FARIS DZIKRUR RAHMAN // APRIL 2020

RICE FIELD PREDICTOR

Employing SSD Object Detection Algorithm to Predict
Rice Field in Banyuwangi Region

Presentation Highlights

01

Executive Summary

Purpose, How It's Done, Project Question, Benefit to Policy Maker

02

Workflow

Collecting training data, preparing the data, exporting training data, training model

03

Conclusion

Accuracy, comparison, insight to policy maker

Executive Summary

Background | Purpose | How It's Done | Project Question | Benefit to Policy Maker

PROJECT BACKGROUND

Agrarian Society

Indonesian people is widely known as an agrarian society.

Important economic foundation

Many people still rely on rice field as their main financial source and most precious assets.

Massive Development

Massive development of buildings and roads make people start losing their own rice field.

Purpose

01 Automatically understand the proportion of rice field in one village / area

02 Using satellite imagery to know how many rice field that cover each area

03 Utilize object detection deep learning algorithm

04 Automate the work of counting and detecting rice field in one area

05 Combining the power of ArcGIS Pro and Python 3 to build the model

🌍 Location of the Analysis

Why Banyuwangi?

Balance proportion between object of four classes

Constitute of rice field, houses, roads, and trees

HOW IT'S DONE

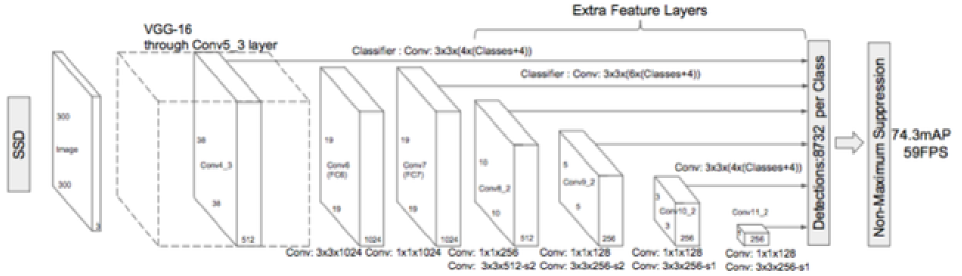
Label Objects for Deep Learning

Create and manage labeled objects for deep learning.

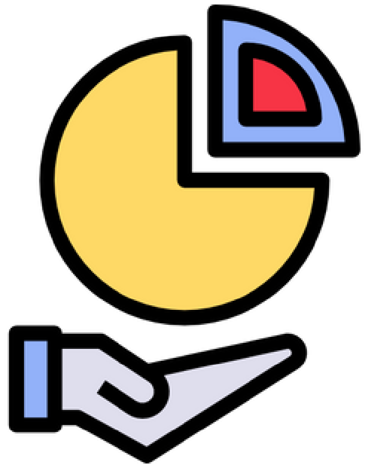
Create label for 4 classes

Train sample

Predict



Project Question



Proportion of each classes

Model performance

BENEFIT TO POLICY MAKER

- Insight on proportion of rice field in particular region
- Comparison with previous year
- Understand density of housing condition
- Ease the process of analysing satelite imagery to extract information

Workflow

Collecting Training Data | Preparing The Data | Exporting Training Data | Training Model

Methods Used

arcgis.learn

- Training data could be fed directly to deep neural network
- Adopt state of the art research in deep learning subject (fine tuning)
- Adopt fast.ai framework to know learning rate before fitting the model
- Integration with ArcGIS platform

