

## Development of discrimination method using four-narrowband imaging selected based on the spectrometer measurement

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Remote sensing using satellites and drones, which can rapidly acquire information on the earth's surface over a wide area, is used in vegetation, natural resources, and geological surveys. Many optical observations use cameras with RGB broadband filters as onboard sensors, and NDVI indexes are used to survey vegetation. Multiband cameras have been used in many remote sensing applications because they have been inexpensive in recent years, and analysis is more uncomplicated than hyperspectral analysis. However, recently, it has been pointed out that NDVI and other indices do not provide accurate correlations with information such as vegetation and plant health. We have to develop new indexes. Another remote sensing uses a hyperspectral camera to image hundreds of wavelength bands. The spectra of visible light to near-infrared wavelengths are analyzed, and minerals are identified based on the absorption spectrum's FWHM, depth, and peak wavelength position. However, hyperspectral sensors are much more expensive than multiband cameras, and it is challenging to prepare multiple units to improve the spectrum database. In addition, making data acquisition, processing, and analysis is complex due to the amount of data increases.

In this study, we develop a discrimination method using multiple narrowband filters (FWHM~10 nm) based on spectral data measured on the ground. We developed a spectrometer, and a multi-narrowband camera mounted on a drone to measure the data for the developed method. The accuracy of the developed method will be verified using observation data from this camera and a satellite equipped with a liquid crystal tunable filter (LCTF). The spectrometer was developed to increase the database of spectra measured on the ground. We loaned this spectrometer to several locations and measured plants with known vegetation and minerals to create a reflectance spectra database. Based on this database, we will develop a discrimination method. Spectra are normalized based on NDSI to extract the differences. The correlation coefficients between wavelengths are calculated from NDSI spectra. The wavelengths with large absolute values of correlation coefficients are used for discrimination. The selected four wavelength bandpass filters (FWHM=10 nm) are mounted on a camera that can capture images of the four wavelengths simultaneously. This camera weighs about 700 g, including batteries and the control PC (Raspberry Pi). One of the measuring methods is to mount it on the drone. Drone measures a range from a few hundred meters to a few kilometers with a resolution of less than a hundred meters at an altitude of about 100 km. The obtained 4-band narrowband images are processed into mapping images based on the developed discrimination method.

This time, we will introduce the spectrometer and 4-band camera developed in this study and show examples of measurement results.

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