Land Cover Classification using Remote Sensing Data

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Agenda

Sentinel-2 Satellite which provided the data for this project

1. Business Understanding
2. Data Understanding
3. Methods
4. Results
5. Recommendations
6. Next Steps

Business Understanding

- **The Nature Conservancy (TNC)** is looking to help protect wildlife migration corridors from development/deforestation, but they can't be everywhere at once.

- In order to help them find where to focus their efforts, we want to build **Land Cover Classifier** so that TNC can monitor land use change using satellite images to observe if an area starts changing from forest or vegetation to another class.

Deforestation and Land Degradation

Since 1990, ~420 million hectares of trees have been lost to agriculture and other land uses.

Forests contain:

- 60,000 tree species
- 80% of amphibian species
- 75% of bird species
- 68% of mammal species

Data from The UN's report *The State of the World's Forests 2020*

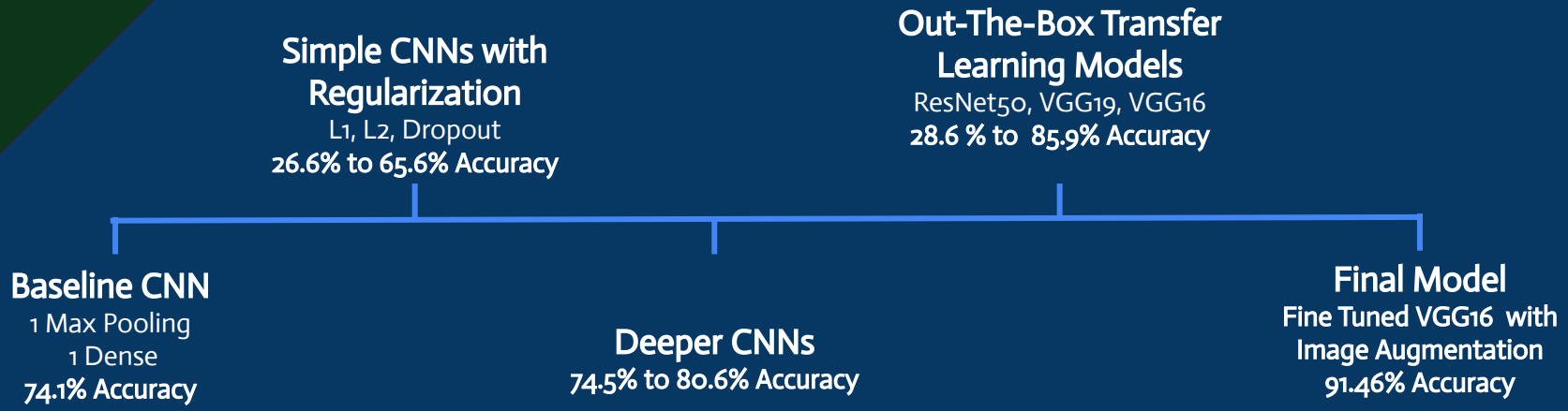
Data Understanding

27,000 RGB Satellite Images across 10 classes

- Annual Crop
- Forest
- Herbaceous Vegetation
- Highway
- Industrial
- Pasture
- Permanent Crop
- Residential
- River
- Sea or Lake

