College of Engineering Chengannur
Department of Computer Engineering
M. Tech. Computer Science (Image Processing)
03CS6901 Seminar I
Abstract of Proposed Seminar Topic.

Camera Array for Multispectral imaging

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December 18, 2020

Keywords: Multi spectral imaging,image acquisation.

Abstract

Nowadays many new applications are introduced for multi-spectral and hyper-spectral imaging. Besides modern biometric systems for identity verification, also agricultural and medical applications came up, which measure the health condition of plants and humans. Despite the growing demand, the acquisition of multi-spectral data is still very complicated. Often, expensive, inflexible, or low resolution acquisition setups are only obtainable for specific professional applications. To overcome these limitations, a novel camera array for multi-spectral imaging is presented in this article for generating consistent multi-spectral videos. As differing spectral images are acquired at various viewpoints, a geometrically constrained multi-camera sensor layout is introduced, which enables the formulation of novel registration and reconstruction algorithms to globally set up robust models. On average, the novel acquisition approach achieves a gain of 2.5 dB PSNR compared to recently published multi-spectral filter array imaging systems. At the same time, the proposed acquisition system ensures not only a superior spatial, but also a high spectral, and temporal resolution, while filters are flexibly exchangeable by the user depending on the application. Moreover, depth information is generated, so that 3D imaging applications like for augmented or virtual reality, become possible. The proposed camera array for multi-spectral imaging can be set up using off-the-shelf hardware, which allows for a compact design and employment in, e.g., mobile devices or drones, while being cost-effective.

In this paper, the following contributions are introduced: • A novel geometrically constrained multi-camera sensor layout is presented together with all required algorithms to acquire high-quality multi-spectral images. • State-of-the-art multi-modal stereo matching and the resulting problem of cross-spectral extinction is discussed. • A novel global registration is formulated for geometrically constrained multi-spectral camera arrays. • In line with this, CAMSI is compared to state-of-the-art cross-spectral stereo-matching methods highlighting the global cost aggregation as key feature. • A fast cross-spectral reconstruction algorithm is introduced, which takes all spectral components into account for reconstructing occluded and mispredicted pixels.

• For CAMSI and several registration methods as well as imaging systems, an extensive evaluation is conducted.
• In contrast to state-of-the-art approaches, an overall processing chain is provided. Starting with the sensor layout, calibration, registration, reconstruction, and direct mesh to resampling strategies are presented.

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