

Automatic Extraction of Building foot prints from CARTOSAT – II



Environmental Science

KEYWORDS: Segmentation, Multi resolution Image Segmentation, Classification.

J.Swaraj

Research Scholar Center for Environment, JNTU Hyderabad.

Dr. M. Anji Reddy

Professor and Director JNTU Hyderabad

ABSTRACT

Multi-resolution segmentation, as one of the most popular approaches in object oriented image segmentation, has been greatly enabled by the advent of the commercial software, eCognition. The present paper deals with extracting of foot prints of buildings on the Cartosat-II image of part of Hyderabad city. The footprints are extracted in the form of shape files using Trimble eCognition Software. The shape files generated are applied in building 3D city model for urban development. In this process the Cartosat-II images of study area Geo-referenced and mosaicked and the image is undergone Multi resolution segmentation.

Introduction

Cartosat-2 Indian ERS satellite was launched on January 10th, 2007 by PSLV-C7 booster. It was set into circular sun-synchronous orbit (inclination – 97.91) with the altitude of 630 km, by PSLV-C7 booster. Its mass is 680 kg. The space vehicle has high rate of turn along and across flight axis for ± 45 deg. The Cartosat-2 imagery is not composed of semantically discrete real-world objects. Instead, it contains a grid of square pixels that only exhibit simple topological adjacency. Segmenting an image into meaningful objects makes it possible to create more informative attributes such as shape, texture, and contextual information. Segmentation is widely adopted as an essential process for most subsequent image-analysis tasks (Haris et al. 1998). It divides an image into regions that are expected to correspond to structural units in the scene (Russ 1999). In remote sensing, image segmentation is desired to provide meaningful object primitives for further feature recognition and thematic classification. From the point view of remote sensing, most often a building is actually visible as the building's roof. In general, building roofs can be very complex and comparatively have the least regularity in terms of shape, size, and structure. Gruen and Dan (1997) classify the models of building roofs according to their number of ridge points. Only buildings with simple roof structures are covered in this research.

Segmentation is the subdivision of an image into separated regions. For many years, procedures for image segmentation have been a main research focus in the area of image analysis. Many different approaches have been followed. However, few of them lead to qualitatively convincing results which are robust and applicable under operational settings. One reason is that segmentation of an image into a given number of regions is a problem with a high number of possible solutions. The high number of degrees of freedom must be reduced to the one or the few solutions which satisfy the given requirements. Another reason is that in many cases regions of interest are heterogeneous; ambiguities arise and the necessary discerning information is not directly available. Requirements concerning quality, performance – size of data set and processing time – and reproducibility can be fulfilled at the same time only by very few approaches.

In image segmentation the expectation is in many cases to be able to automatically extract the desired objects of interest in an image for a certain task. However, this expectation ignores the considerable semantic multitude that in most cases needs to be handled to successfully achieve this result, or it leads to the development of highly specified algorithms applicable to only a reduced class of problems and image data.

Description of the Study Area

A part of the Hyderabad city, is taken into consideration. **Hyderabad** is the capital and largest city of the southern Indian state of Andhra Pradesh. Occupying 650 square kilometers

(250 sq mi) on the banks of the Musi River, it has a population of 6.8 million in 2011 with a metropolitan population of 7.75 million, making it India's fourth most populous city and sixth most populous urban agglomeration.

