CLASSIFICATION OF TREE SPECIES IN FIELD SCIENCE CENTER, TOHOKU UNIVERSITY, USING AERIAL HYPER SPECTRAL DATA

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ABSTRACT: Seasonal data of aerial hyper spectral image are acquired using AISA system in 2007 and data have 190 bands from visible to short wave infrared. In field survey, we determine each tree species and positions. We classify tree species in Field Science Center, Tohoku University using the hyper spectral data. The hyper spectral data have 190 bands and it is necessary to decline the bands for performing the classification. We want to classify with high accuracy by using suitable bands. For the reason, we conduct feature selection and the feature selection is the method for getting suitable bands from many bands. For the feature selection, training data are necessary and we use field survey data for the training data. Using suitable bands, feature extraction transform method is performed for data reduction. We classify the hyper spectral data by tree species with supervised method using transformed data. We compare with the results and field survey data.

1. INTRODUCTION

The aim of the study is classification of tree species using aerial hyper spectral data. We want to classify by spectrums of the object using hyper spectral data. Hyper spectral data have 190 bands from visible to short wave infrared. We classify survey area in Field Science Center, Tohoku University, with supervised method at two seasons in 2007. Spectral data of tree change each season and we compare with summer and winter.

2. SURVEY AREA

We study the survey area in Field Science Center, Tohoku University that is located in the west side of Miyagi Prefecture in Japan and situated in mountainous area. The site has been used for experimental farm and forest of university since 1947. The experimental farm and forest consists of natural and artificial forest, grass field, cultivated field and others. The survey area has a small mountain and some parts have shadow in winter by the mountain.

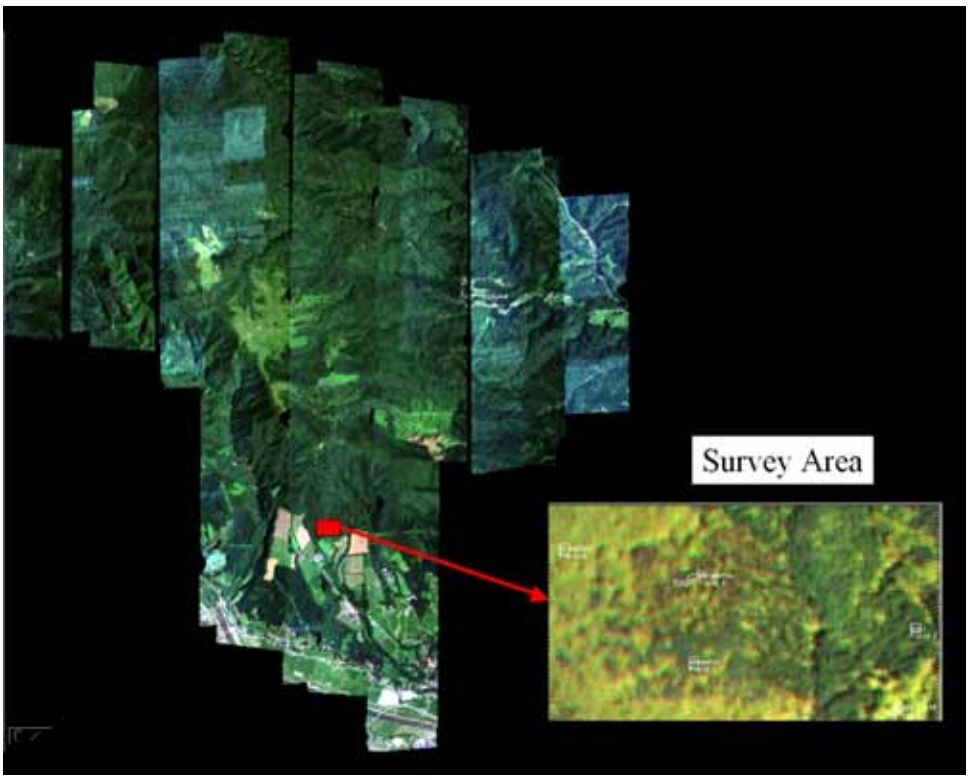

Fig.1 Aerial hyper spectral data of Field Science Center

3. DATA

We classify an area using aerial hyper spectral data at 11th August 2007 and 25th Novemver 2007. The specifications of hyper spectral data are showed in table1. Aerial hyper spectral data are acquired using AISA system and data have 190 bands from visible to short wave infrared.