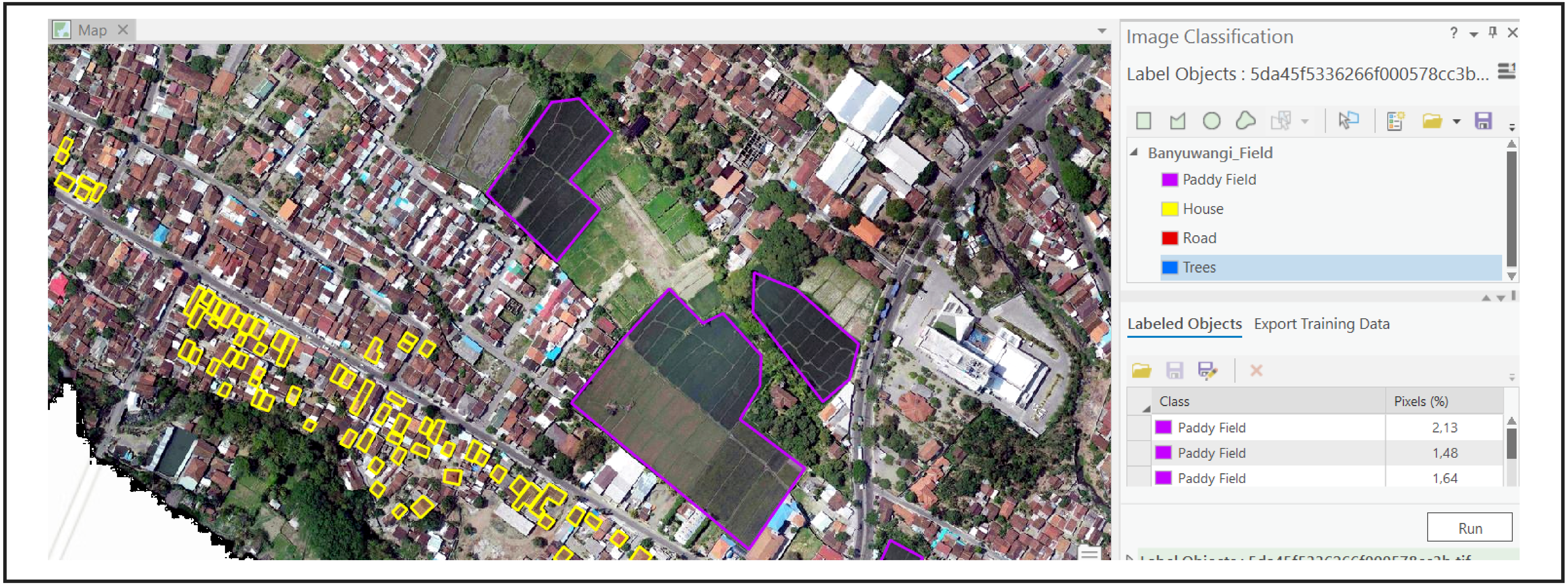
COLLECTING TRAINING DATA

Use Label Objects for Deep Learning Tool

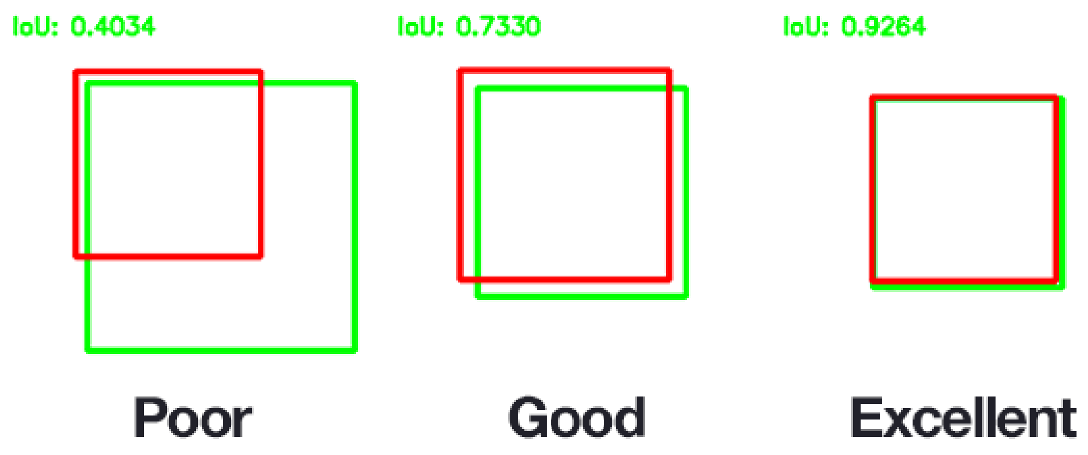
Label Objects for Deep Learning
Create and manage labeled objects for deep learning.

