Road and Field Boundary Detection in Satellite Imagery

Group 15

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Problem statement

Road and field boundary detection in satellite or aerial view images is very important in specific areas such as agriculture and urban plan designing. To perform tasks such as managing the field areas supplying resources, it is necessary that the maps of the roads and fields should be accurate and detailed. The clarity of the images is the key. But in this case, the landscapes are very complex and complicated with many interconnections. Hence, the automation process will be a little bit difficult. To overcome this, the project requires a method that can identify the roads and field boundaries in increased pixels to have large and clear images.

Thus, the main problem statement of this project is to detect the roads and field boundaries. And to differentiate the roads and field boundaries from other line features such as waterbodies, railway lines, etc.

Data

The project utilizes two data sets. The images utilized for this project are satellite-captured aerial images of various places in the United States. These images provide visual information about the landscape.

The first set is the development data, which is used to train the models, and the second set is for evaluation and validation, which determines how good and efficient the model is. The images in the dataset are provided by the U.S. Department of Agriculture from the agricultural fields in the USA. They are in jpeg format. These images are cropped from the sections of the large images, and their pixel size is 1 m^2.

Method

To perform this project there are many methods that need to be followed. They are mentioned below:

1. Data preprocessing: This includes techniques such as Noise reduction, increasing the contrast, resizing the image, using filters for better results, etc.
2. Model Design: Design the model so that the model is efficient and works effectively. Design the model using different models like CNN, using different libraries using Py Torch, TensorFlow, and check for effectiveness. While designing the model, tune the parameters for better results.
3. Evaluation: Evaluate the models' performance using different evaluation metrics.

Various kinds of filters are used for better performance like Gaussian Blur, Histogram Equalization, Canny Edge Detector, Sobel edge Detector.

Evaluation

Evaluation is one of the most important parts of developing a model. In this project, evaluation of the models' performance is done using evaluation metrics like precision, recall, F1-score, and Intersection over Union (IOU) on the validation dataset, shows how good the developed model is. By evaluating, we can also configure how a model can be improved.

Timeline

September 15 - September 30:

Project kickoff and planning.
Data acquisition and initial preprocessing.
Begin model selection and setup.

October 1 - October 15:

Continue model selection and setup.
Try different hyperparameters to improve performance.

October 16 -October 30:

Complete the model.

November 1 - November 15:

Evaluate the model.

November 16 - November 30:

Report