Table1 Aerial hyper spectral data

wavelengths(nm)	401.87～2397.58
range of wavelengths(nm)	8.16～11.40
bands	190
height(m)	2284
Speed of plane(knot)	120
day	11th August 2007 25th November 2007
sensor	AISA Eagle

4. METHOD

Multi Spec (Purdue Univ.) is used in this study. We check spectral data of tree and select training field in survey area. Tree species of training field are selected using

field survey data. First, we perform feature selection and get suitable bands to classify with high accuracy. Feature selection is Bhattacharyya Distance method and is method declining 190 bands to suitable band number. Second, using selected bands, we conduct feature extraction that is Decision Boundary Feature Extraction. The feature extraction transforms performed the selected bands to Decision Boundary Feature Extraction Matrix. Third, we use the Matrix for classification. We classify hyper spectral data by tree species with supervised method. The method of classification is Fisher Linear Likelihood.

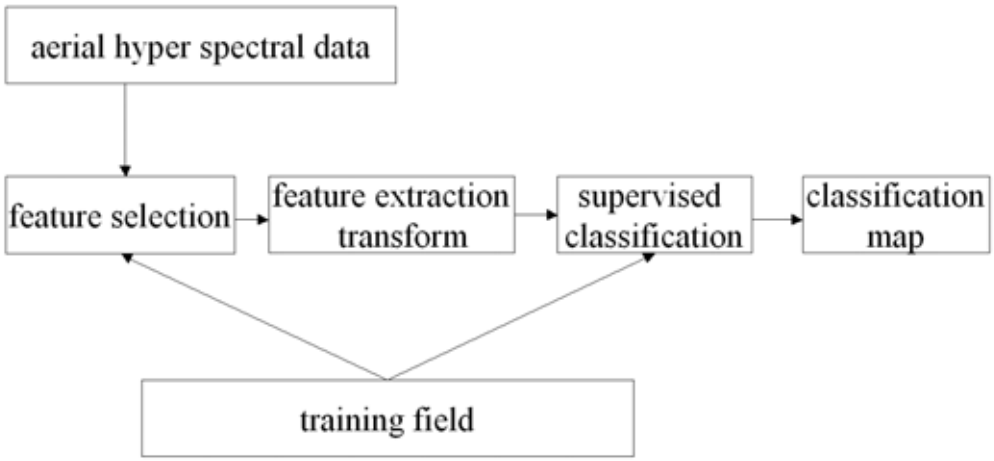

Fig.2 Flowchart

5. RESULT AND CONCLUSION

We make to classify tree species from getting suitable bands. We cannot classify tree species of broadleaf tree because there are no suitable training fields.
Figure3 and 4 are the target area of Field Science Center. There are groups of cedar, red pine, larch and broadleaf. We classify mainly their groups. Figure5 and 6 are the result of classification. We have 5 classes using 11th August 2007 data and the classes are cedar, red pine, larch, broadleaf and grass field. We have 7 classes using 25th Novemver 2007 data and the classes are cedar, red pine, larch, broadleaf, snow, cedar in shadow and broadleaf in shadow. At small sun elevation, we must make different training fields in sunshine and shadow in mountain area. Figure7 and 8 are the spectral data of the training field. Hyper spectral data of summer and winter are extremely different. In winter, broadleaf tree and larch lose the leaves. Each seasonal characteristic of tree reflects the characteristic of spectral data.
More study is needed to improve the accuracy of the classification. We will study to increase classes of the classification and be extended the survey area. Mainly, we will classify the species of broadleaf.

