Multi-label Classification on Satellite Images of the Amazon Rainforest

BACKGROUND

- Classify satellite images of the Amazon Rainforest to detect atmospheric labels, human activity and important natural resources
- Help understand where and why deforestation happens, potentially reducing deforestation rates

PROBLEM

- Use Convolutional Neural Networks to classify the following labels:

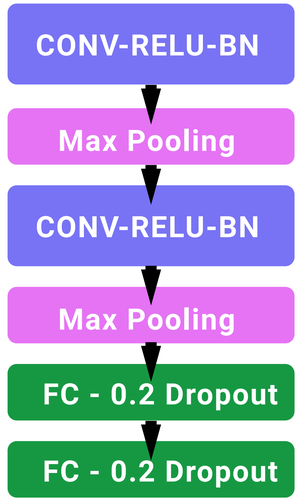
agriculture	artisanal mine	bare ground	
blooming	blowdown	clear	cloudy
conventional mine	cultivation	habitation	
haze	partly cloudy	primary	road
selective logging	slash burn	water	

DATASET

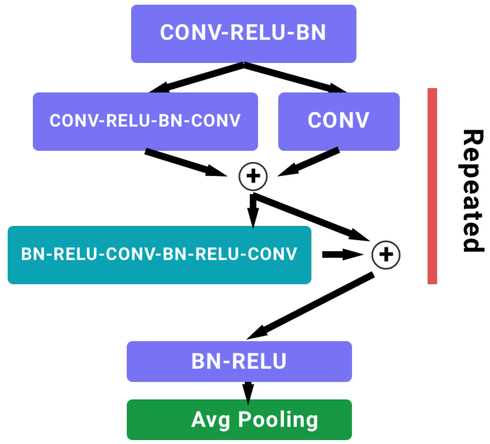
- 40,000 training images with 60,000 test images in JPG format with a split of 80/20 for train and validation
- Noise in training labels and few images for certain images such as slash burn, conventional mine and blow down

OUR APPROACHES

Simple Model

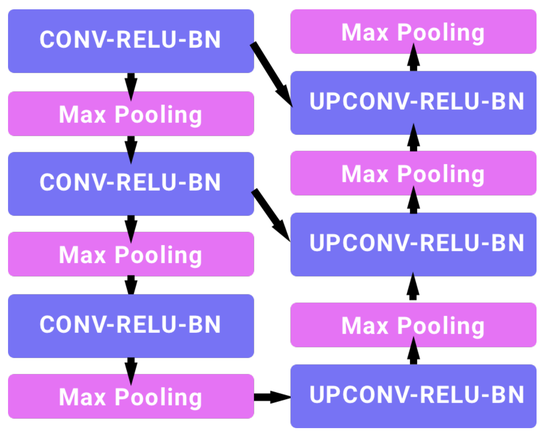


Wide ResNet



VGG Net 16

UNet Architecture

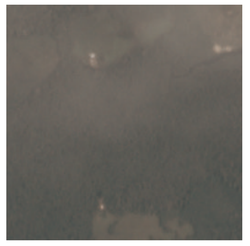


RESULTS

Evaluation of results: F2 Score

$$(1+\beta^2)\frac{pr}{\beta^2 p + r} \qquad p = \frac{tp}{tp+fp}, \quad r = \frac{tp}{tp+fn}, \quad \beta = 2.$$

1. Guessing Most Common Labels	Test: 0.64640
2. Simple Model	Test: 0.84221
3. U Net Architectures	Test: 0.88161
4. Wide Res Net	Test: 0.89520
5. VGG Net 16	Test: 0.90066



agriculture, clear, cultivation, haze, primary, road, water

agriculture, clear, habitation, primary, road

CONCLUSIONS

- Knowing that F2 Score favors recall over precision, we decided to use a weighted loss operation that allows us to punish false negatives
- Our model sometimes labels images with more than one atmospheric label which hurts the score
- Experimentation with most models found that depth and parameters were ideal for higher precision
- Future Work: Try combining earlier layers with later layers and do some form of attention

Albert Tung ● Jeffrey Zhang