This data is from the EuroSat benchmark dataset

Methods

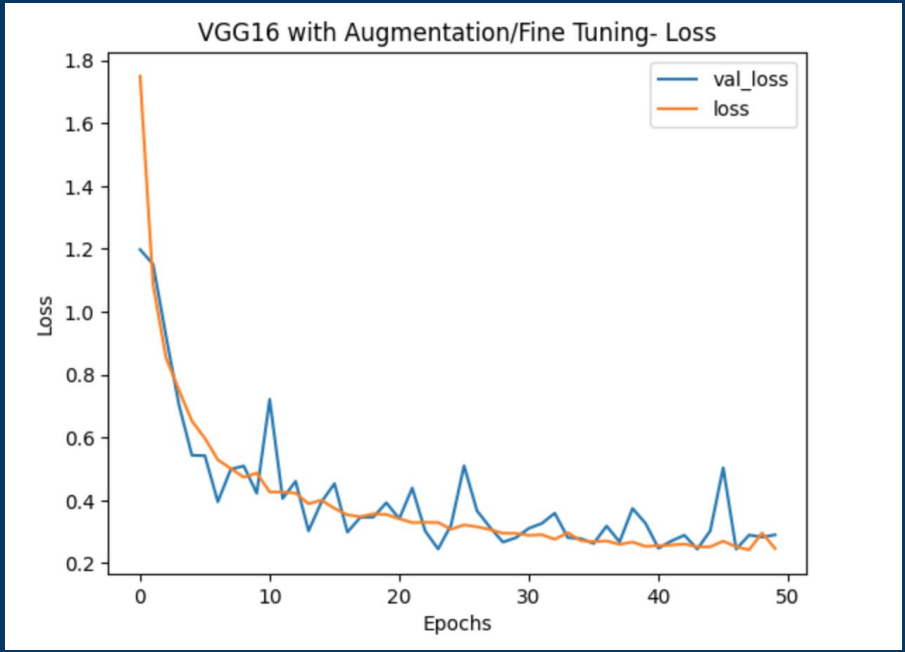

Baseline CNN
1 Max Pooling
1 Dense
74.1% Accuracy
Simple CNNs with Regularization
L1, L2, Dropout
26.6% to 65.6% Accuracy
Deeper CNNs
74.5% to 80.6% Accuracy
Out-The-Box Transfer Learning Models
ResNet50, VGG19, VGG16
28.6 % to 85.9% Accuracy
Final Model
Fine Tuned VGG16 with Image Augmentation
91.46% Accuracy

