Understanding the Amazon from Space

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Agenda

- Motivation
- EDA / Base Models
- Optimization Methods
- Best Model Architecture
- Error Analysis
- Next Steps

“Every minute, the world loses an area of forest the size of 48 football fields.

Motivation

- Better data about the location of deforestation and human encroachment on forests can help governments and local stakeholders respond more quickly and effectively.

Motivation

Downfall of existing methods of monitoring:

- Not effective on small scales
- Cannot differentiate between human causes of forest loss and natural causes
- No robust methods have been developed for high resolution imagery like those provided by Planet

Planet:

- Designer and builder of the world's largest constellation of Earth-imaging satellites
- Provided data for this competition

Task:

- Label satellite image chips with atmospheric conditions and various classes of land cover and land use.
- Resulting algorithm would potentially help the global community better understand where, how, and why deforestation happens all over the world - and ultimately how to respond

Labels:

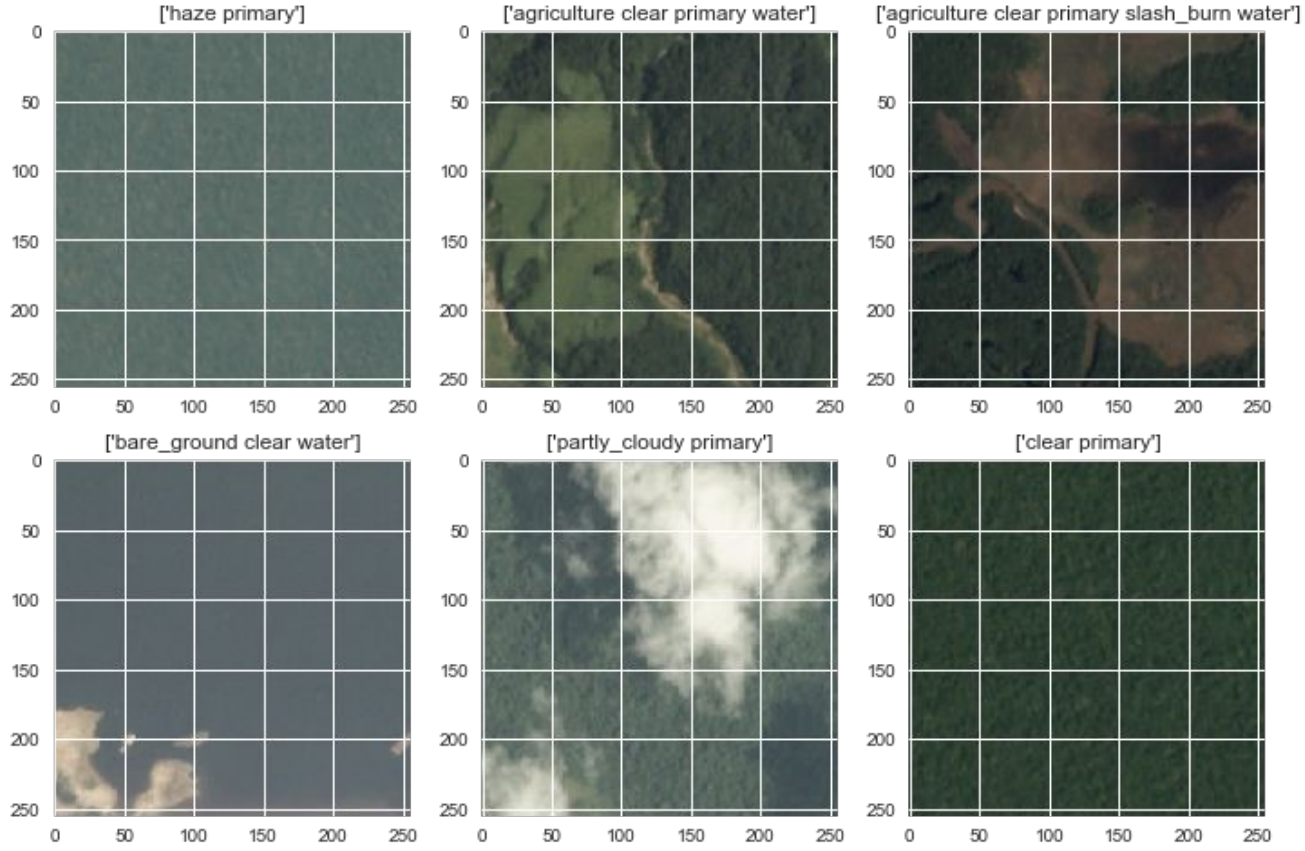
Land:

1. Primary
2. Agriculture
3. Road
4. Water
5. Cultivation
6. Habitation
7. Bare Ground
8. Selective Logging
9. Artisinal Mine
10. Blooming
11. Slash Burn
12. Conventional Mine
13. Blow Down