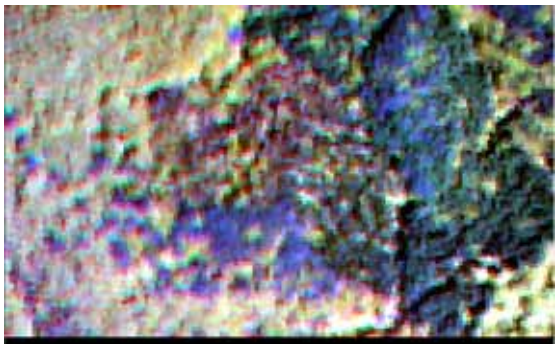

Fig.3 Data of 11th August 2007

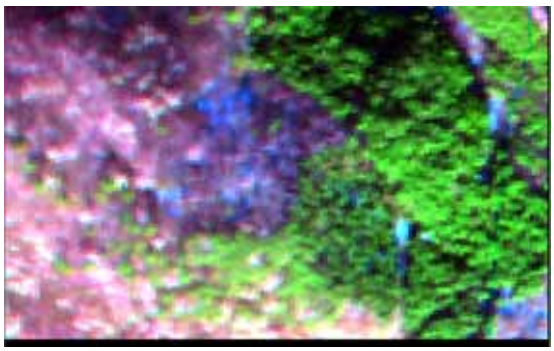

Fig.4 Data of 25th November 2007

Table2 Selected bands

11th August 2007, 8 bands		25th November 2007, 18 bands			
band	wavelength(nm)	band	wavelength(nm)	band	wavelength(nm)
34	688	6	442.96	96	1326.48
74	1075.79	35	696.93	112	1508.79
81	1155.55	55	878.7	128	1691.11
91	1269.5	71	1041.61	134	1759.47
149	1930.4	77	1109.98	136	1782.27
154	1987.37	80	1144.16	156	1998.77
163	2089.92	89	1246.72	159	2044.34
173	2203.87	90	1258.11	163	2089.92
		94	1303.69	169	2158.29