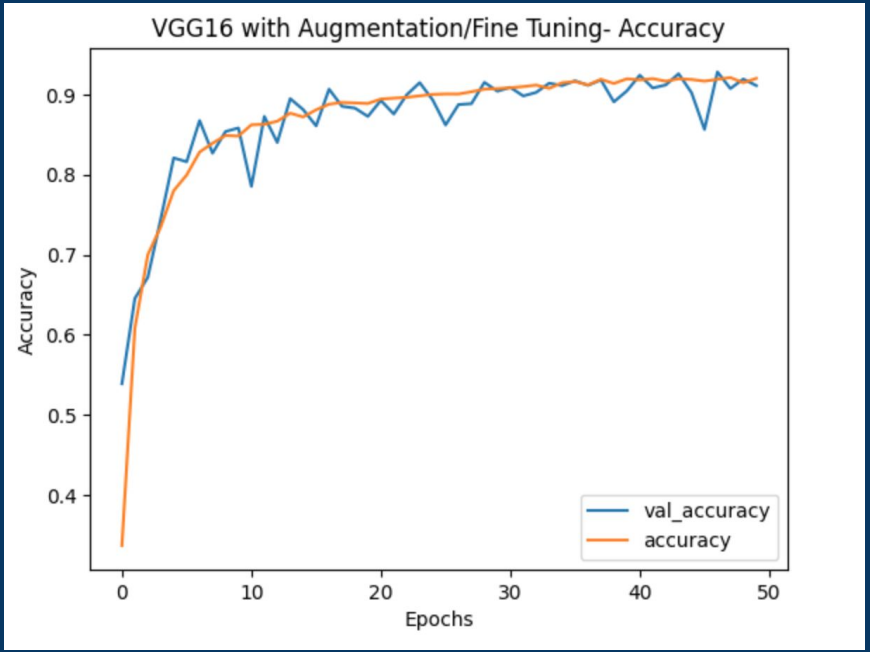
Results- Training

Best: Epoch 47

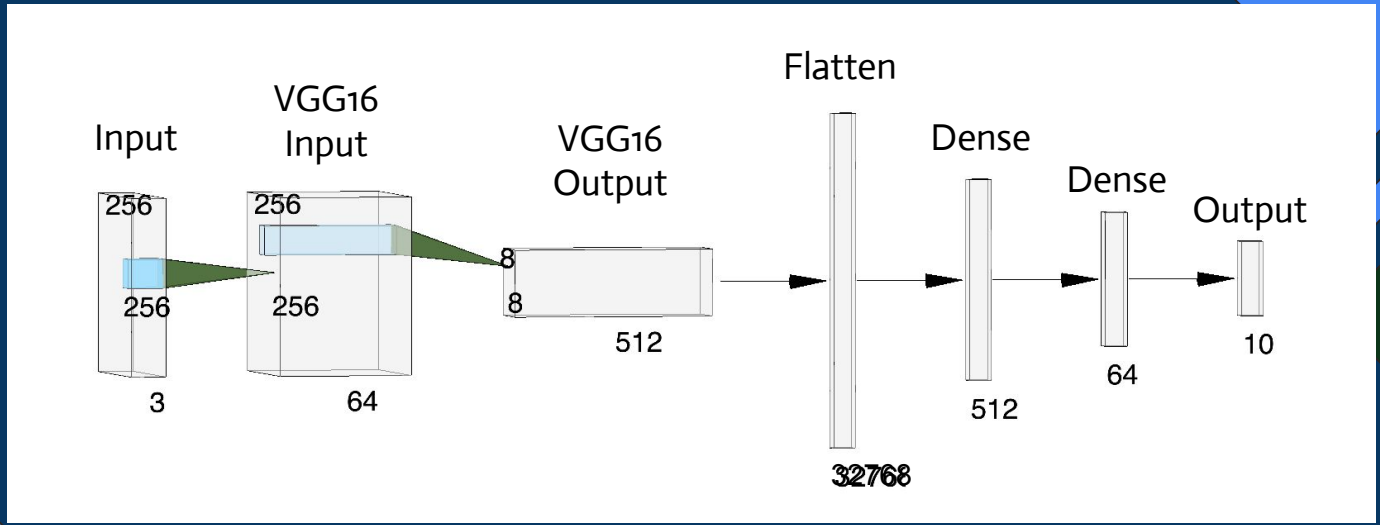
Train Accuracy: 91.90%

Validation Accuracy: 92.82%





Final Model

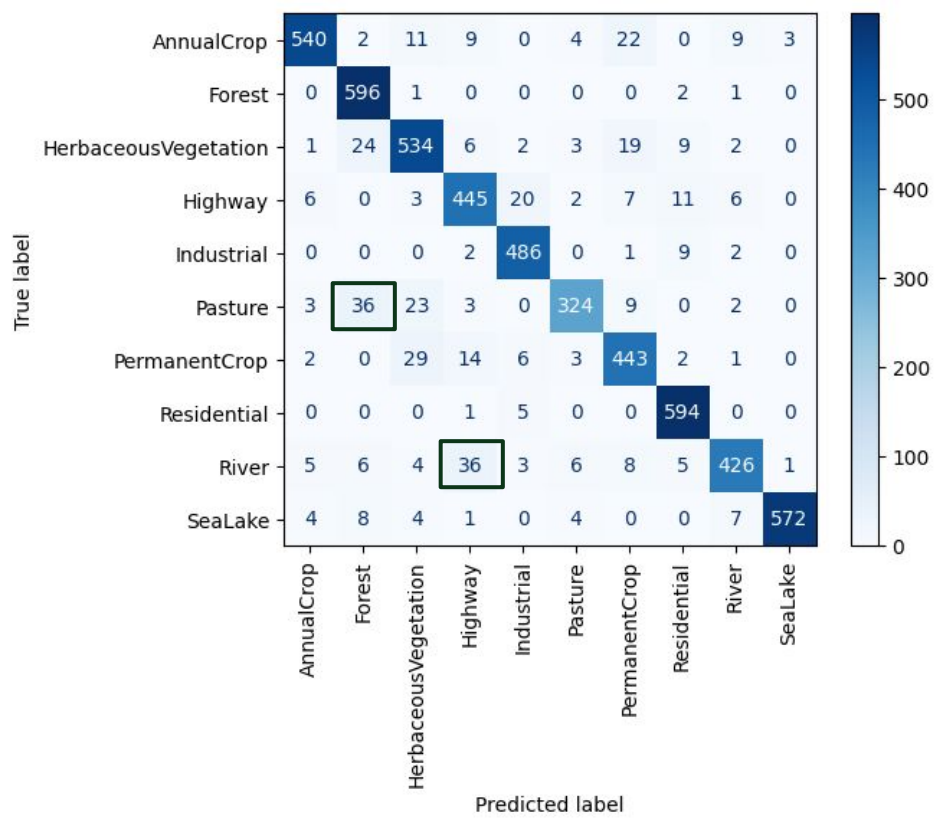


Trainable Parameters: 23,890, 634

Non-trainable Parameters: 7,635,264

Overall Test Accuracy: 91.46%

Test Accuracy by Class



Most Confused Classes:

- Pasture as Forest
- River as Highway

Recommendations

- Use this land cover classifier tool on images of the same land area over time.
- Focus deforestation prevention efforts on known wildlife corridor areas where an image's class has changed over time.

Next Steps

- Refine model on confused classes (i.e. river and highway) possibly through preprocessing.
- Create object detection to help classify multiple areas of land cover within an image.

Thank You

Questions?

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