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# Design of Four-Band Multispectral Imaging System with One Single-Sensor

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**Abstract:** In order to acquire multispectral images precisely and quickly, a four-band multispectral capturing system with one imaging sensor is designed and evaluated in this paper. Firstly, four imaging bands are arranged in a 2×2 multispectral filter array (MSFA), and their filter spectral transmittances within the visual wavelength are designed uniformly. Then, the mosaicked four-band image is generated on the single-sensor according to the designed MSFA. In order to recover the mosaicked images, a demosaicking algorithm based on constant hue assumption is employed to highly maintain the image edges. At last, the four-band spectral capturing system is characterized by using the calibration target Macbeth Colorchecker, and a linear relationship between the band values and spectrum are calculated based on polynomial regression method, afterwards the demosaicked four-band pixels can be converted into the multispectral reflectance with that obtained relationship. In the experiment, the four-band multispectral imaging system with the proposed demosaicking algorithm is evaluated, and the experiment result demonstrates the proposed algorithm outperform the other methods in PSNR and RRMS.

**Key words:** multispectral image; demosaicking algorithm; multispectral filter array (MSFA)

## 1 INTRODUCTION

Multispectral image is a composition of several monochrome images normally captured with different sensors. Each monochrome image and sensor corresponds to specific wavelength which is usually referred to as a band or channel. Compared to classical RGB images, multispectral images contain much more information in the visible or invisible wavelength. Now multispectral images have been widely used in the area of aerospace, biomedical, agriculture, cultural heritage, and so on, thus it's significant to develop precise and fast multispectral capturing systems.

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