Object Segmentation in Satellite Images for Generating the Base Map of a Region

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INTRODUCTION

- Satellite images are a great source for obtaining a pictorial view of a region
- Satellite images provide a lot of information over a wide range of area and annotating data can make interpretation lot easier.
- Out of the various types of satellite data, VISIBLE IMAGERY (RGB pictures taken in daylight) is commonly found and will be used in this system.
- Satellite images have a lot applications.

APPLICATIONS

- **Disaster mitigation planning and recovery**
  Object-based image classification using change detection (pre and post-event) is a quick way to acquire damage assessments data.

- **To automatically generate relevant and real-time maps.**

- The satellite images are used for urban management, civil defense operations or planning and also for smart city development.

WHAT IS A BASE MAP

- A Base Map provides features of a region that do not change often like roads, buildings, rivers etc.

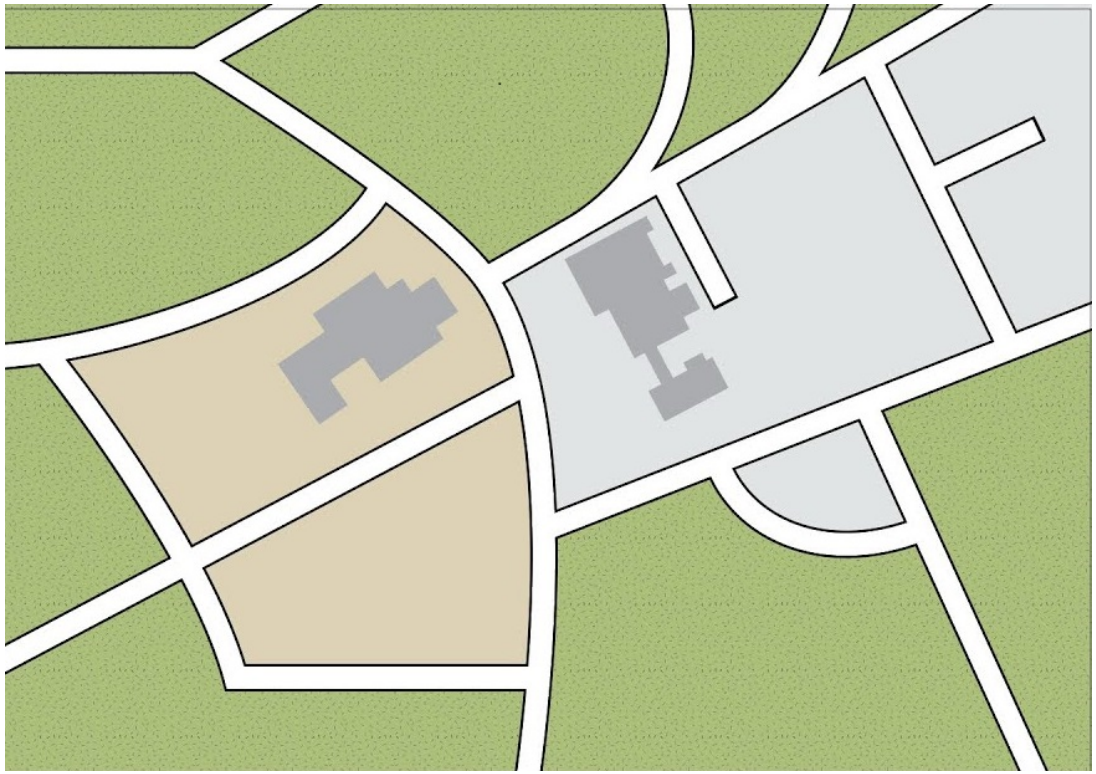

Figure: Example of a Base Map

DATA COLLECTION

- Satellite image data is available in abundance and offered by various organisations (eg. AICrowd, Kaggle, DEEPGLOBE - CVPR Satellite Challenge etc)

- The type of data that will be used is Visible Imagery (RGB), and a sample (Input and Output) from a dataset available on AICrowd is shown.

Figure: Sample Image from Dataset

PROBLEM STATEMENT

- The main aim of this project is to analyse satellite images by identifying and accurately annotating objects such as buildings, roads etc in the image using Image Processing, Object Detection and Segmentation, Deep Learning techniques

- A Deep Learning model (Convolutional Neural Network with suitable architecture)

- **Input:** Satellite images

- **Output:**
  The model tries to annotate all available roads, buildings in the input picture.

- A web interface

OBJECTIVES

- To annotate objects such as roads, buildings in a given satellite image.
- To generate a Base Map using the annotations produced from the satellite image.
- To provide a suitable interface for annotating images.

MOTIVATION

- Satellite images consist a lot of data (and a lot to be explored).
- Proper annotation of satellite imagery adds a great deal of value to the image by expressing knowledge in the picture.
- A good technique to annotate satellite images can help in generating base maps for a region easily.

