Classifying Sentinel-2 Satellite Images Based on Tree Coverage

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Introduction

As the number of imaging satellites increases, so too does the amount of image data about our planet's surface.

Various subsets of this data have been used to model economic and sociological patterns. However, this imagery could prove useful in identifying trends in Earth's ecosystems.

For instance, deforestation and tree density, aspects of our planet that contribute greatly to larger issues, such as climate change.

Thus, we sought to train machine learning models that utilize a subset of this data to classify whether a given satellite image contains tree coverage.

Machine Learning Models

Random Forest
Decision Trees in Ensemble
Training Time: 3.6s
(Required Parameter Tuning)

Convolutional Neural Network
Utilizes Convolutions and Pooling
Training Time: 1m 27s

Residual Neural Network
Groups Convolutions in Identity Blocks to Increase Efficiency
Training Time: ~10m

Using Google Colab GPU Accel

Conclusion

All three of our models performed well with accuracies greater than 90%, however it is clear our Neural Networks excel over the Random Forest.

The simpler CNN and the ResNet34 have similar performances. This was expected considering the small size of our input images and thus less utilization of all layers in the ResNet.

Future Implications

With satellite image datasets constantly increasing, it is entirely possible to make these models more robust using larger, higher resolution images from other sources, such as Satellite image APIs.

In doing so, we will be able to track tree coverage and deforestation rates over large areas by aggregating classifications of smaller areas. This could yield useful information about climate change and the future of our planet as a whole.