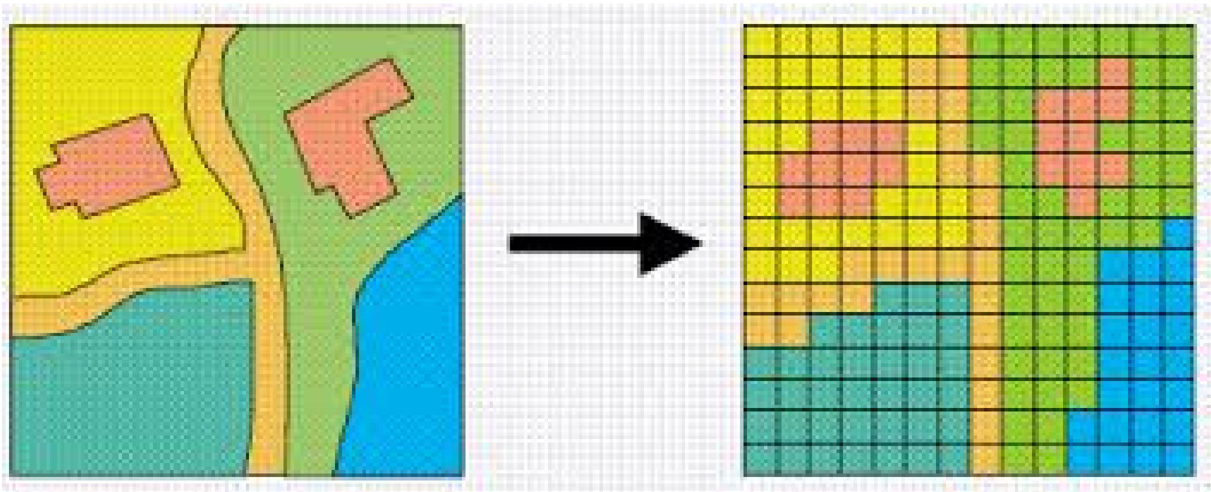
Save data as image chips to a folder

COLLECTING TRAINING DATA (2)



