

# LAND USE DETECTION COMPARISON FROM SATELLITE IMAGES WITH DIFFERENT CLASSIFICATION PROCEDURES

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## ABSTRACT:

Land use information is required for most of the studies as map updating, land use detection, cartography, city planning etc. For that reason, this study aimed to apply a methodology to detect and compare land use results acquired by classification of different satellite images with different resolutions. The study region is Golbasi Municipality of Ankara city of Turkey. The images and their resolutions used in this study are QuickBird 2.4m, Ikonos 4m. Two different classification procedures are carried out in this study. Firstly, supervised classification technique is applied to images and the majority filter is applied to classification results in order to increase the accuracy. Secondly zonal based classification technique is applied to data. The accuracy of the classification results generated with two different classification procedure and for two different images are compared with GIS database that includes the boundaries of buildings.

## 1. INTRODUCTION

Building extraction from satellite imagery has been research topic of photogrammetry sociality for many years. (Baltsavias, et al, 2001, Gürün et al, 1997; Mayer 1999). The recent availability of commercial high-resolution satellite imaging sensors such as IKONOS and QuickBird provide a new data source for building extraction. The high spatial resolution of the imagery reveals very fine details in urban areas and greatly facilitates the classification and extraction of urban-related features such as buildings ( Jin and Davis, 2005, Benediktsson et. al., 2003, Guindon, 2000. Most of the recent work on building extraction from high resolution satellite images is based on supervised techniques. These techniques either require a classification based on initial training data to provide hypotheses for the positions and sizes of the candidate building features. (Benediktsson et. al.,2003 and Lin and Nevatia, 1998). In this study two different classification procedure are applied to QuickBird and Ikonos images. Firstly two different images are classified using MCL supervised classification procedures and majority filter is applied to classified images in order to increase the classification accuracy. Secondly zonal based classification technique is applied to data. The accuracy of the classification results generated with two different classification procedure and for two different images are compared with GIS database that includes the boundaries of buildings.

## 2. METHODOLOGY

The objective of this study is to refine the supervised classification results to obtain the realistic building boundaries. The study region is located at the Golbasi region of Ankara, Turkey. In this study we concentrate on urban areas because of the high density and regularity of the buildings in these areas. Our approach includes following steps. First, the statistical parameters describing each class of Ikonos and QuickBird

images are determined including buildings, roads and vegetation. Then training set for each class is selected homogenously covering whole image. And then images are classified using supervised Maximum Likelihood Classification (MLC) procedure where the results are shown in figure 1 and 2 respectively. The result of the classification procedures are tested with the GIS database that includes the boundaries of buildings. According to generated results of Ikonos 50% of the whole image cover building areas. On the other hand QuickBird image occupy 41% building areas compared to whole region (Table 1-2).

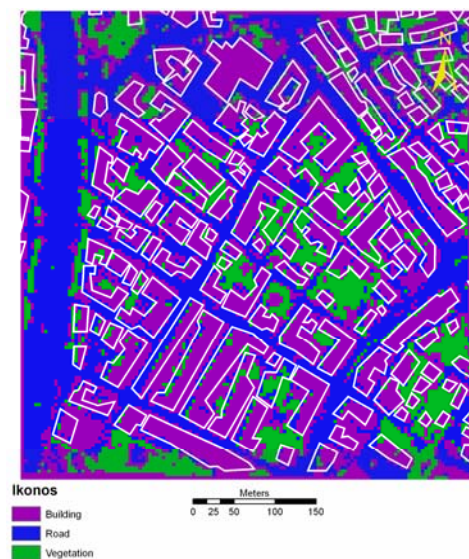


Figure 1. MLC of Ikonos



Figure 2. MLC of QuickBird



Figure 3. Majority Filter applied of MLC of Ikonos

	Cell Count	%
Building	9278	50
Road	6271	33
Vegetation	3211	17
Total	18760	100

Table 1 Results of MLC of Ikonos

	Cell Count	%
Building	22862	41
Road	20346	37
Vegetation	12013	22
Total	55221	100

Table 2 Results of MLC of QuickBird

The majority filter which replaces cells in a raster based on the majority of their continuous neighbouring cells is applied to classified image in order to increase the accuracy (Fig 3 and 4). After application of majority filter the building pixel percentages compared to whole images of Ikonos and QuickBird are 51% and 42% respectively (Table 2-3).