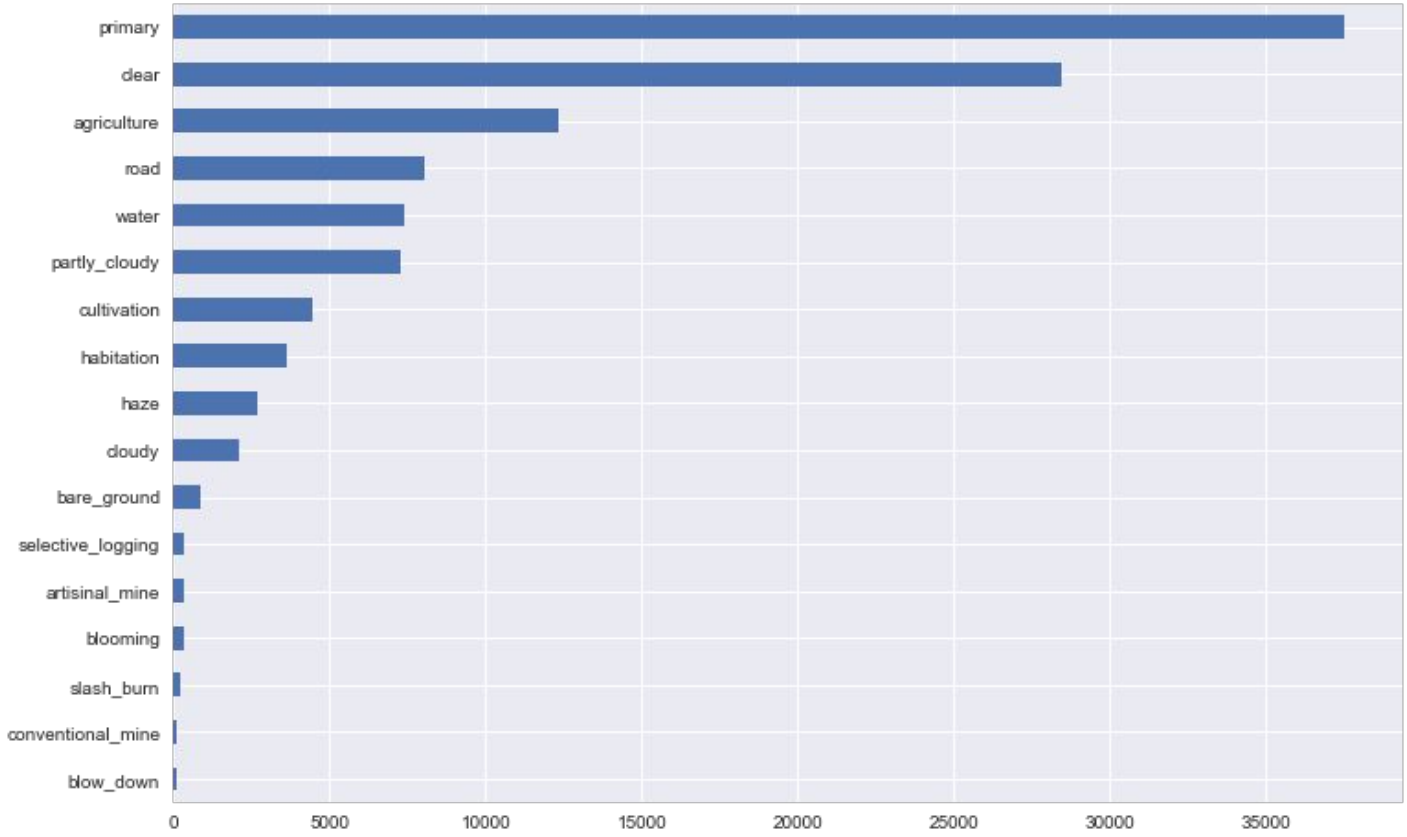
Atmosphere:

