Object Based Image Classification for Mapping Urban Land Cover Pattern; A case study of Enugu Urban, Enugu State, Nigeria.

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INTRODUCTION

Mapping is the accurate representation of part of the earth surface which is spherical on a plane surface to a conventional scale at a particular epoch; maps are finished using cartographic abstractions and generalizations based on the purpose for which the map is made. In recent times mapping is done using remotely sensed imageries. To derive land-cover information from high resolution imagery, however, can be a difficult task depending on the complexity of the landscape and the spatial and spectral resolution of the imagery being used. This study focuses on using the object based classification method to classify map Trans-Ekulu Enugu, Enugu state Nigeria as a means of examining the urban land cover pattern in the area.

In order to achieve object-based image classification, image segmentation is carried out. Image segmentation is carried out on the image using user defined constraints which controls the segmentation of different image objects into independent objects. Segmentation is the division of an image into spatially continuous, disjoint and homogeneous regions. For most previous studies, the aim of image segmentation is to find a single good segmentation result (Carleer et al., 2005; Plaza and Tilton, 2005). On the other hand, since high resolution image usually has limited spectral resolution, the accuracy of the classification using spectral information alone is very limited. Thus, incorporation of spatial information in urban land cover classification would lead to higher classification accuracy (Bruzzone et al., 2006; Carleer and Wolff, 2006; Zhang et al., 2006). In this study, we therefore explore the capabilities of the object-based method in identifying and classifying accurately the different image objects in the urban area according to the chosen themes.

STUDY AREA

The study area is located at the north east part of Enugu urban, Enugu state Nigeria, between 330,891.846E and 334,798.096E on the east and 714,523.934N, and 716,716.593N on the north, covering an area of 570.83 hectares.

The study area is an urban area characterized by built up areas with different kind of surfaces and different reflectance abilities (values), water bodies and so many other features which make the high resolution image so complicated.

Due to the heterogeneity of the land cover of the urban area, there is the need for us to use the object based image classification technique to intelligently differentiate this.
METHODOLOGY

This study followed the following steps to achieve the object based image classification;

- Ground Truthing
- Projection and Georeferencing of the image of the study area
- Choice of Classes to be classified
- Choice of segmentation parameter values
- Segmentation
- Training of sample sites
- Classification
- Class Mapping
- Class Area Computation
- Accuracy assessment

RESULTS AND ANALYSIS

The results of this study are in the forms of;

a) A classified raster image of the study area.
b) Statistical analyses
Accuracy Assessment

- To assess the accuracy of the classified map, we imported the ground truthing data, that is, the coordinates of the corresponding reference points with their Reference ID. With this we were able to assess the accuracy of the classification. The classification accuracy is achieved by comparing the ground truth data points of the six (6) themes with the classified image. The degree of agreement of the classified image position and the ground truth data points now gives us the classification accuracy of the image classification process.

STATISTICAL RESULTS

<table>
<thead>
<tr>
<th>Class/Type</th>
<th>Reference</th>
<th>Overall</th>
<th>Overall</th>
<th>Overall</th>
<th>Overall</th>
<th>Overall</th>
<th>Overall</th>
<th>Overall</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>UnClassified</td>
<td>18</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Tree</td>
<td>15</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>Building</td>
<td>87</td>
<td>85</td>
<td>78</td>
<td>81.48%</td>
<td>81.48%</td>
<td>81.48%</td>
<td>81.48%</td>
<td>81.48%</td>
<td>81.48%</td>
</tr>
<tr>
<td>Vegetation</td>
<td>58</td>
<td>85</td>
<td>63</td>
<td>82.42%</td>
<td>82.42%</td>
<td>82.42%</td>
<td>82.42%</td>
<td>82.42%</td>
<td>82.42%</td>
</tr>
<tr>
<td>Road</td>
<td>73</td>
<td>85</td>
<td>68</td>
<td>81.48%</td>
<td>81.48%</td>
<td>81.48%</td>
<td>81.48%</td>
<td>81.48%</td>
<td>81.48%</td>
</tr>
<tr>
<td>Shadow</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Forest</td>
<td>41</td>
<td>57</td>
<td>57</td>
<td>99.29%</td>
<td>99.29%</td>
<td>99.29%</td>
<td>99.29%</td>
<td>99.29%</td>
<td>99.29%</td>
</tr>
<tr>
<td>Total</td>
<td>344</td>
<td>544</td>
<td>544</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Overall Classification Accuracy: 91.48%
Table 2.0: Land Use Percentage Table

<table>
<thead>
<tr>
<th>Class Name</th>
<th>Area (Features)</th>
<th>Classified Total Area</th>
<th>Percentage Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclassified</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0</td>
</tr>
<tr>
<td>River</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.00%</td>
</tr>
<tr>
<td>Buildings</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.00%</td>
</tr>
<tr>
<td>Vegetation</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.00%</td>
</tr>
<tr>
<td>Road</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.00%</td>
</tr>
<tr>
<td>Shadow</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.00%</td>
</tr>
<tr>
<td>Paved_Area</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.00%</td>
</tr>
<tr>
<td>Total</td>
<td>0.000000</td>
<td>0.000000</td>
<td>100%</td>
</tr>
</tbody>
</table>

CONCLUSION

As we can see from this study, the classification results have been greatly improved by the object-oriented, besides, the whole procedure proves feasible and efficient, and the reasons are as follows:

i. Segmentation has its special way of eliminating the noise problem.

ii. The object concept enables the usage of various features, making full use of high-resolution images information. Beyond purely spectral information, image objects contain a lot of additional attributes, which can be used for classification.

iii. With different segmentation parameters (user-defined), it provides the possibility to easily adjust image object resolution (size) to specific requirements, data and tasks depending on application.

iv. There is flexibility in editing which enables one to amend or delete the wrongly classified objects.

v. The object-based method is more suitable for classifying high-resolution images especially in urban areas, and will be the trend for the high-resolution remotely sensed data.

vi. This makes object-based image classification technique a unique tool for environmental mapping, monitoring and national development.
REFERENCES