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 (Bruzzones 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.

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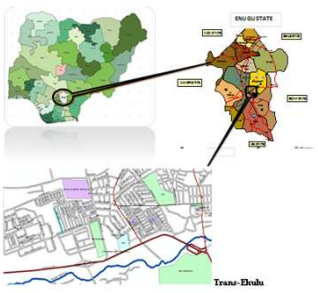
STUDY AREA



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.

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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

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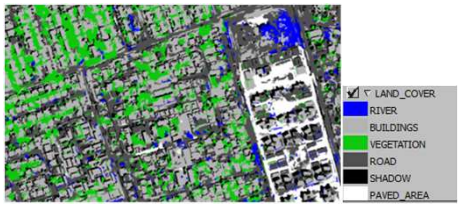
RESULTS AND ANALYSIS

The results of this study are in the forms of;

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

Original Image of the study area before classigfication



Classified image of the study area after classification

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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.

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STATISTICAL RESULTS

Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy	KAPPA (K) STATISTICS
Unclassified	0	0	0			0.0000
River	55	46	45	81.82%	97.83%	0.9741
Buildings	83	83	78	93.98%	93.98%	0.9206
Vegetation	66	66	61	92.42%	92.42%	0.9063
Road	72	85	68	94.44%	80.00%	0.7471
Shadow	27	27	27	100.00%	100.00%	1.0000
Paved_Area	41	37	37	90.24%	100.00%	1.0000
Totals	344	344	316			
Overall Classification Accuracy				91.86%		0.8999

ACCURACY TOTALS
Table 1.0: Accuracy Assessment Table

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Table 2.0: Land Use Percentage Table

Class Name	Area Classified (Hectares)	Total Area	Percentage Land Use
Unclassified	0	83.298954	0
River	2.943912	83.298954	3.53%
Buildings	37.975993	83.298954	45.59%
Vegetation	1.789721	83.298954	2.15%
Road	35.685095	83.298954	42.84%
Shadow	0.780999	83.298954	0.94%
Paved_Area	4.120728	83.298954	4.95%
Totals	**83.298954**	**83.298954**	100%

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CONCLUSION

As we can see from this study, the classification results has 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.

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