BOUNDARY CLEARNESS OF LAND COVER CLASSIFICATION BY DIFFERENCE OF RESAMPLING METHOD FOR MULTISPECTRAL IMAGE

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ABSTRACT: In this study, classified accuracy in boundary of land cover is examined for high-resolution satellite image. The panchromatic image and multispectral image taken by the high-resolution QuickBird satellite were used. Ground resolution of multispectral image and panchromatic image is 2.44m and 0.61m respectively. High resolution multispectral image was created from these satellite image. When the high resolution multispectral image was created the resolution of panchromatic image and multispectral image should be matched. Nearest neighbor method and bi-cubic method were used in resampling of multispectral image. The high resolution multispectral image was classified by maximum likelihood method and clustering method. Classified result showed that boundary of land cover extracted from the image created by bi-cubic interpolation was clearer than that from the image created by nearest neighbor interpolation. Classification accuracy by clustering method is more stable than those by maximum likelihood method.

1. INTRODUCTION

Some methods[1],[2],[3],[4],[5] for object detection of high resolution satellite images have been proposed. High resolution satellite image has two mode, multi spectrum mode and panchromatic mode. Multi spectrum mode has optical spectral information. Panchromatic mode has advantage of high ground resolution compare with that of multi spectrum mode. These two mode images can be combined by HIS transformation. Pan sharpened image can be created by using HIS transformation. We can classify these images by ordinary classification method. Classified result showed some jitters in boundary area of house. These jitters came from low resolution of multi spectral image. In this study, we proposed an algorithm to improve the classification accuracy in boundary area of house by using interpolation techniques. Multi spectral image should be interpolated to fit with panchromatic image. There are three methods for interpolating the multi spectral image. These three methods are nearest neighbor method, bi-linear method and bi-cubic method. Nearest neighbor method is the most popular algorithm. Bi-linear method has smoothing effect. Boundary of object become blurry. We cannot use this method for the boundary clearness. Bi-cubic method has smoothing and sharpening effect. There are three types, standard, sharp and smooth. We tried these 4 methods for evaluating the interpolation. After enlarging multi spectral image, we created pan sharpened image. We classify the pan sharpened image into some classes.

2. SATELLITE IMAGE DATA

Image data used in this study is the high resolution satellite data obtained by QuickBird. Obtained date is 2 May 2001. Target area is Keihinjima that is island located in south west area of Tokyo. Panchromatic image and multi spectral image were shown in Figure 1 and Figure 2 respectively.

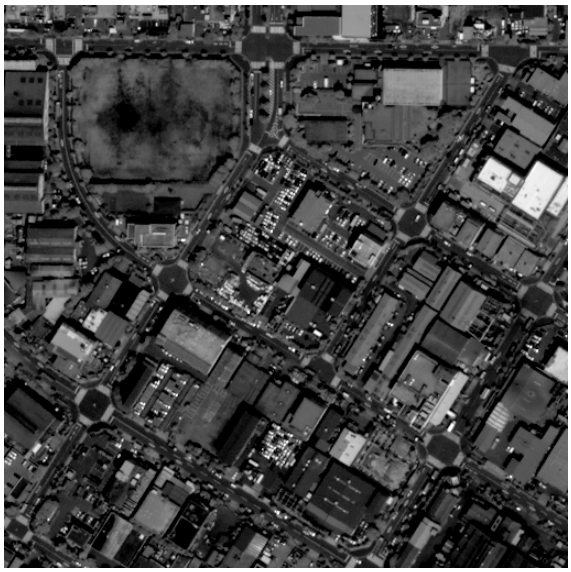

Figure 1 Pan chromatic image of target area

Figure 2 Multi spectral image of target area

3. PAN SHARPENING IMAGE

Ground resolution of multi spectral image is less than that of panchromatic image. We improve ground resolution of multi spectral image by interpolation. Ground resolution of panchromatic image is 4 times higher than that of multi spectral image. One pixel of multi spectral image corresponds to 16 (=4x4) pixels of panchromatic image. Difference of ground resolution is too large. Therefore, we increased the ground resolution of multi spectral image to 4 times. Size of multi spectral image enlarged to 4 times for both horizontal and vertical direction. At this process, we select four methods, nearest neighbor, bi-cubic standard, bi-cubic sharp and bi-cubic smooth. Enlarged image by using these four interpolation are shown in Figure 3, Figure 4, Figure 5 and Figure 6 respectively. Figure 3 shows jitter on boundary of house. Enlarged image by using bi-cubic methods show smoothing effect in the boundary of house.