PREPARING THE DATA





Object must be surrounded inside bounding box

Bounding box must include raster layer containing information of pixel and band

TRAIN THE MODEL

01

Build SSD Model

02

Determine learning rate

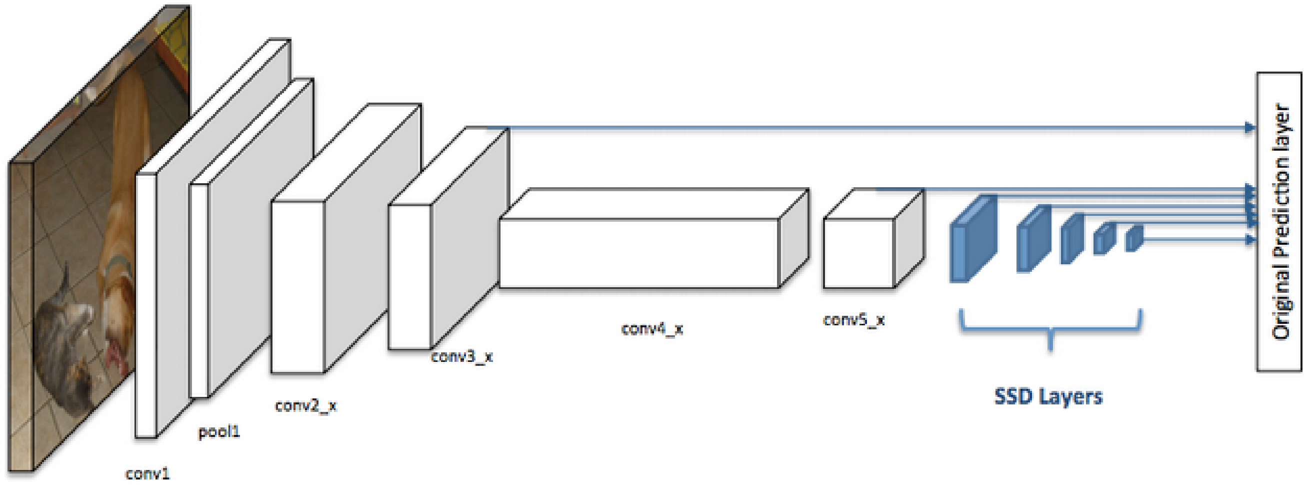
03

Fit the model

04

Visualize in validation set

BUILD SSD MODEL



Backbone model

ResNet

SSD head

Additional Convolutional layer

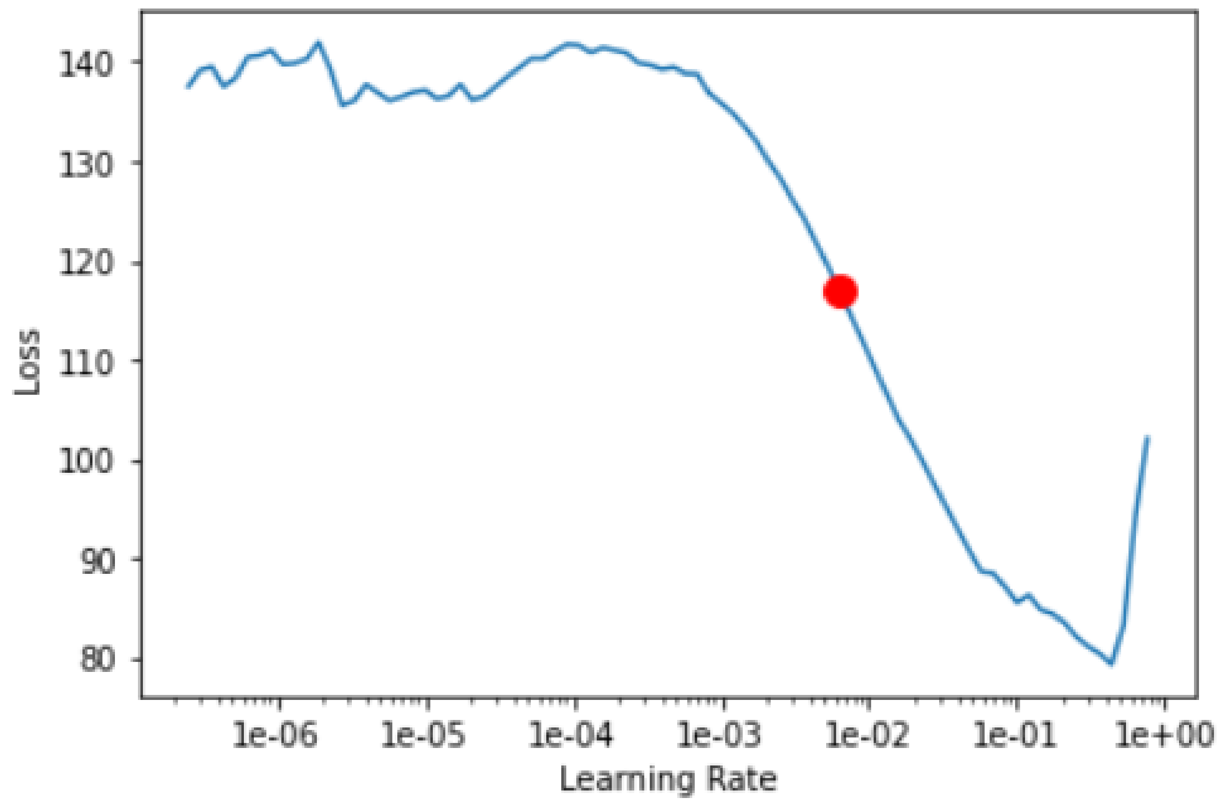
DETERMINING LEARNING RATE

The most important part of hyperparameter tuning

control how many change should be made by model to tackle the error everytime model weights are updated

