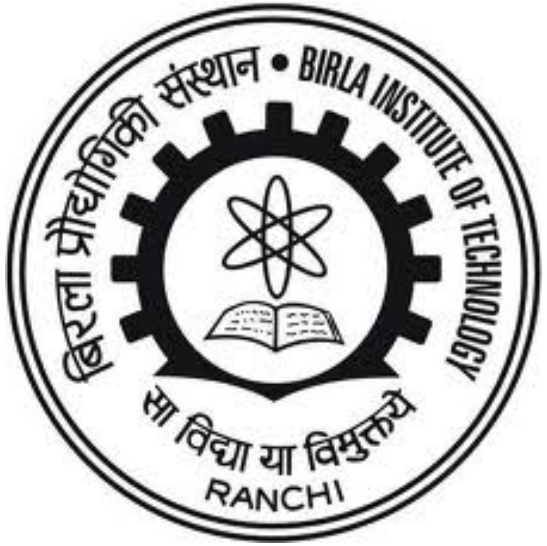
Estimation of Urbanization of an Area



Team Members

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Introduction

Urbanization refers to the population shift from rural to urban areas, "the gradual increase in the proportion of people living in urban areas", and the ways in which each society adapts to the change. Urbanization can be quantified either in terms of the level of urban development relative to the overall population, or as the rate at which the urban proportion of the population is increasing.

Previous literature measures the extent of urban areas using household-survey based socio-economic data, night-time lights, and mobile-phone records which requires some professional expertise for estimation. In our project we will use Satellite Imaginary to classify Built Up(BU) and Non Built-Up Area(NBU) and use some techniques for vegetation extraction and building detection, which will result in the urbanization of an area.

Scope

The Project will helpful in the following areas:-

- Urban Planning
- Nature Monitoring
- Change Detection
- Military Application

Objective

- Classification of Built-Up and Non Built-Up areas.
- Vegetation extraction and Building Detection.
- Graphical representation of Urbanization of an area.

General Constraints, Dependencies, Guidelines

- **Software Constraints**

  Windows XP, Windows 7, 8.

  Matlab and other libraries.

- **Hardware Constraints**

  Minimum of 10GB space of hard disk.