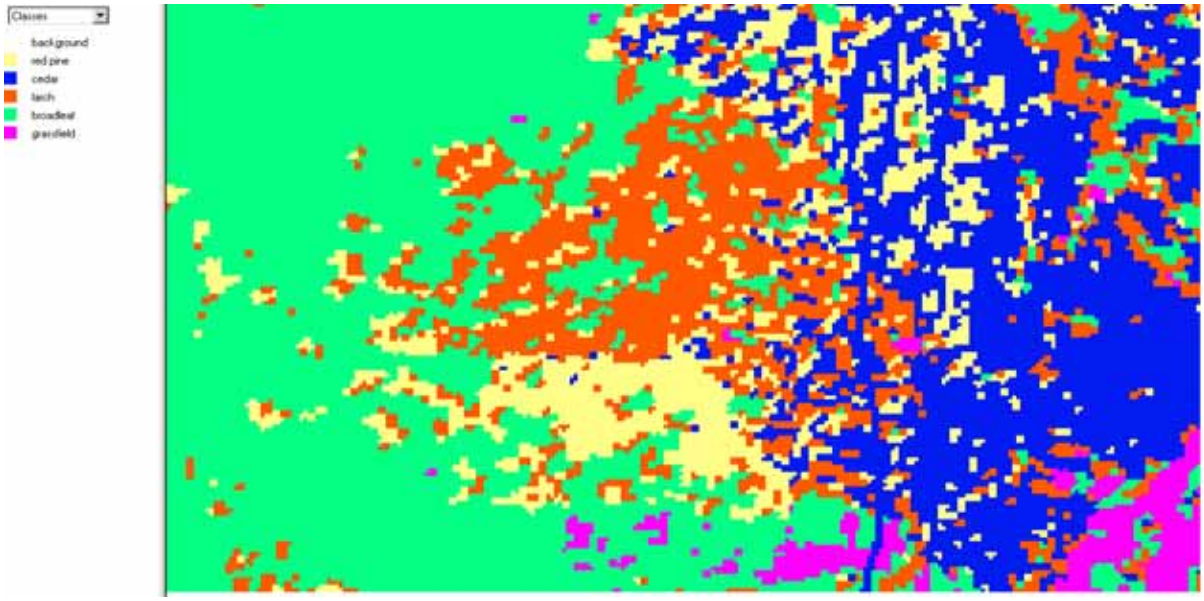

Fig.5 Classification of 11th August 2007

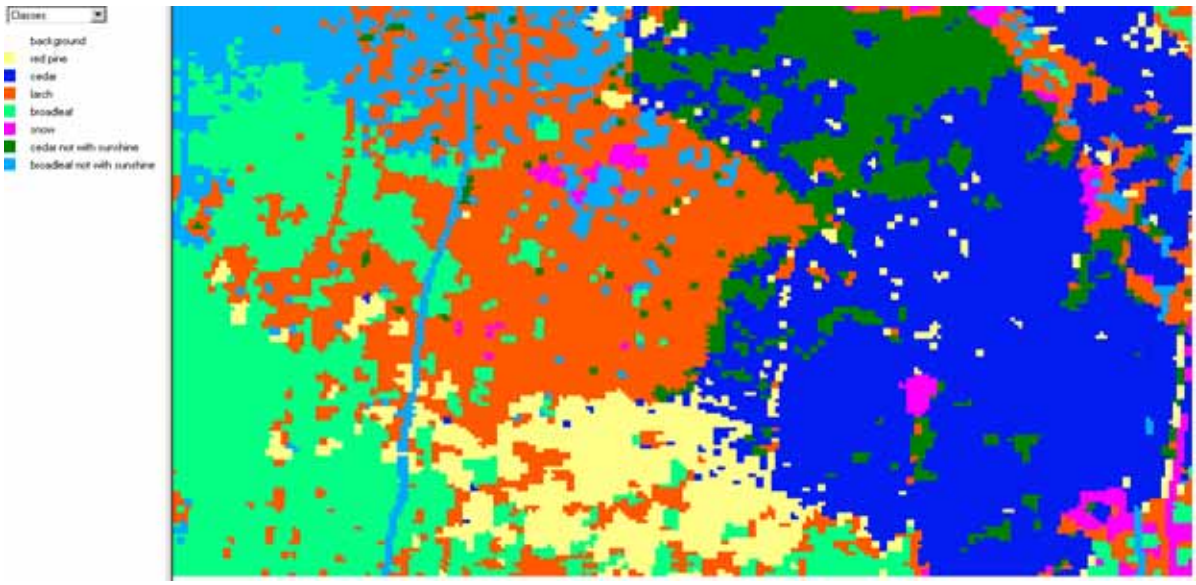

Fig.6 Classification of 25th November 2007

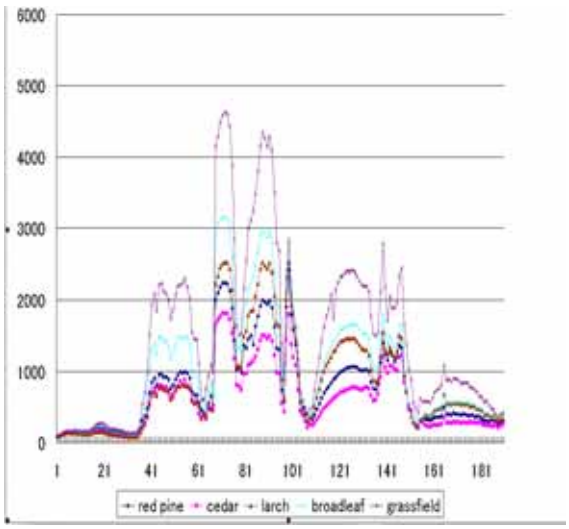

Fig.7 spectral data of 11th August 2007

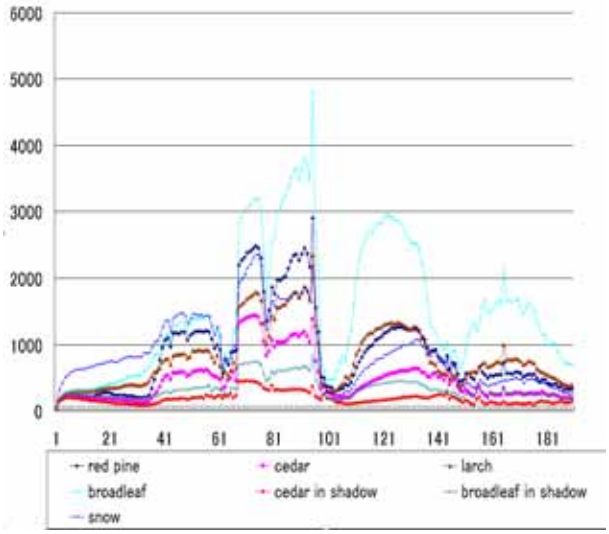

Fig.8 Spectral data of 25th November 2007

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