Pan sharpening image was created from panchromatic image and the multi spectral image enlarged by four interpolation methods, nearest neighbor, bi-cubic standard, bi-cubic sharp and bi-cubic smooth. Multi spectral image has 4 bands. Blue, green and red images are selected for RGB image from 4 bands. This RGB image was transformed to HIS (Hue, Intensity and Saturation) image. The intensity image was replaced by panchromatic image. This HIS image was transformed to RGB image.

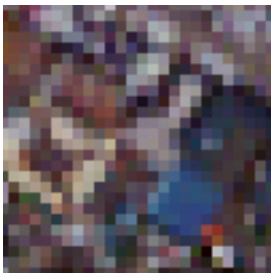

Figure 3 Enlarged image by nearest neighbor

Figure 4 Enlarged image by bi-cubic standard

Figure 5 Enlarged image by bi-cubic sharp

Figure 6 Enlarged image by bi-cubic smooth

Pan sharpening image of the target area created by bi-cubic smooth is shown in Figure 7.

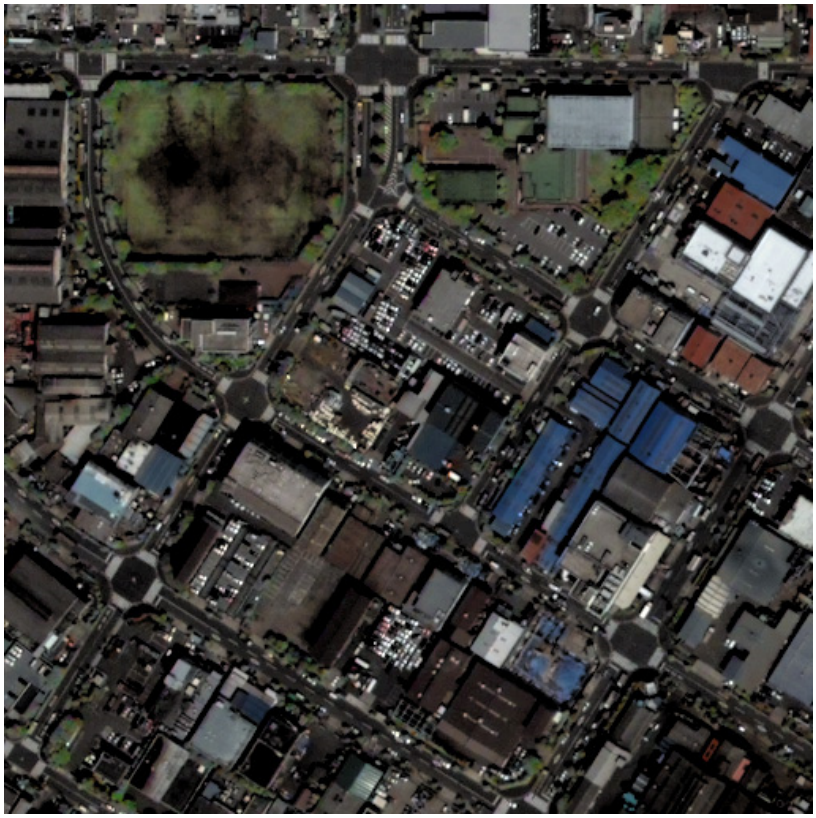

Figure 7 Pan sharpening image created by bi-cubic smooth

4. LAND COVER CLASSIFICATION

Land cover classification was executed for the pan sharpened images. Two method was selected for the land cover classification algorithm, maximum likelihood method and ISODATA method. Number of class was selected 7 classes. These classes are shown in Table 1.

Table 1 Land cover classes

Vegetation	Green
Blue roof	Blue
Gray roof	Gray
White roof	White
Red roof	Red
Asphalt	Yellow
Shadow	Black

4.1 Maximum likelihood method

Maximum likelihood method is the representative supervised classification algorithm. Land cover classification was executed for 4 pan sharpening images which created by 4 interpolation. Classified results are shown in Figure 8, Figure 9, Figure 10 and Figure 11. Figure 8 shows the classified result for the pan sharpened image obtained by nearest neighbor interpolation. Figure 9, Figure 10 and Figure 11 show the classified results for the pan sharpened images obtained by bi-cubic standard, bi-cubic sharp and bi-cubic smooth, respectively.