  Minimum of 1024MB RAM

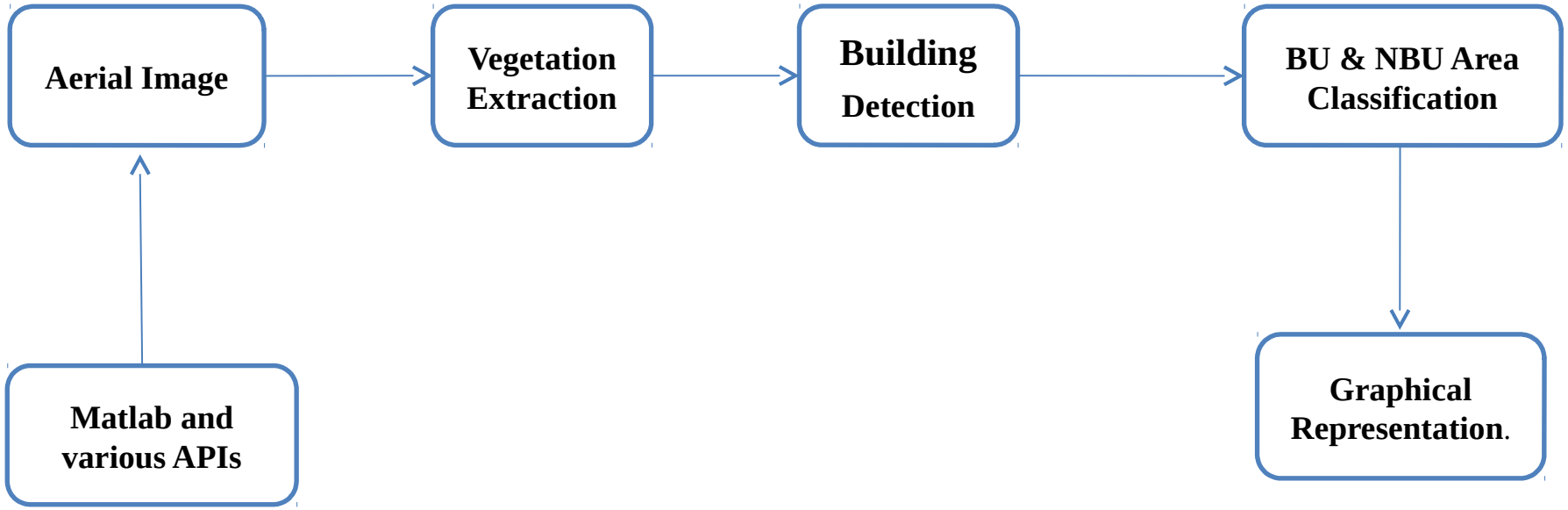
- **Guidelines**

  Code is kept clean and simple for future upgrades and maintenance

- **Assumptions**

  User will provide aerial or satellite image with a preferable quality.

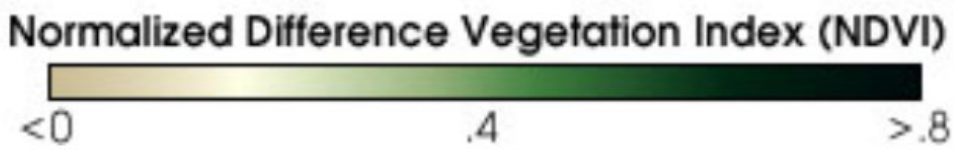
How it Works?


Aerial Image
Vegetation Extraction
Building Detection
BU & NBU Area Classification
Matlab and various APIs
Graphical Representation.

Vegetation Extraction

Normalized Difference Vegetation Index is a spectral band calculation that uses the Visible (RGB) and Near Infrared (NIR) bands of the electromagnetic spectrum. True NDVI also known as Red NDVI and has been used in scientific research for over 40 years .

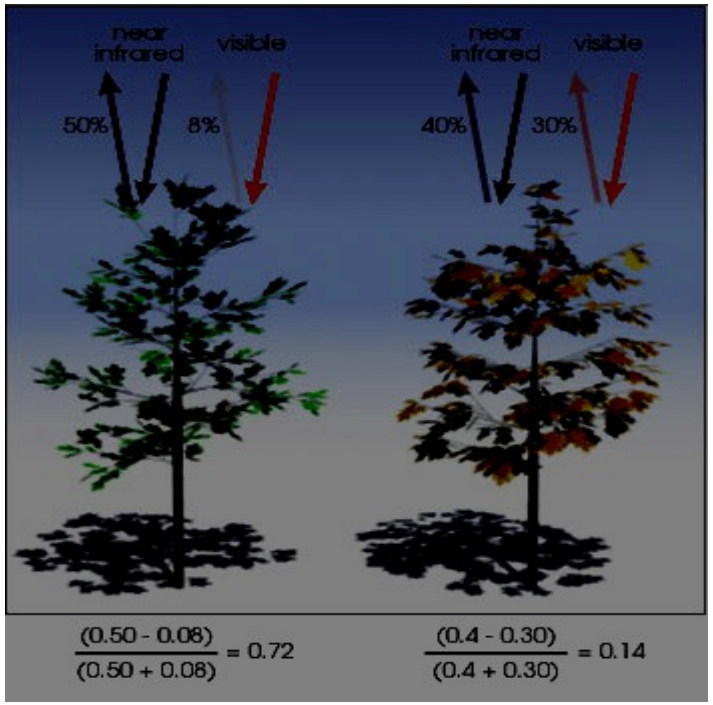
The basic concept is that chlorophyll in plants absorb red light during photosynthesis and healthy plants reflect very strongly in the NIR band. The Red NDVI vegetation index has been widely studied and adopted by the scientific community as a means of measuring crop health.

