Comparison of Land Cover Classification Methods in Hyperspectral Remote Sensing

Jin-Duk Lee*(Corresponding Author), Kon-Joon Bhang*, Young-Don Joo*, Seung-Hee Han**
*Kumoh National Institute of Technology, Korea, **Kongju National University, Korea
E-mail : jdlee@kumoh.ac.kr, bhang.1@kumoh.ac.kr, porkkang@nate.com, shhan@kongju.ac.kr

1. Introduction

Recently hypererspectral imagery has opened the new era of mapping and contributed to acquiring and managing spatial information with airborne LiDAR. Two different types of airborne sensors which can collect simultaneously hyperspectral imagery and LiDAR data were operated by Korean mapping companies but at present data acquisition expense is still very high not enough to use easily such airborne sensors. It has been realized that such hyperspectral imagery has high application potential in various areas which need spatial information like coastal area, urban area, forest area and so forth.

Prior to land cover classification, atmospheric correction as a preprocessing work was conducted for hyperspectral imagery acquired by Airborne hyperspecrtral sensor, CASI-1500. The maximum likelihood classification, the minimum distance classification and the spectral angle mapper classification were applied respectively to the images on which conducted and didin't conduct atmospheric correction. The results of land cover classification as well as accuracies of the results were compared and evaluated according to wheather atmospheric correction was conducted or not.

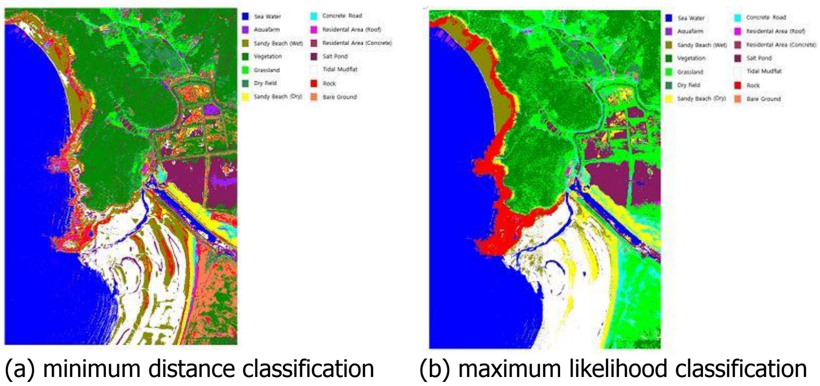
2. Description of hyperspectral sensor and imagery

The airborne hyperspectral sensor used in the study is CASI-1500 model, ITRES Ltd. This provides spectral range of 380 to 1050nm and at maximum 288 spectral bands with pushbroom type. It offers great signal to noise ratio and radiometric resolution and has a flexibility of changing spectral resolution as well as spatial resolution.

The object area of the study is Manripo district, Taean, Chungnam in Korea. These images were acquired at flying height of around 2,000m at about noon in July 30, 2012. They comprise of 1,462 by 1,976 pixels with radiometric resolution of 14 bit and spatial resolution of one by one meter.

3. Land cover classification

To conduct land cover/ land use classification from hyperspectral images, atmospheric correction should be carried out as one of preprocessing work. The representative atmospheric distortions which should be corrected are caused by lense difference of sensor sensivity characteristic, the difference of ground and sensor, the sun's elevation, atmospheric absorption and scattering and so on. In this study, the atmospheric model of Mid-Latitude Summer, which has the condition that comes close to August mean air temperature 26℃of the object area was used in FLAASH module of ENVI 4.7 software.



(a) minimum distance classification (b) maximum likelihood classification

Figure.1 The results of land cover classification

In Fig.1(a) that shows the result of Minimum Distance Classification(MDC), the dry sandy areas were misclassified as a rocky area and it is considered because of sand or soil sticked to rocks on characteristic of coastal districts. In Fig.1(b) of Maximum Likelihood Classification(MLC) result, it is confirmed that classification was conducted with high accuracy in areas of sea water, mud flat, sandy beach and so on than another methods. Also misclassification of salt pond, asphalt road, concrete road and so on which was conducted in MDC was improved in MLC and boundry between sea and land became more defined in the result of MLC.

Spectral Angle Mapper(SAM) Classification is compared in the same n dimension as reference spectrum using atmospheric-corrected pixels. The Spectral Angle Mapper Classification (SAM) is an automated method for directly comparing image spectra to a known spectra (usually determined in a lab or in the field with a spectrometer) or an endmember. This method treats both (the questioned and known) spectra as vectors and calculates the spectral angle between them. This method is insensitive to illumination since the SAM algorithm uses only the vector direction and not the vector length. The result of the SAM classification is an image showing the best match at each pixel. This method is typically used as a first cut for determining the mineralogy and works well in areas of homogeneous regions.

Fig. 2 shows the result of landcover classification conducted with the images after atmospheric correction. In the case of SAM classification using atmospheric-uncorrected images, a considerable portion of tidal mudflat was misclassified as rocky terrain. Also a boundary between land and sea appeared unclearly but the boundary became clear and misclassification of a sandy beach area was corrected. after atmospheric correction.

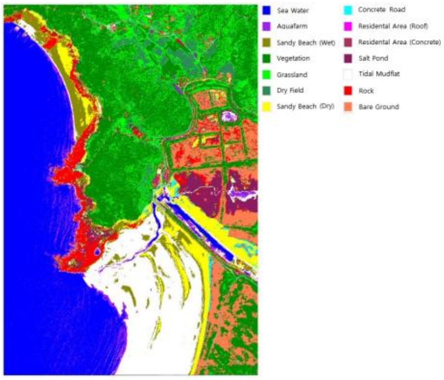


Figure 2. The results of SAM classification

4. Conclusion

The effect of atmospheric correction was confirmed by conducting respectively land cover classification with before- and after- atmospheric correction images.

The maximum likelyhood method among pixel-based classification methods showed the highest classification accuracy and improved classification result would be expected by object-based classification method than pixel-based classification methods in hyperspectral images.

As the result of classification by Spectral Angle Mapper(SAM) method, the boundary boundary between land and sea became clear and misclassification of a sandy beach area was removed after atmospheric correction.

5. Acklnowledgements

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6. References

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