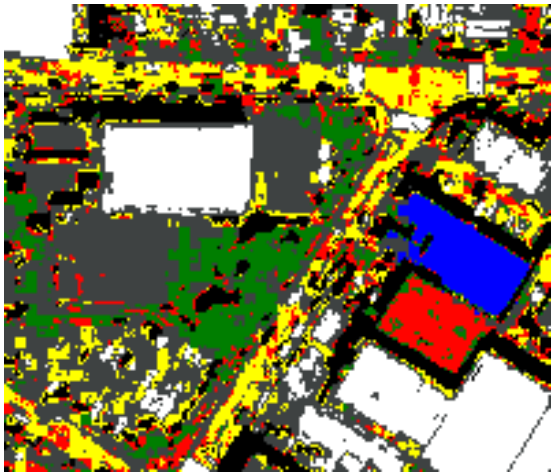

Figure 8 Classified result by using Maximum likelihood method and Nearest neighbor interpolation

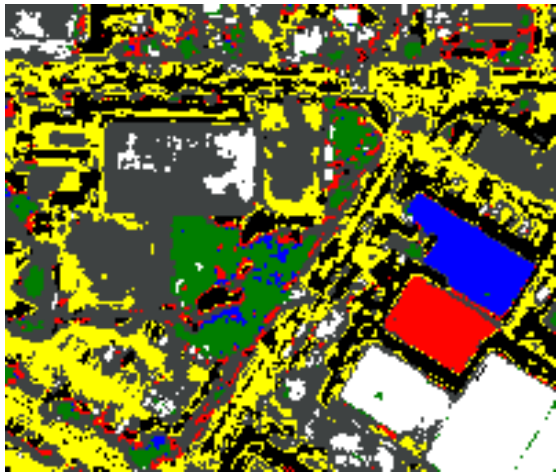

Figure 9 Classified result by using Maximum likelihood method and bi-cubic standard interpolation

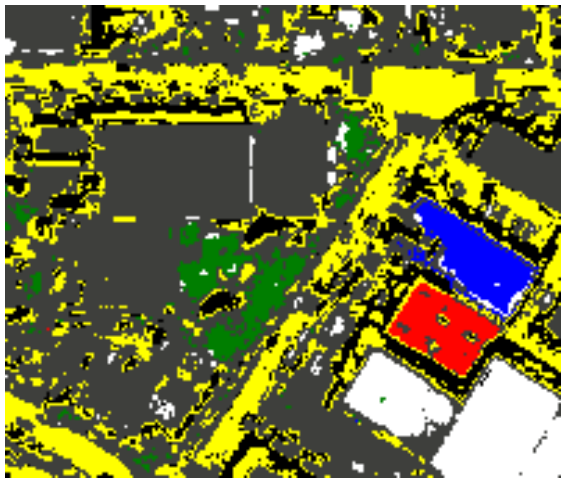

Figure 10 Classified result by using maximum likelihood method and bi-cubic sharp interpolation

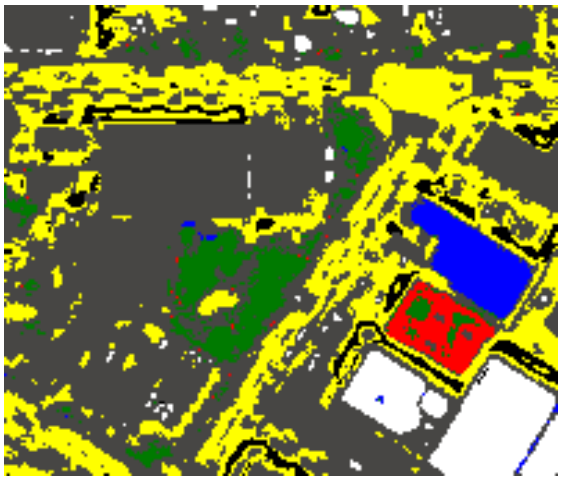

Figure 11 Classified result by using maximum likelihood method and bi-cubic smooth interpolation

There exist jitter and misclassified pixels around the boundary of land cover in classified result by nearest neighbor interpolation. Classified result by bi-cubic standard interpolation shows smoothing effect at boundary of land cover. There is not jitter in this case. But, there are some misclassified pixels in the boundary of land cover. There is not so many misclassified pixels in boundary of land cover for both of classified results obtained by bi-cubic sharp and bi-cubic smooth interpolation. Land cover boundary smoothness of classified result by bi-cubic smooth interpolation is better than that of classified result by bi-cubic sharp interpolation.

4.2 ISODATA method

Clustering is the representative method of unsupervised classification algorithm. ISODATA method was used as clustering. The number of class was 120. These classes were merged into 7 classes. Classified results are shown in Figure 12, Figure 13, Figure 14 and Figure 15.