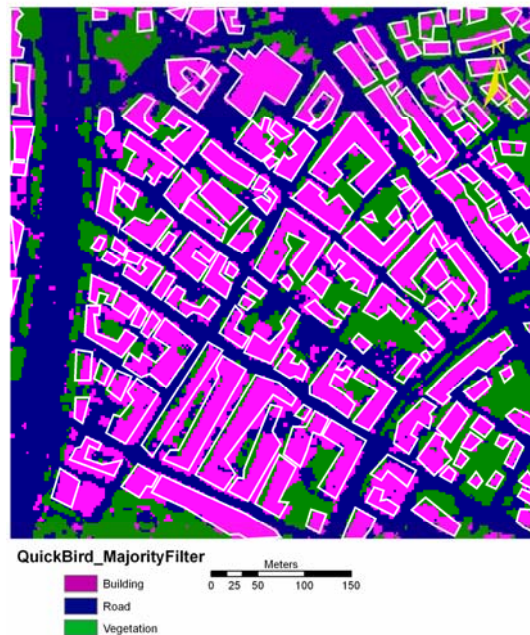


Figure 4. Majority Filter applied of MLC of QuickBird

	Cell Count	%
Building	9488	51
Road	6250	33
Vegetation	3022	16
Total	18760	100

Table 3. Results of Majority Filter applied of MLC of Ikonos



	Cell Count	%
Building	22923	42
Road	20263	36
Vegetation	12035	22
Total	55221	100

Table 4. Results of Majority Filter applied of MLC of QuickBird

The second step of the study is zonal based classification procedure. For that procedure image data are segmented into building and non-building areas then zonal statistics that calculates the statistics on values of a raster within the zones of building polygons is performed then each object assigned to building class. The result of this analysis is given in figure 5 and 6. According to generated results building pixel percentages compared to whole images of Ikonos and QuickBird are 33.6% and 33.8% respectively (Table 5-6).



Figure 5. Zonal Statistics applied of MLC of Ikonos



Figure 6. Zonal Statistics applied of MLC of QuickBird

	Cell Count	Total cell	%
Building	6311	18760	33.6

Table 5. Results of Zonal Statistics applied of MLC of konos

	Cell Count	Total cell	%
Building	18696	55221	33.8

Table 6. Results of Zonal Statistics applied of MLC of QuickBird

### 3. CONCLUSION

In this study, we assessed the utility of fine-resolution satellite imagery for building extraction. It was strongly felt that fine resolution satellite imagery is very useful for building extraction. The accuracy assessment of the classification results clearly indicates this assumption.

The accuracy assessment process is applied by using the boundaries of building areas which represents the reality. First the boundaries of buildings are converted to raster depending on the resolution of QuickBird and Ikonos images. Then the building pixel numbers at each classification result of each image are overlaid with this ground truth. And the percent of the truly classified building pixels are assessed and compared. The result of the accuracy of each classification is given at below (Table 7)

Application Type	Ikonos (%Accuracy)	QuickBird (%Accuracy)
MLC	50.24	82.9
Majority Filtered MLC	68.34	85
Zonal Procedure	92.93	95.5

Table7. Accuracy result of classifications

The accuracy comparison result of classifications indicate that the accuracy of buildings increase with the spatial resolution. In addition, the Table 7 shows that MLC results are enhanced by the application of majority filter and with the zonal procedure. It can be clearly seen that the buildings are classified with %50.2 accuracy at the Ikonos image on the other hand this accuracy increased to 82.9% by the usage of QuickBird image. After application of majority filter and zonal process the accuracy of QuickBird image increased to 85 and 95.5% respectively.

As a result it can be concluded that according to generated results applied procedure can be used reasonably to extract buildings in urban areas.

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