpness of subjects, such as people or pets, due to the subjects' small movements during capture. Lastly, it is easy to overexpose the image without using additional equipment or more advanced skills.

In this project, our system is able to faithfully recreate foreground blur that minimizes the unwanted features caused by the elements listed above. Our approach follows that of the paper, *Computational Long Exposure Mobile Photography* by Tabellion et al. First, we capture a burst of images from an iPhone. We detect and segment the static elements of the scene to be used in the compositing step to preserve sharpness of the static features. We then align the images to remove motion noise caused by shaking hands and track the motion of the scene over the burst of frames. We predict inter-frame motion and synthesize motion-blur to fill the temporal gaps between the frames. Lastly, we