IDENTIFICATION OF TREES IN THE SHADE OF HOUSES IN RESIDENTIAL AREAS USING AIRBORNE MULTI-SPECTRAL IMAGES

Haruki Oshio, Jiang He and Akira Hoyano

Interdisciplinary Graduate School of Science and Engineering,

Tokyo Institute of Technology

1. INTRODUCTION

Trees around houses make a comfortable microclimate in residential spaces by lowering surface temperature of leafs and making shade. Therefore, it is important to consider the distribution of trees around houses in the urban planning. Airborne multi-spectral images are effective to identify these trees. But previous method we proposed can't identify trees accurately in the shade. Therefore, the purpose of this study is to develop a method to identify trees shaded by buildings and other structures in residential areas.

2. CLASSIFICATION METHOD

In our previous method, VCRP (Vegetation Cover Ratio in a Pixel) calculated by visible and near infrared bands was used to identify vegetations. But spectrum shape at these bands are resemble between vegetation and other land covers in the shade. The Characteristics of temperature variation of tree crown surface were analyzed in this study. The analysis result show that remotely sensed data of surface temperature observed in the summer and winter can be used to identify trees in the shade. From the characteristics of surface temperature of ground covering materials in residential areas (Fig.1), it is clarified that the crown surface temperature of trees with leaves is lower in the summer night time and higher in the winter night time than other materials. The proposed method is indicated in Fig.2. At the first step, pixels classified into shade by the previous method are extracted. The second step is to calculate surface temperature difference (subtract nocturnal surface temperature in the summer from that in the winter) in the extracted pixels, and discriminate

trees from others based on calculated values. The values seem to be large in tree-planting areas from characteristics of surface temperature as mentioned above. Thus, pixels with large surface temperature difference value are classified into tree. At the last step, vegetation indexes are used to reduce misclassification. The proposed method aims to extract the gray area shown in Fig.1.

3. VERIFICATION OF PROPOSED METHOD

Three residential areas covered with many vegetations were selected for verification. Airborne MSS data observed in Zushi city (Kanagawa Prefecture, Japan) at noon and night on a clear sky summer and

