AN ANLYSIS ON THE OPTIMAL SEGMENTATION OF VHR SATELLITE RGB IMAGES

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ABSTRACT: With the development of satellites in the form of high-resolution and constellation satellites, it is necessary to mosaic and analyze dozens of images due to the narrower swath of high-resolution satellites compared to that of medium- or low-resolution satellites. As such, various studies using mosaic images are needed, and since these mosaic images have distorted spectral characteristics, there have been many restrictions on their use. Therefore, in this study, an analysis on the segmentation using only RGB bands was conducted to utilize the images with distorted spectral characteristics for segmentation and even classification.
According to the segmentation results, the optimal segmentation scale was 75 for the mosaic images of Korean Peninsula, and the combination of RGB and Vegetation index seems the most appropriately segment the image especially for the boundary of bare ground and buildings. However, this study is optimized for mosaic images of Korean Peninsula, and it is necessary to compare and analyze the research results using other images and the results applied to other regions. Therefore, further research using those segmentation results should be made to validate and promote the use of mosaic images.

1. INTRODUCTION

Recently, the development of satellites in the form of high-resolution and constellation satellites has become one of the biggest trends in the commercial satellite market. However, when using such high-resolution satellites, it is necessary to mosaic and analyze dozens of images because the swath of high-resolution satellites is narrow compared to that of medium- or low-resolution satellites.
As such, various studies using mosaic images are needed, and since these mosaic images have distorted spectral characteristics, there have been many restrictions on their use. And there are some studies to classify land uses using only RGB images (Upadhyay et al., 2016; Ayhan and Kwan, 2020), however, the efforts to segment RGB images are rarely performed. Therefore, in this study, an analysis on the segmentation using only RGB bands was conducted to utilize the images with distorted spectral characteristics for segmentation and even classification.

2. STUDY REGION AND DATA

Research area in this study is Sejong city, which is the new administrative city of S. Korea. And the mosaic images of the Korean Peninsula, which is generated and distributed annually by Korea Aerospace Research Institute(KARI) for public users, were used. The mosaic images were created using KOMPSAT-2/3/3A images and the spatial resolution is 1m. And R, G, and B bands were provided among multispectral bands except NIR band. Moreover, the production year of the mosaic images is 2018.

3. METHODOLOGY

First of all, we collected and merged the mosaic images over Sejong city, and subset the image using a shapefile of the administrative district map. After that, we extracted Vegetation, Water, and Built-up indices using RGB bands, and followings are the algorithms to calculate each index, which were introduced on Upadhyay et al.(2016).
Finally, we performed image segmentation using various combinations of RGB and Vegetation, Water, and Built-up indices, and compared the results. The software we used for this study is QGIS 3.4.9 and eCognition developer 10.1.

3.1 Vegetation Index(V)

We generated vegetation index(V) using following algorithm.

$$V = \frac{BLUE + RED - GREEN}{BLUE + RED + GREEN}$$

3.2 Water Index(W)

We generated water index(W) using following algorithm.

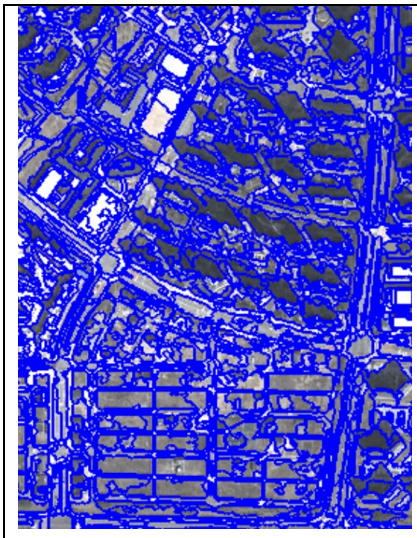
$$W = \frac{RED - BLUE + GREEN}{BLUE + RED + GREEN}$$

3.3 Built-up Index(BU)

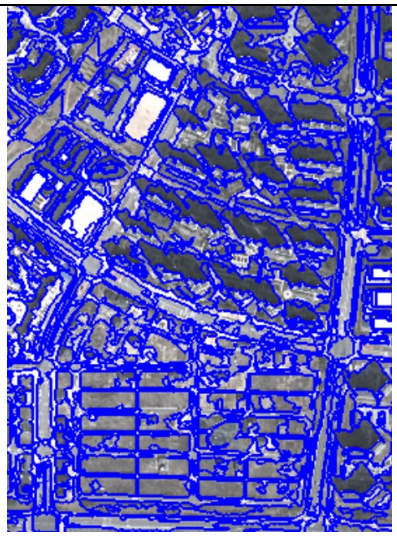
We generated built-up index(BU) using following algorithm.