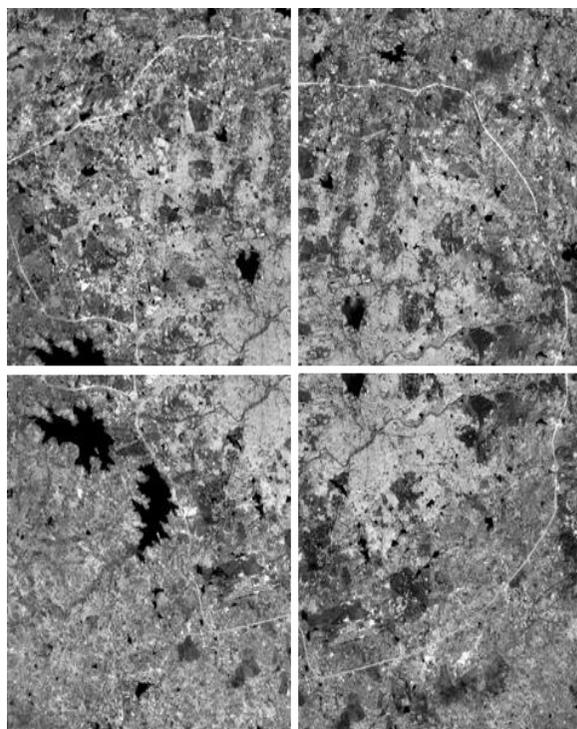


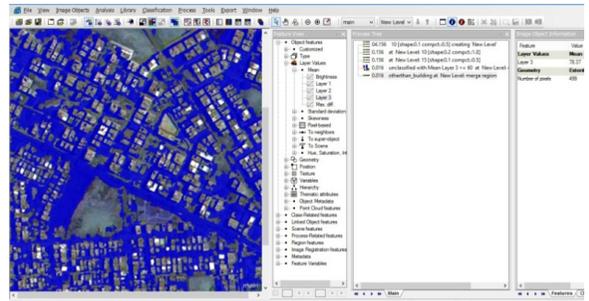
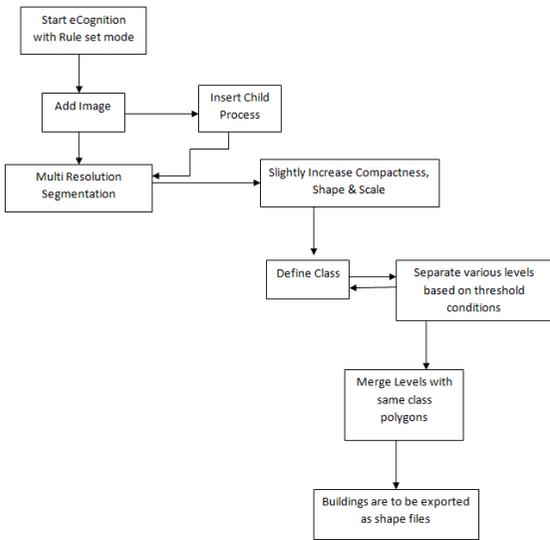
Figure 1 Showing the Study area

Methodology

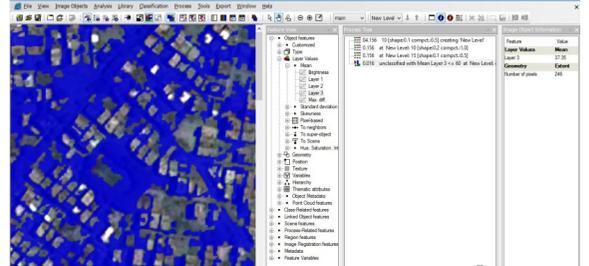
Multi Resolution Segmentation: Objects of interest typically appear on different scales in an image simultaneously. The extraction of meaningful image objects needs to take into account the scale of the problem to be solved. Therefore the scale of resulting image objects should be freely adaptable to fit to the scale of task. Hence segmentation is done based on assigning scale parameters.

Assigning Class and Class description: To assign classes to the image for object identification one has to choose Class Hierarchy task. Each class should be created with different colour for the identification. One can classify objects in sub classes also. By applying algorithms for the different classes with mean value of the image layers one can extract footprints by correcting the values of the different classes. By merging same class polygons one can correct the polygons for acquiring accurate boundaries of the footprint.

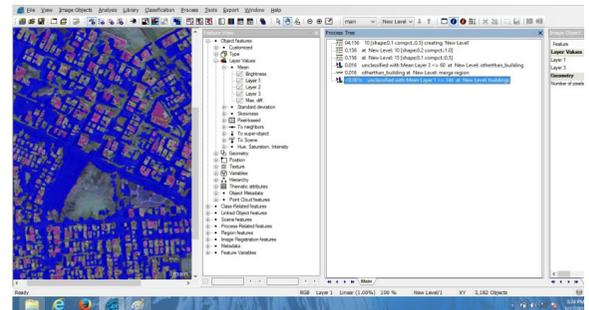
Flow chart showing the methodology



Step - 3



Step - 4

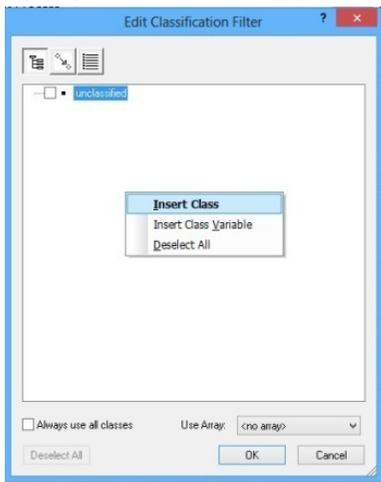


Final Step of Classification showing only building blocks

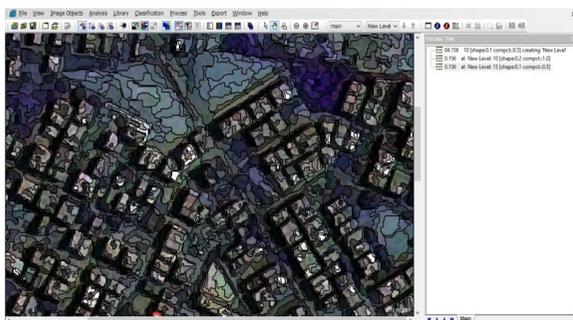
Results and discussions

The selected building footprints areas are eliminated to extract 3D City Model the building footprints extracted using this methodology in eCognition are clipped using Arc GIS software package. These foot prints are overlaid on to the Digital Elevation Model developed to generate mean heights which are then transferred to Arc Scene to extrude 3D buildings of the study area.

Images showing step wise extraction of building foot prints using eCognition



Step - 1



Step - 2