Use lr.find() method from arcgis.learn

learning rate = 0.006



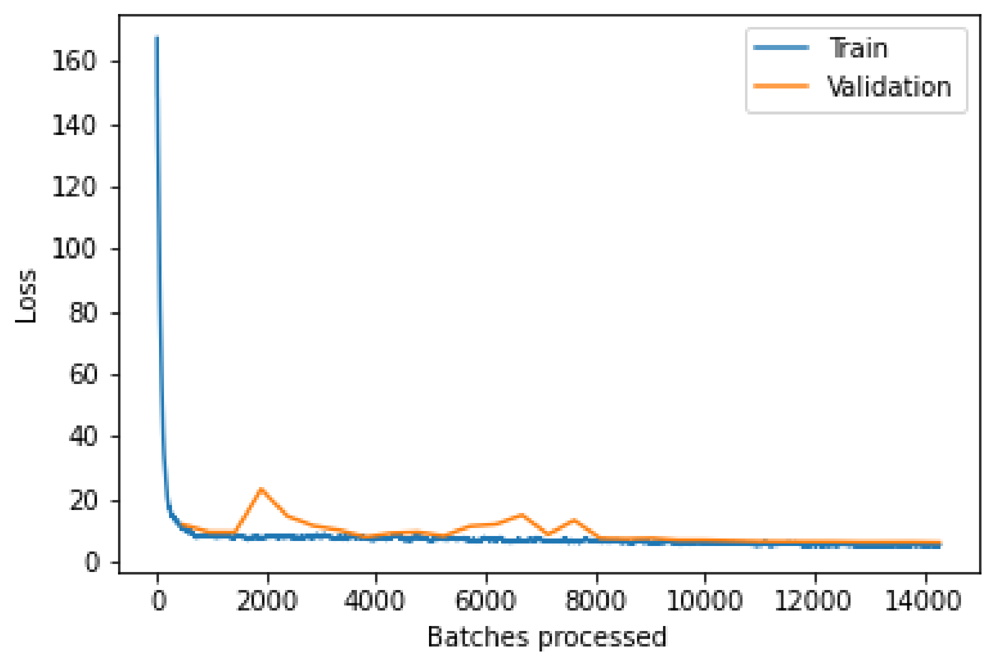
FIT THE MODEL

```
model.fit(epochs = 30, lr = 0.006)
```

loss table

epoch	train_loss	valid_loss	time
0	10.315011	11.733285	06:37
1	8.113664	9.358253	06:47
2	7.934251	9.320403	06:44
3	7.289202	23.042048	06:44
4	7.615413	14.468821	06:49
5	7.603299	11.346416	06:48
6	7.834518	9.946873	06:50
7	7.511830	7.811392	06:47
8	7.941373	9.044391	06:48
9	7.663841	9.387100	06:37
10	6.969141	8.132494	06:36
11	6.616311	11.194818	06:35
17	6.267069	7.189839	06:38
18	5.962504	7.379387	06:39
19	5.827171	6.793268	06:37
20	6.217280	6.798838	06:36
21	5.887025	6.581117	06:35
22	5.392021	6.367720	06:33
23	5.823403	6.286198	06:26
24	5.224324	6.270298	06:22
25	5.385494	6.245301	06:21
26	4.911328	6.133076	06:19
27	4.997423	6.138157	06:30
28	5.394149	6.147987	08:54
29	5.199675	6.023864	10:18

loss graph



MODEL PRECISION SCORE

Precision is how precise/accurate your model is out of those predicted positive, how many of them are actual positive.

