Hawk

Object Detection in Aerial Imagery

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Research Goals

Develop machine learning classifiers to assist human annotation of natural resources in aerial imagery

Automate analysis and detection of resources in aerial imagery to further efforts in disaster inventory management and natural resource inventory management

Background and Impact

There is a need for assessment of natural resources post major disasters for efficient aid distribution:

> Securing existing food sources such as coconut trees

> Assessing road conditions for aid distribution

Current annotation efforts and analysis take more than a day

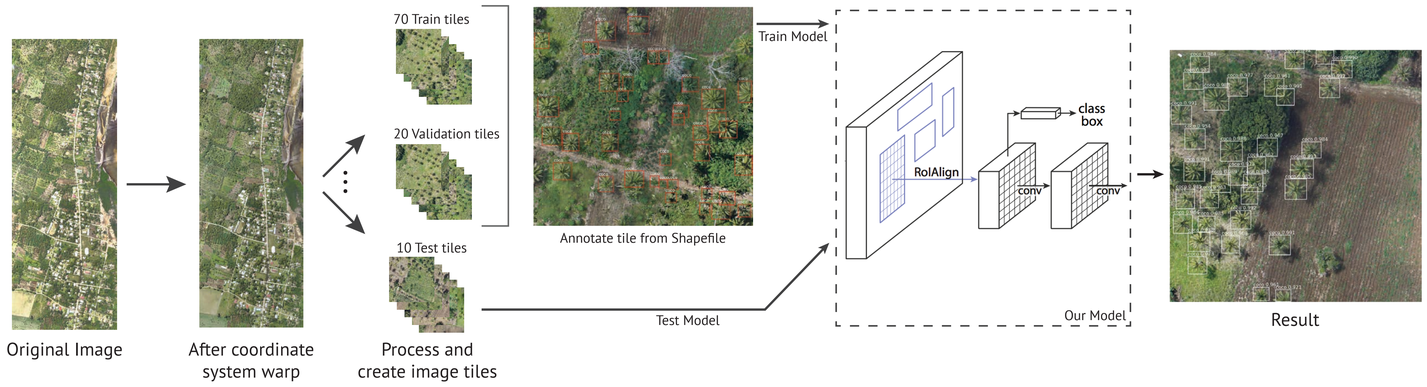
Challenges

Selection of suitable detection framework

Unavailability of different weather conditions and time of day in dataset

Numerous mislabeled and missing datapoints in provided ground truth

System Pipeline



Results

Coconut Trees

Mean Average Accuracy	**85%**
Precision	**91.3%**
Recall	**97.1%**
F1 Score	**94.1%**

Conclusion

Able to detect and count Coconut Trees with high accuracy, and Banana Trees with low accuracy

Neural Net Architecture

BACKBONE	resnet101
DETECTION_MIN_CONFIDENCE	0.8
TRAIN_ROIS_PER_IMAGE	100
NUM_CLASSES	2
BATCH_SIZE	1
LEARNING_RATE	0.001
WEIGHT_DECAY	0.0001
STEPS_PER_EPOCH	100
VALIDATION_STEPS	10

Dataset

Area of Interest	50 km^2
Spatial Resolution	8 cm
Region of Interest	Kolovai, Tonga
Tiles Generated	100
Tile Width	1000 pixels
Tile Height	1000 pixels
Number of Coconut Trees	10314
Number of Banana Trees	2729

Future Work

Increase training data for Banana Trees and retrain our model

Include other Tree subtypes such as Papaya and Mango, and detection of Roads

Develop interface to interact with our model

Tools

Geo Info Systems and Shapefile manipulation	Image Processing and Manipulation	Deep Learning
> GDAL	> Pillow	> Tensorflow
> OSGeo	> Scikit-Image	> Keras
> Fiona		

References

[1] Meier, Patrick. "Open AI Challenge: Aerial Imagery of South Pacific Islands." Open AI Challenge: Aerial Imagery of South Pacific Islands, 10 Jan. 2018, werobotics.org/blog/2018/01/10/open-ai-challenge.

[2] Girshick, Ross, et al. "Rich feature hierarchies for accurate object detection and semantic segmentation." Proceedings of the IEEE conference on computer vision and pattern recognition. 2014.

[3] He, Kaiming, et al. "Mask r-cnn." Computer Vision (ICCV), 2017 IEEE International Conference on. IEEE, 2017.

[4] Dutta, Abhishek, et al. "{VGG} Image Annotator ({VIA})" {VGG} Image Annotator ({VIA}), 2016, www.robots.ox.ac.uk/~vgg/software/via.

Supporters

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