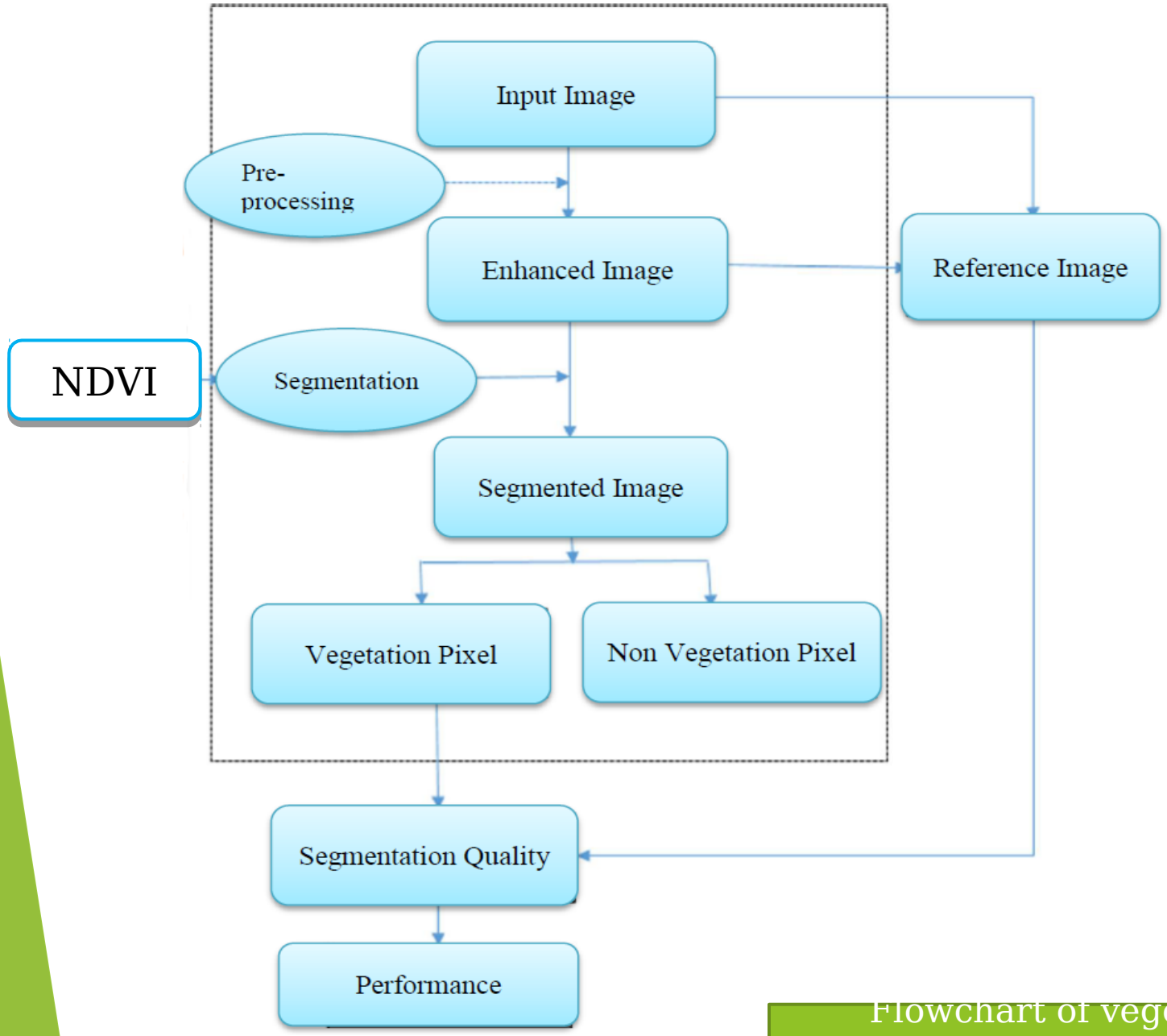


Very low values of NDVI (0.1 and below) correspond to barren areas of rock, sand, or snow. Moderate values represent shrub and grassland (0.2 to 0.3), while high values indicate temperate and tropical rainforests (0.6 to 0.8).