$$\text{Precision} = \frac{True\ Positive}{True\ Positive + False\ Positive}$$

Rice Field = 81%

Houses = 34%

Trees = 55%

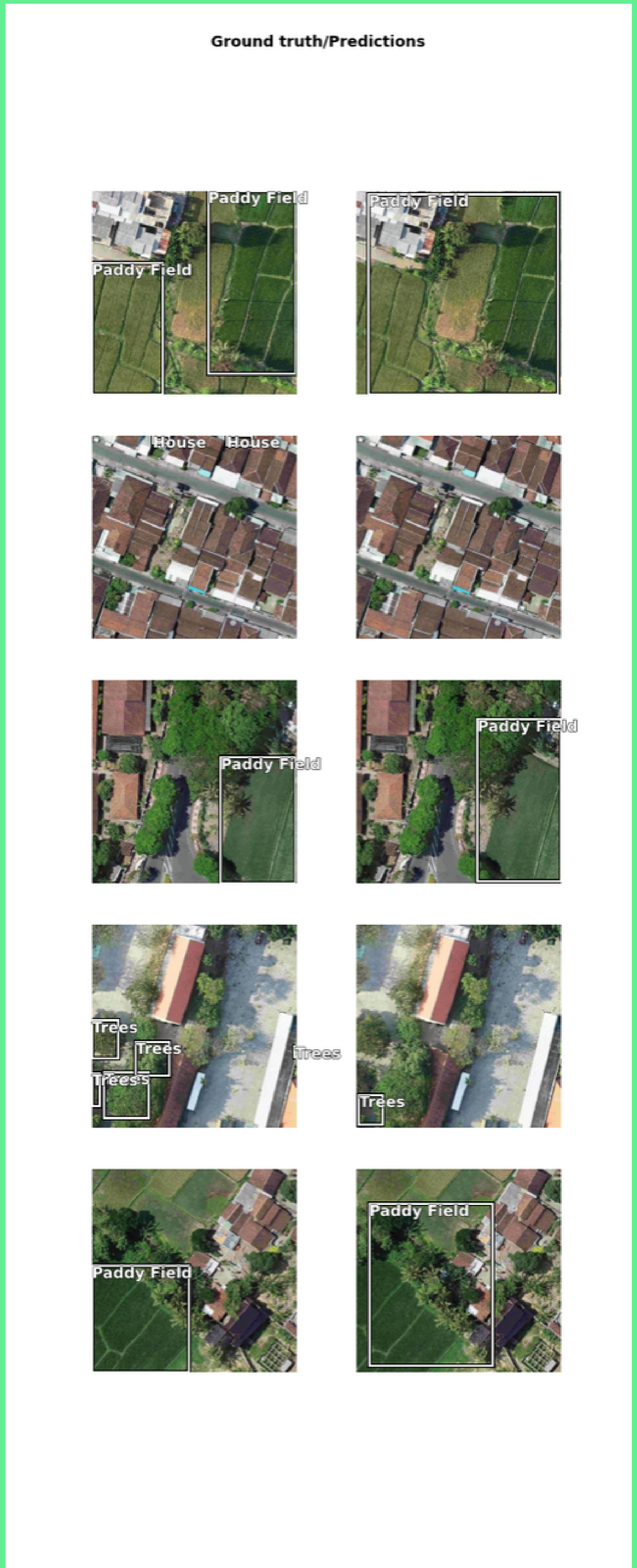
Roads = 53%

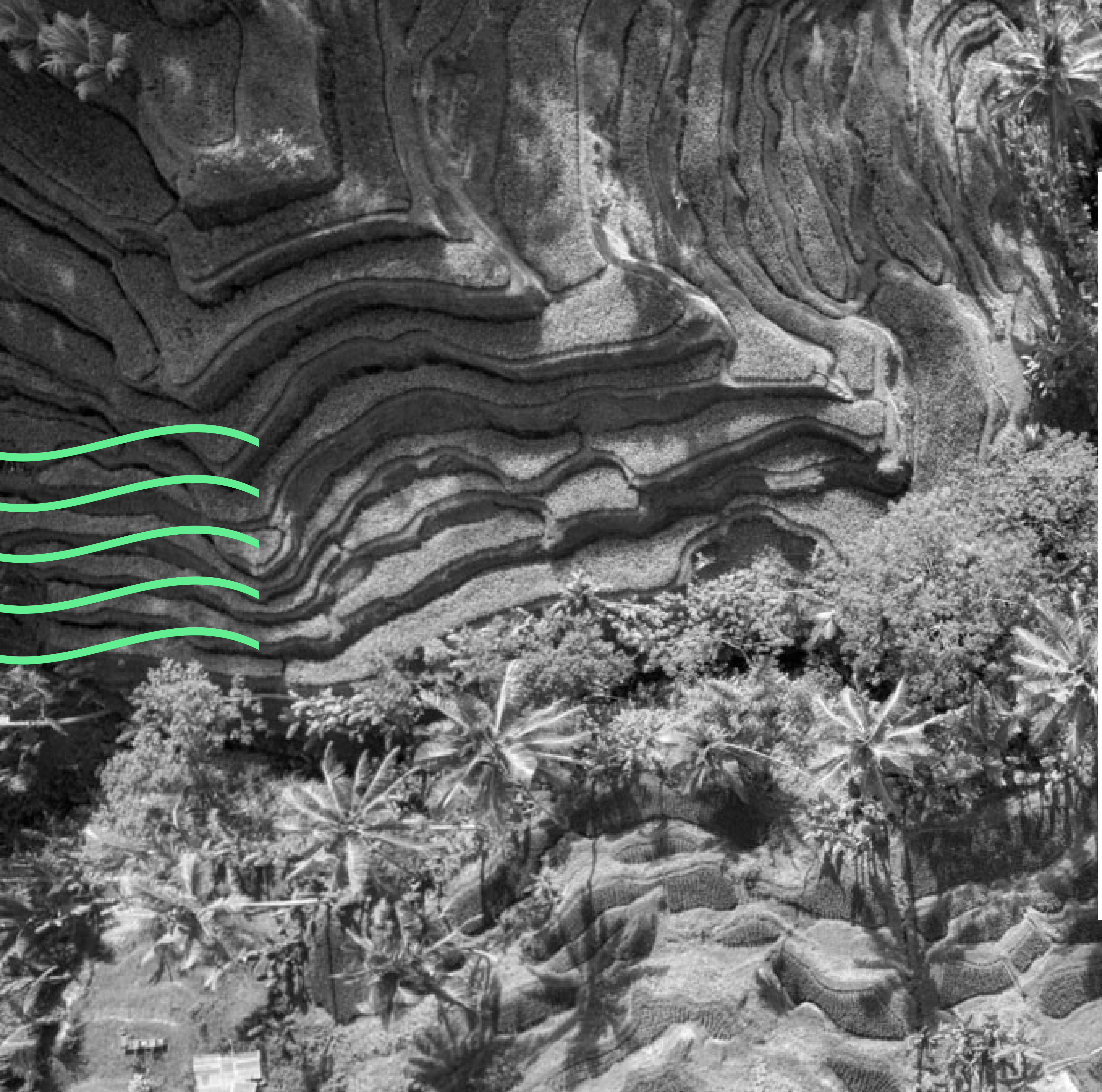
Rice field shows pretty fair result of precision due to the amount of data that is collected

Other class seems to lack in precision due to the insufficient sample data

VISUALIZE IN VALIDATION SET

show the prediction result hand in hand with the ground truth, so that we could get the picture on how our model perform compared to ground truth.





Conclusion

Fair result of precision on rice field class

Good comparison between ground truth and prediction

Can be used by policy maker to leverage the well being of society

THANK YOU

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