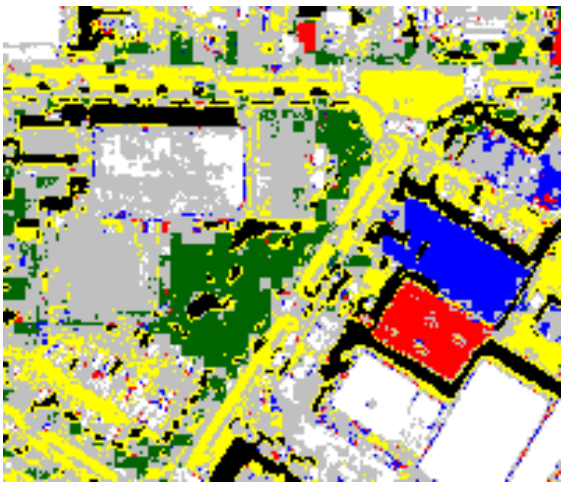

Figure 12 Classified result by using ISODATA method and Nearest neighbor interpolation

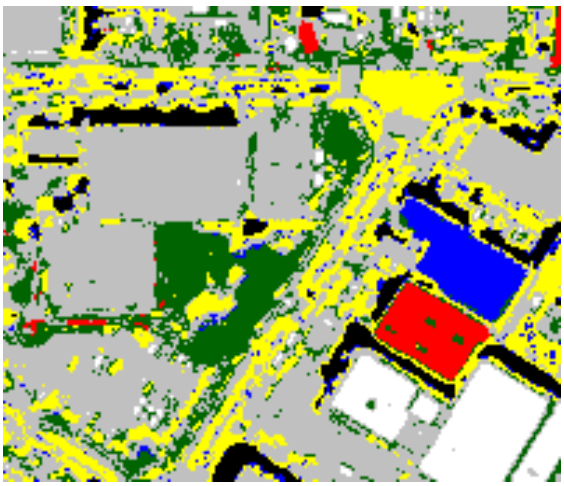

Figure 13 Classified result by using ISODATA method and bi-cubic standard interpolation

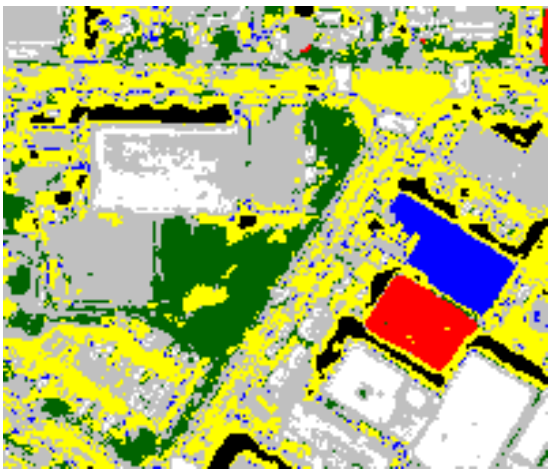

Figure 14 Classified result by using ISODATA method and Bi-cubic sharp interpolation

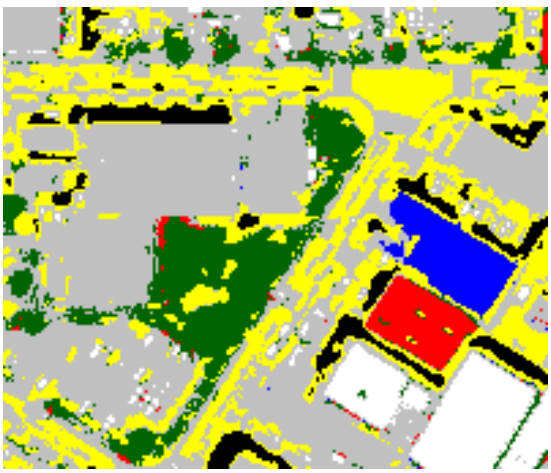

Figure 15 Classified result by using ISODATA method and bi-cubic smooth interpolation

Obtained results for ISODATA method show similar tendency as the obtained results for maximum likelihood method. Classified result by ISODATA method is more stable than the classified result by maximum likelihood method.

5. CONCLUSION

We found out that the best interpolation method for improving the clearness of boundary area between land covers was bi-cubic smooth interpolation. There were many jitters and misclassified pixels in the boundary of land cover for the classified result by using nearest neighbor interpolation. Classification results by ISODATA method showed more stable than those by maximum likelihood method.

REFFERENCES

[1] Hosomura, T., 2008, Road Extraction From High Resolution Satellite Image by Using Circle Area, Proc. of ISPRS XXI Congress.

[2] Tuker,M., 2010 Building Detection from Pan-sharpened IKONOS Imagery through Support Vector Machines Classification, Proc. of ISPRS Technical Com. VIII Symposium.

[3]Hosomura, T., 2010, Airplane Extraction from High Resolution Satellite Image using Boundary Feature, Proc. of ISPRS Technical Com. VIII Symposium.

[4] Hosomura, T., 2012, Airplane Detection by Using Pseudo Ground Resolution Improvement for Multiband Image, Proc. of ACRS2012.

[5] Hosomura, T., 2013, .mprovement of Classification Accuracy in Airplane Boundary by Using Smoothing Techniques, Proc. of ACRS2013.