1. Clear
2. Haze
3. Cloudy
4. Partly Cloudy

Sample Images and Labels

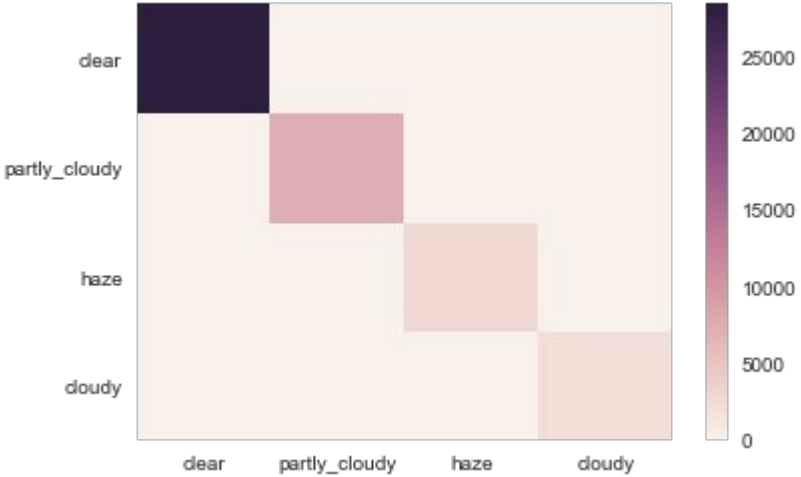


Label Imbalance

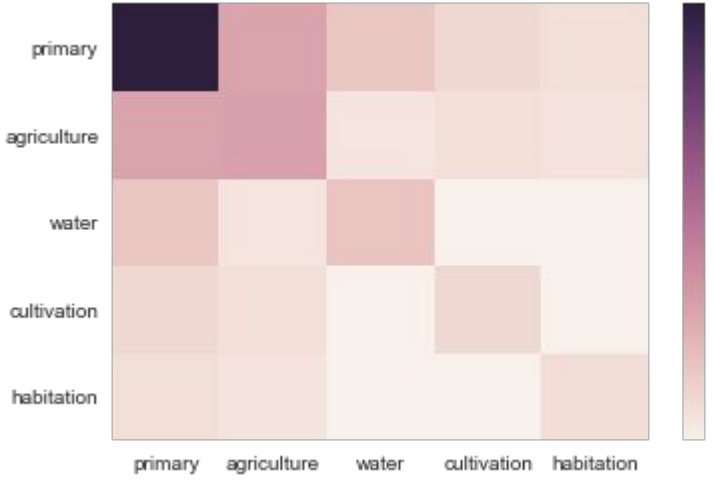


Co-occurrence matrices

Atmospheric Labels:



Land Labels:



Simple Models:

- ONLY for Atmospheric Labels
  - SVC
    - Flatten the feature matrix
    - argmax(y)
    - Accuracy: 73% Fbeta: Irrelevant for this case
- Dense
  - Accuracy: 90% Fbeta: .64

Overfitted Simple Models:

Successful Models:

- Weather labels only
- Model predicting common labels

Not quite 100% accuracy:

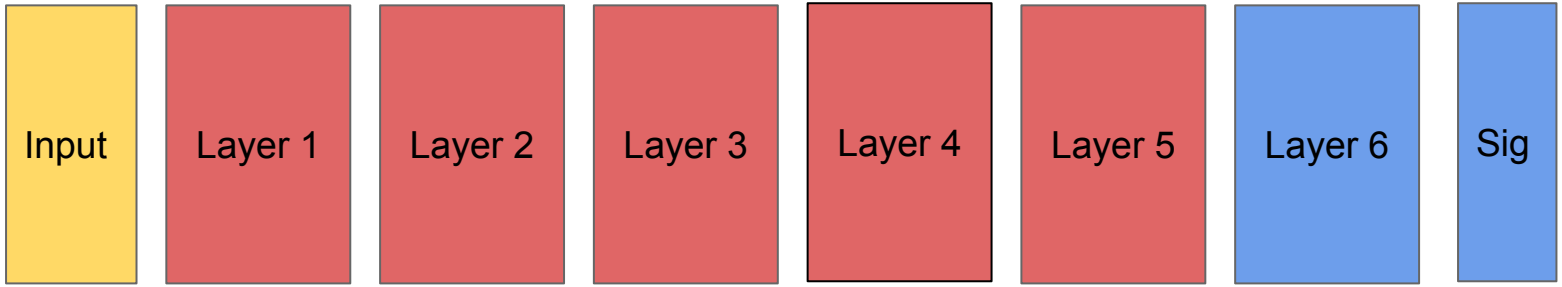
- Land Labels
- Predicting all labels at once

Hyperparameter Tuning: GridSearchCV

- Batch Sizes = [32, 64, 128]
- Epochs = [3, 5, 10, 20]
- Optimizer = [sgd, ‘Adam’]
- Activation = [‘softmax’, ‘relu’, ‘tanh’, ‘elu’]
- Dropout Rate = [0.1, 0.2, 0.3, 0.5]
- Learning Rate = [0.0001, 0.001, 0.01, 0.1]
- Momentum = [0.6, 0.8, 0.9]

Best Model Architecture

Accuracy: 95% Fbeta: 85%



Layers 1-5: Conv2D (padding), Activation = ‘elu’, Conv2D, Activation, MaxPooling, Dropout

Layer 6: Flatten, Dense, Activation, Dense, Activation, Dropout, Dense, Sigmoid

Challenges:

- Beating the Baseline Dense Model
- Dealing with mislabeled images
  - Getting rid of less frequent labels
- Fourth dimension (Time)
  - Hyperparameter tuning

Next Steps:

- Gain a new perspective
  - Near-infrared band images
- Implement existing models (VGGNet)
- Build parallel models
- Pay attention to Kaggle deadlines..

THANKS!

Any questions?