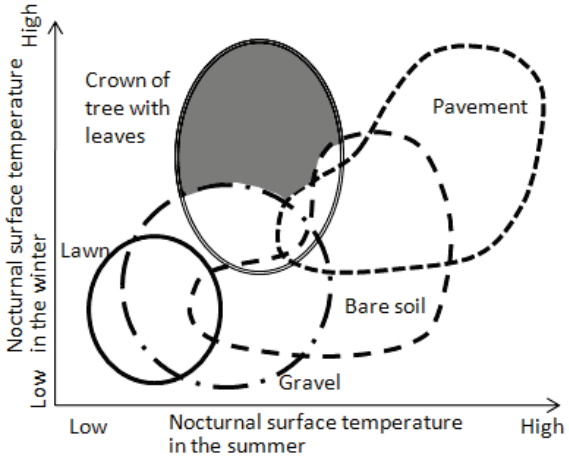

Fig.1 Characteristics of surface temperature

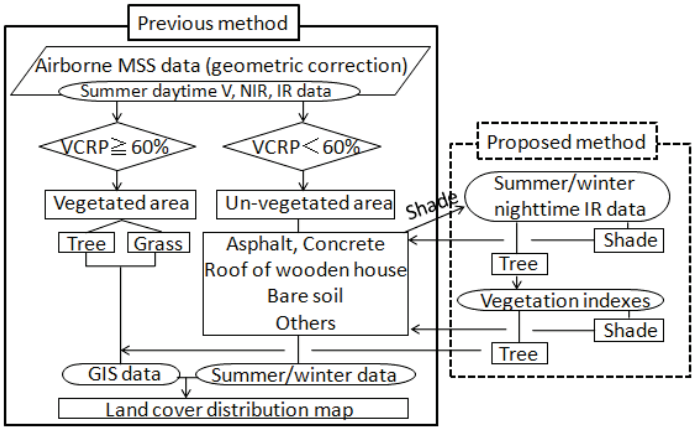

Fig.2 Diagram of classification method

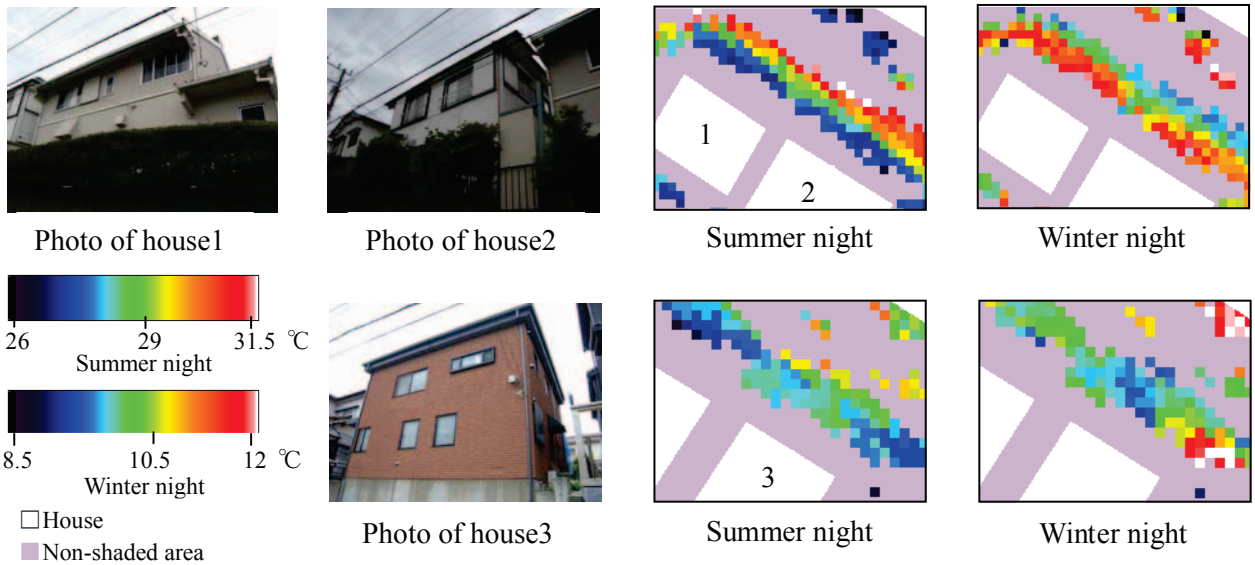

Fig.3 Surface temperature distribution of tree-planting area (upward) and non-tree-planting area (downward)

winter day was used in the verification. Land cover classification was conducted by the previous method and pixels classified into shade were extracted. Thermographs of surface temperature distribution in the shade are shown in Fig.3. It was found that the tree-planting areas show lower surface temperatures in the summer night time and higher surface temperatures in the winter night time than other areas. The surface temperature difference between summer and winter night time was calculated. When discriminating trees from others based on calculated value, the threshold was determined as follows. The results discriminating trees from others were calculated about several thresholds and most suitable threshold was selected by comparing the results and correct data (photos taken at the location and aerial photos) (Fig.4). Furthermore, reducing misclassification method using vegetation indexes was carried out. Pixels with small vegetation index value were removed from pixels classified into trees using surface temperature difference. NDVI, MRVI, MRVI'

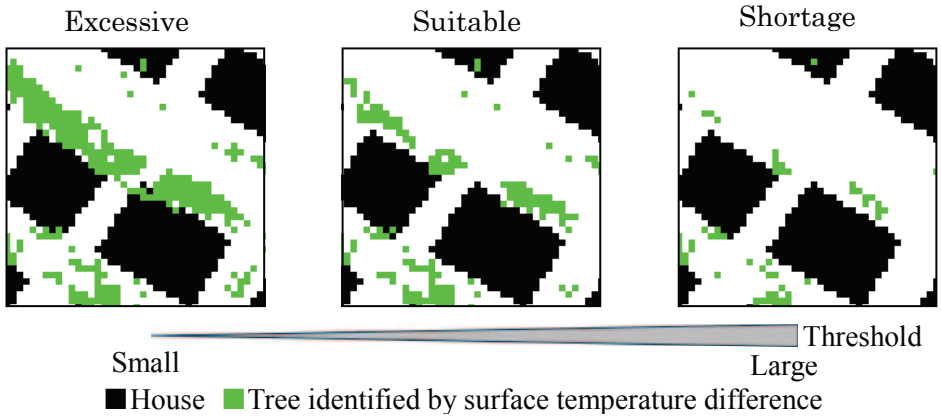

Fig.4 Relationship between threshold and trees identified by surface temperature difference

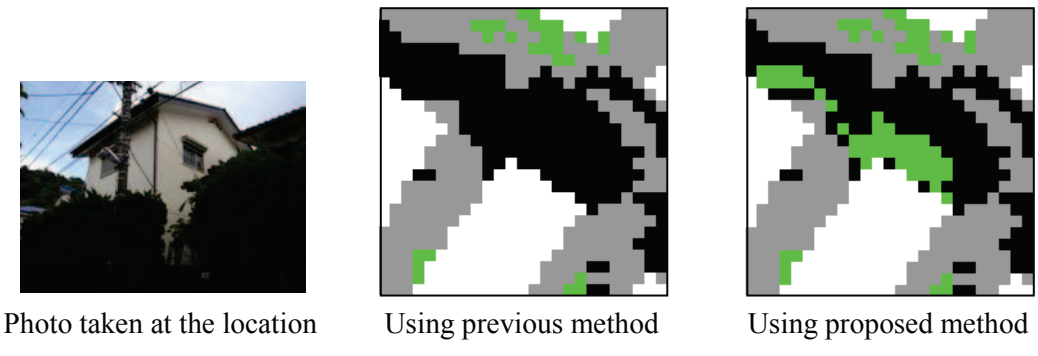

Fig.5 Classification result using proposed method

and RVI were used as vegetation indexes. Consequently, misclassifications were further reduced when NDVI was used. From classification results (fig.5), trees couldn't be identified by the previous method can be identified by the present method. And it was found that 65-70% of the shaded evergreen trees unidentified by the previous method can be identified using the proposed method in each study area.

4. REFERENCES

[1] Hoyano A. and Komatu Y., "Classification of urban land cover using multi-temporal MSS Image and GIS data", Journal of the Japan Society of Infrared Science and Technology, 13(1), pp.50-56, 2003.9

[2] Hoyano A. and Yun D., "Index to Extract Vegetation Cover Ratio in a Pixel in Urban Areas", Journal of the Remote Sensing Society of Japan, 18(3), pp.228-240, 1998.9

[3] Komatu Y., Hoyano A., Matunaga M., Ashie Y. and Miyasaka S., "Support System of City Environmental Planning utilizing CIS and RS data : Part3 Detailed Vegetation Map", Summaries of technical papers of Annual Meeting Architectural Institute of Japan. D-1 2001, pp.585-586, 2001.7