Example :-

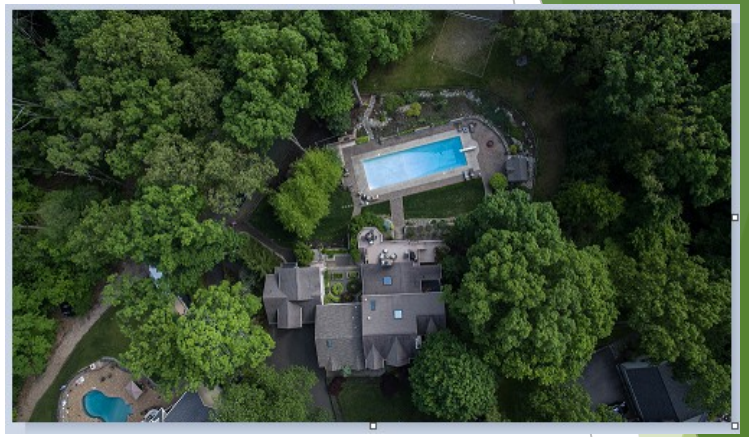
when sunlight falls on the leaves on a healthy plant or tree, as indicates on the left, the red band absorbs more light and reflects more NIR light producing a larger NDVI value while the tree on the right absorbs less Red light and reflects less NIR resulting in a lower NDVI value.