LITERATURE SURVEY

PAPER TITLE	METHODOLOGY	LIMITATIONS
Road Network Identification and Extraction in Satellite Imagery using Otsu's method and Connected Component Analysis.	• High resolution satellite image is converted to grayscale image, then contrast of image is enhanced by histogram equalization. • Convert image to binary image using Otsu's threshold. Connected Component Analysis is performed which removes the areas which are not connected to road network, and the extracted road network is the output.	• Only High Definition (HD) satellite images will give accurate results. • Areas connected to road network could not been removed.
Building Extraction in Very High-Resolution Remote Sensing Imagery Using Deep Learning and Guided Filters.	• The VHR remote sensing images are pre-processed using NDVI(Normalized Differential Vegetation Index), NDSM(Normalized Digital Surface Model) techniques. • Then, the proposed deep neural network Res-U-Net and guided filter is used for extraction of buildings.	• Shape of some buildings covered by trees cannot be detected precisely. • Some blurry and irregular boundaries are hardly classified.

LITERATURE SURVEY

PAPER TITLE	METHODOLOGY	LIMITATIONS
A framework for automatic building detection from low-contrast satellite images.	• The input image is enhanced using DWT(Discrete Wavelet Transform) method based on SVD(Singular Value Decomposition). • Then, a line-segment detection scheme is applied to accurately detect building line segments and the complete contours of the building are attained to obtain candidate rectangular buildings.	• Small buildings are not easily detected. • Small buildings that are closely distributed are extracted and merged as a single building.
An improved method for road extraction from high-resolution remote-sensing images that enhances boundary information	• A coordconv module by putting coordinate information into feature maps aimed at reducing the loss of spatial information and strengthening road boundaries. • An improved dense convolutional network that could make full use of multiple features through own dense blocks. • A global attention module designed to highlight high-level information and improve category classification by using pooling operation.	• The interference from complex backgrounds (buildings, different road types and widths, forests etc.) will cause discontinuities in the extraction results.

SYSTEM DESIGN

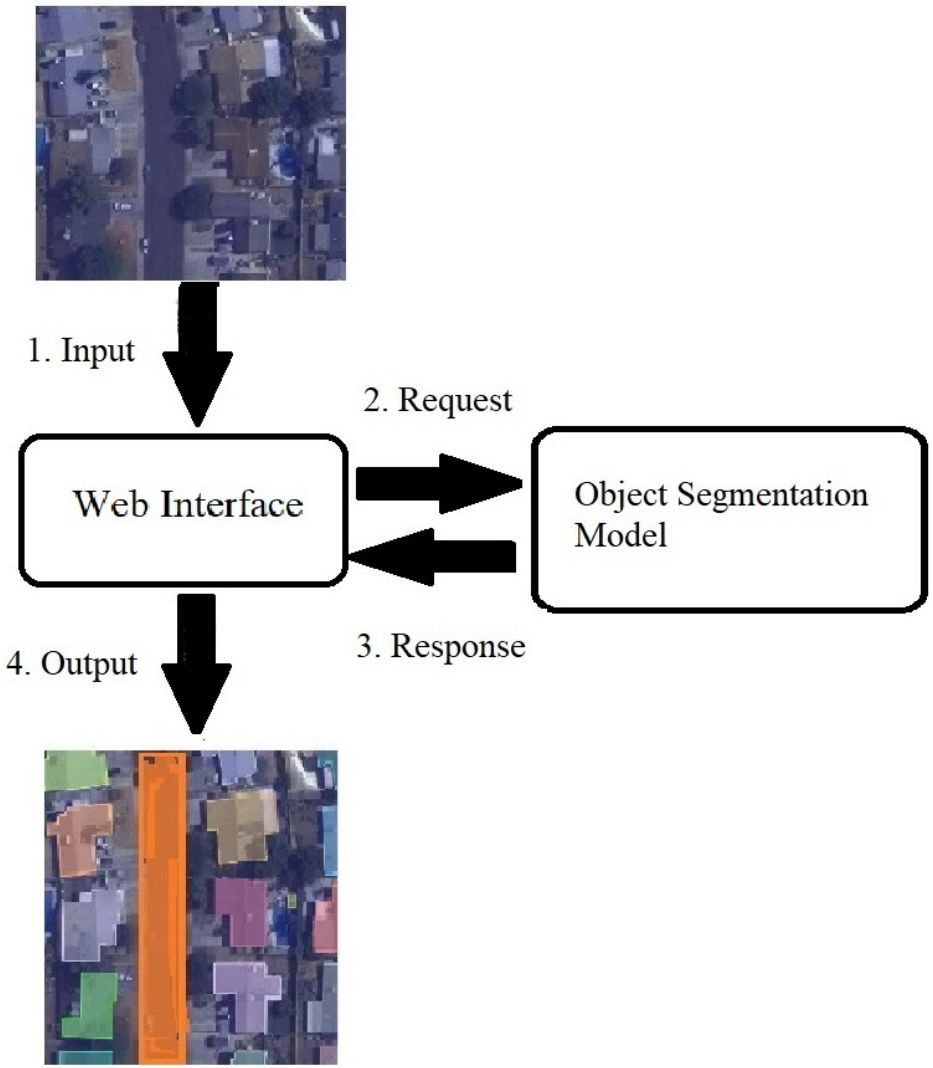

Figure: System Design

MODULES SPLIT-UP

- **Data Collection**
- **Data Pre-Processing**
- **Training**
- **Fine Tuning**
- **Testing**
- **Web Client**

REFERENCES

- P. Yadav and S. Agrawal, *"Road network identification and extraction in satellite imagery using otsu's method and connected component analysis,"* ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, vol. XLII-5, pp. 91–98, 11 2018.
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Thank You