Preliminary Results of Road Detection in Informal Settlements using Object-Oriented Technology and IKONOS Data

INTRODUCTION

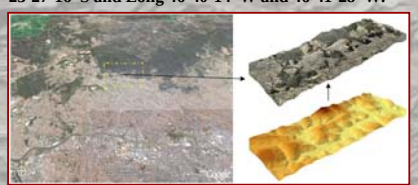
Uncontrolled sprawl occurring in large cities of developing countries requires intensive efforts of mapping to update the spatial databases. Aerial data, and more recently satellite imagery have been employed to supply these information.

Regarding the new high resolution satellite imagery, results from automated classification processing have demonstrated unsatisfactory results when traditional per-pixel classifiers are used. Considering information present in remote sensing scene is fractal in nature, the more characteristics for these fragments, the more realistic the classification can be. The extraction of object-primitives based on image segmentation has supported the best results.

The increasing success of object-based classification has stimulated researches on different fields. This poster illustrates this technology applied to provide information for road in informal settlements areas. Preliminary results, have indicated that this classification method produces highly accurate results. Procedures and rules of the present methodology are presented here.

STUDY AREA

The intense urbanization process experienced since the 70's in Sao Paulo city has caused many problems concerning land use. The study area is characterized by recent and unplanned occupation, where dense urbanization areas are found intermixed with preserved nature areas. The study area covers 2.75 x 1.50 Km, located between the Lat 23°26'26"S and 23°27'16"S and Long 46°40'14"W and 46°41'28"W.



General visualization of north region of Sao Paulo city, extracted from Google Earth, including the study area.

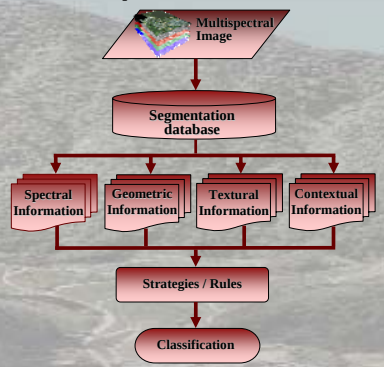
CHALLENGES

Regarding the automatic detection of roads in informal settlements, the following characteristics remain a challenge:

- ☑ irregular patterns
- ☑ differences in length and width and paving
- ☑ discontinuity
- ☑ high spatial heterogeneity

OBJECT-ORIENTED ANALYSIS

The idea is extract object-primitives from image and use their information to compose strategies to improve the classification process.



METHODOLOGY

An 11 bit Ikonos 2002 image was used. All multispectral bands were employed. Principal components also were previously computed and employed as customized features using Definiens eCognition.

Multiresolution segmentation generated objects and provided information for further analyses. Auxiliary data were computed from spectral information and combined with geometric information of customized features.

Original Image

Multiscale Objects

Considering the Ikonos second principal component as a good indicator of impervious surface, it was used on the first analysis.

2nd Principal Components

Impervious Indicator Areas

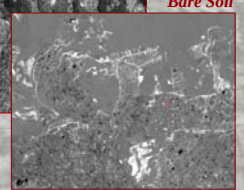
"Auxiliary Data 1"

Features were customized from objects information, by using combination between original multispectral bands as well as principal components.

Vegetation Index

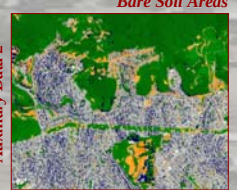
Shadow

Bare Soil



Bare Soil Areas

"Auxiliary Data 2"

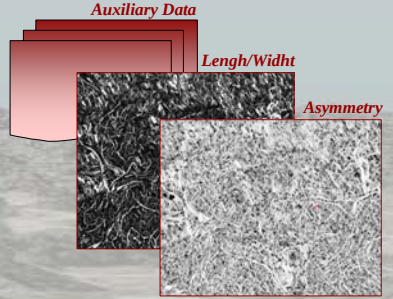


Also, two more features were customized, using combinations of geometric characteristics like width, length, neighbor and asymmetry.

Auxiliary Data

Lengh/Widht

Asymmetry



Paved Roads and Unpaved Roads

PRELIMINARY ANALYSIS

Regarding to the goal of the project, many inconsistencies in classification still occur. The complex spectral and spatial scenario found on informal settlements areas from Ikonos imagery suggests many improvements are needed to amend the current classification strategies. The main objective of implementing improvements is minimize commission and omission errors of automatic roads classification.

Moreover, progress on methodology will be analyzed according to the effective accuracy of classification. Thus, a set of very high resolution aerial orthophotos will be employed. Comparisons between automatic approaches and manual ones will attest the efficiency of the technique. However, computing time will not be considered on this research.

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