Flowchart of vegetation Extraction

Input Image



Output Image

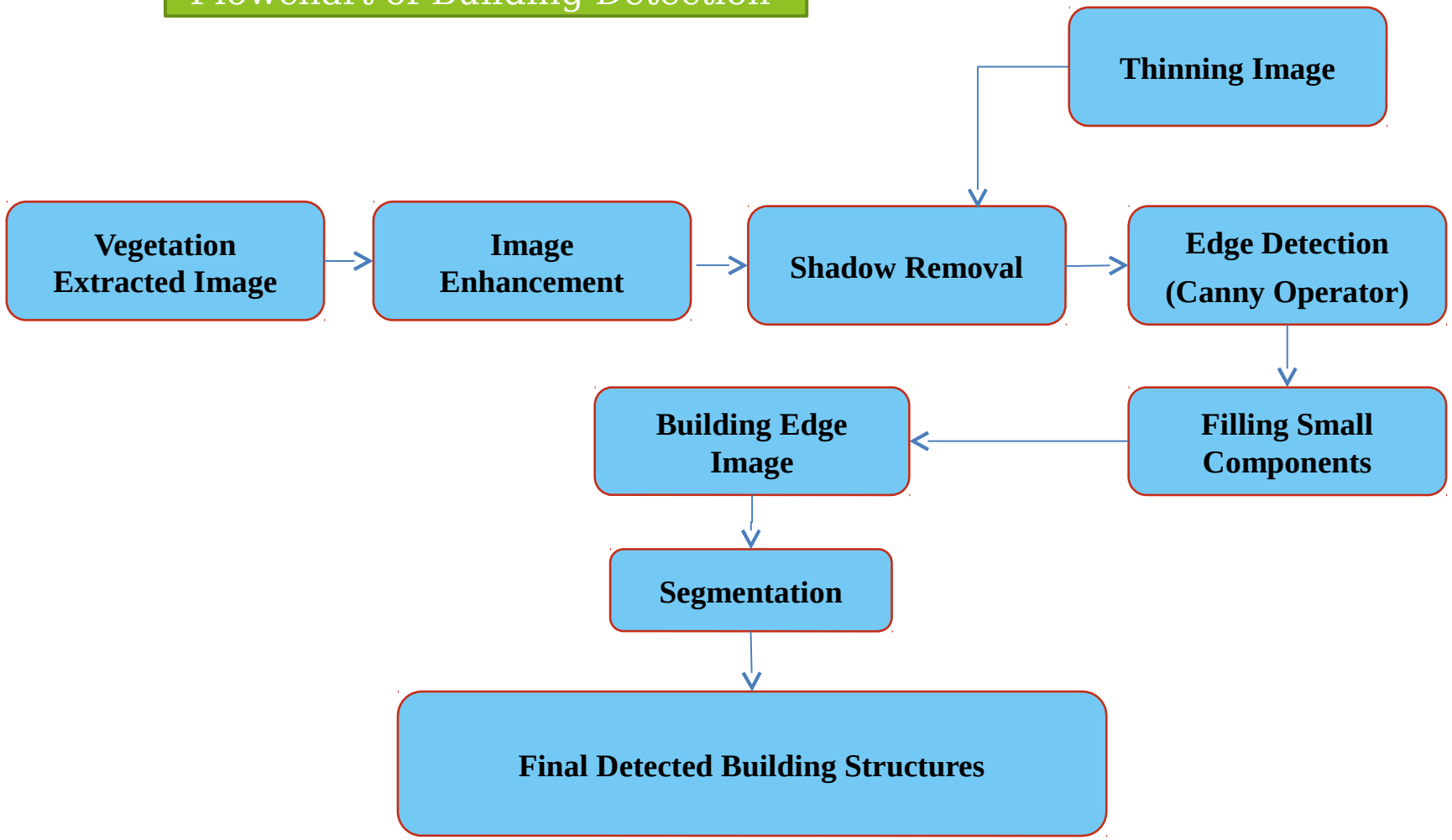
Building Detection

In automated analysis of digital images, a sub problem often arises of detecting simple shapes, such as straight lines, circles or ellipses. In many cases an edge detector can be used as a pre-processing stage to obtain image points or image pixels that are on the desired curve in the image space.

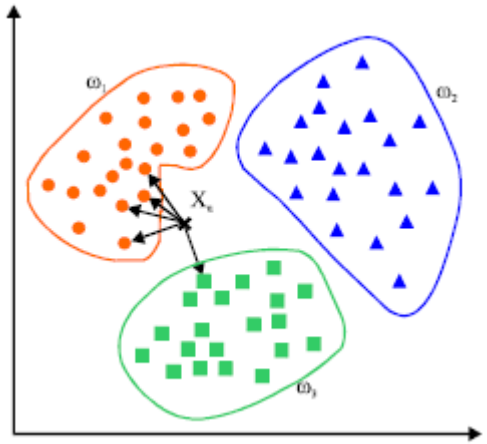
Due to imperfections in either the image data or the edge detector, however, there may be missing points or pixels on the desired curves as well as spatial deviations between the ideal line/circle/ellipse and the noisy edge points as they are obtained from the edge detector. The following pre-processing has to be done before applying any detection method

- Image Enhancement
- Shadow Removal using Thresholding
- Canny Edge Detection
- Filling Small holes

Flowchart of Building Detection



KNN Classifier



In pattern recognition, the k-nearest neighbors algorithm (k-NN) is a non-parametric method used for classification and regression . In both cases, the input consists of the k closest training examples in the feature space.

In k-NN classification, the output is a class membership. An object is classified by a majority vote of its neighbors, with the object being assigned to the class most common among its k nearest neighbors (k is a positive integer, typically small).

If k = 1, then the object is simply assigned to the class of that single nearest neighbor.

Expected Outcomes

- Estimation of Urbanization of an Area.
- Visualization of development Graphically.

References

Satellite Imaginary-

- Digitalglobe : http://www.digitalglobe.com/
- Geoeye : http://www.geoeye.com/

Dataset-

- Worldpop : http://www.worldpop.org.uk/

Research Papers-

- BigPixel : http://www.bigpixel.ucsd.edu/
- International Journal of Computer Applications Volume 145 – No.3, July 2016

Work Distribution

Piyush Kumar (BE/25032/14)

- Vegetation extraction.

Himanshu Changwal (BE/25012/14)

- Building Detection.

Rahul Kumar (BE/25013/14)

- K-Nearest Neighbor point Clustering
- Documentation

Thank you