$$BU = \frac{BLUE + GREEN - RED}{BLUE + RED + GREEN}$$

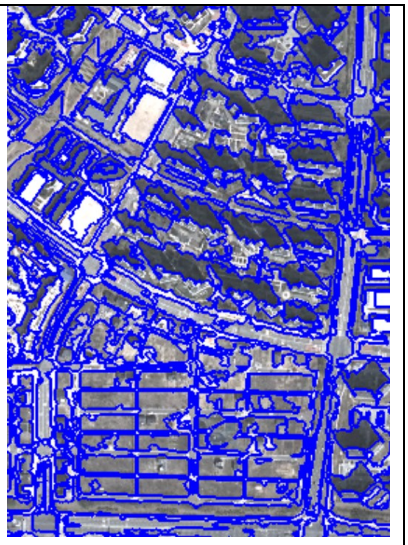
4. RESULTS



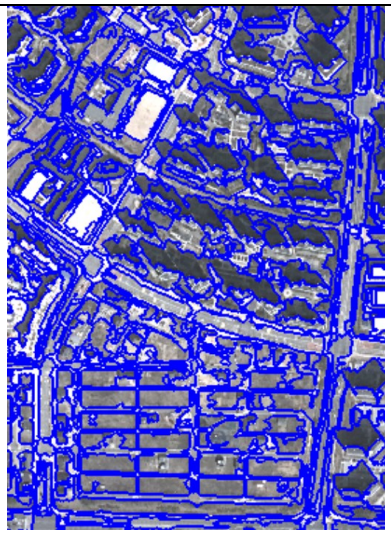
<Scale: 50, Bands: RGB>



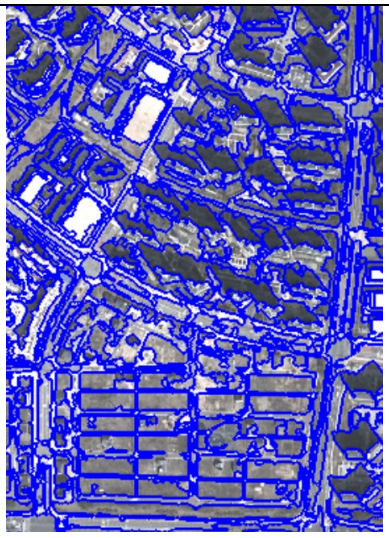
<Scale: 75, Bands: RGB>



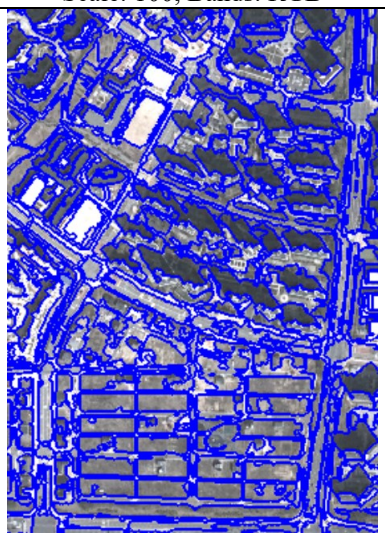
<Scale: 100, Bands: RGB>



<Bands: RGB+BU>



<Bands: RGB+V>



< Bands: RGB+W>

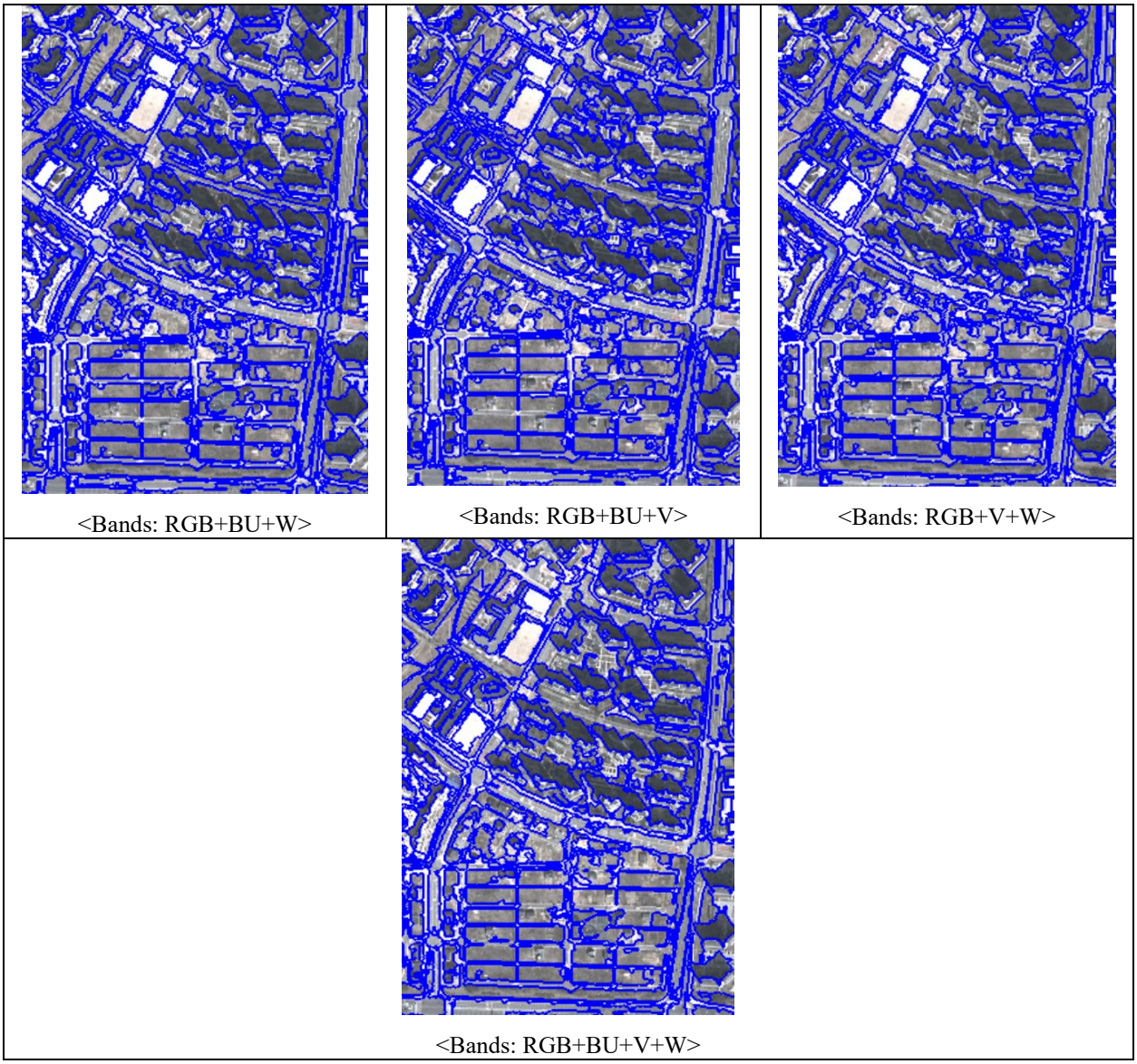


Figure 1 Segmentation Results

According to the segmentation results, the optimal segmentation scale was 75 for the mosaic images of Korean Peninsula. And the shape and compactness parameters are set to the default value of 0.1 and 0.5 respectively.
Moreover, the combination of RGB and Vegetation index seems the most appropriately segment the image especially for the boundary of bare ground and buildings.

5. DISCUSSION AND CONCLUSION

The study on the segmentation for the mosaic images of Korean Peninsula were analyzed to promote the utilization of the mosaic images, which have only RGB bands with distorted spectral characteristics. And those results showed that even RGB images with differentiated spectral characteristics could be used for image segmentation. Furthermore, the segmentation results could be slightly improved using various indices extracted from the combination of RGB bands. However, this study is optimized for mosaic images of Korean Peninsula, and it is necessary to compare and analyze the research results using other images and the results applied to other regions.
Therefore, further researches using those segmentation results should be made to validate and promote the use of mosaic images.

6. REFERENCES

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Upadhyay, P., Mahadik, S. and Kamble, A., 2016, Image Classification using Visible RGB bands, 2016 International Conference on Computing for Sustainable Global Development, 2660-2663.

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