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Blueberry Drone AI: Smart Farming of Blueberries using Artificial Intelligence and Autonomous Drones

Robert Czarnota
Rowan University

Anthony Segrest
Rowan University

Anthony Thompson
Rowan University

Harper Zappone
Rowan University

Hieu Nguyen
Rowan University

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Student Name
Robert Czarnota, Anthony Segrest, Anthony Thompson, Harper Zappone, Hieu Nguyen, Nguyen Thanh, Ik Jae Lee, Lori Green, and Tuan Le

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BLUEBERRY DRONE AI

Smart Farming of Blueberries using Artificial Intelligence and Autonomous Drones

Robert Czarnota[3], Anthony Segrest[1, 2] Anthony Thompson[1], Harper Zappone[1], Hieu D. Nguyen[2], Thanh Nguyen[2], Ik Jae Lee[2], Lori Green[3], Tuan Le[3]

Departments of Computer Science[1] and Mathematics[2], Rowan University, Camden County College[3]

ABSTRACT: This project seeks to assist blueberry growers in New Jersey with preventing blueberry scorch disease. Plants can't be cured of scorch, so they have to be removed to prevent the disease from spreading to other bushes. This project aims to use object detection and classifier machine learning models in order to detect scorch disease with photos from intelligent drones. Images are first tiled, then processed through and convolutional neural network that detects scorch symptoms. Lastly, a fully connected neural network is implemented to make a final prediction.

Annotation Limitations

- It's not always clear what should be marked as separate annotations
- Scorch has many varying symptoms
- Other diseases can look like minor scorch symptoms

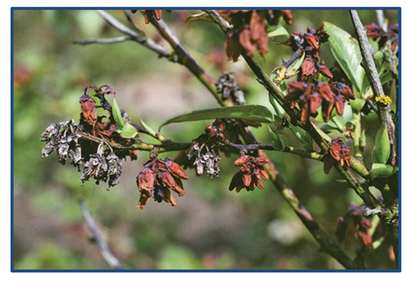
Our Current Dataset (annotated):

- Scorch model: 1485 image tiles
- Data augmentation

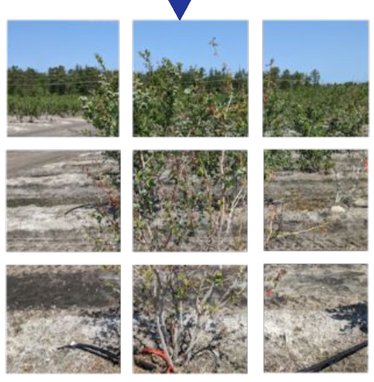
Scorch Detection Deep Learning Models

Blueberry Field

Scorch symptoms

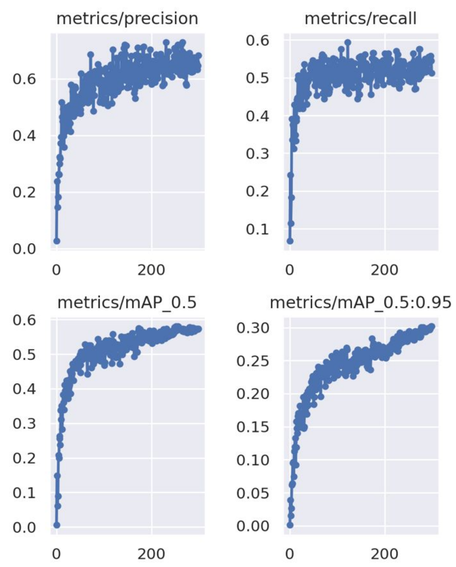


Original Image



Tiled Image

YOLOv5 Metrics



Classifier Metrics

True Positive	False Negative
38	3
False Positive	**True Negative**
13	40

Precision: 0.745

Recall: 0.927

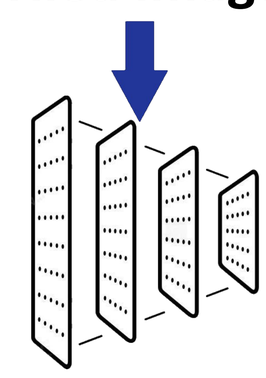
Tiling Benefits

- Tiling allows us to combine datasets with closeup photos with full bush photos
- Tiling gives the model flexibility to work with different aspect ratios

Prediction

YOLOv5 Medium

Convolutional Neural Network

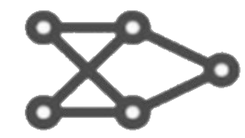


YOLOv5 Output

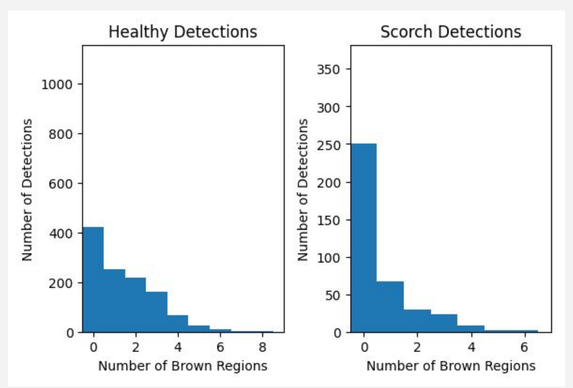
- Model displays confidence level for each annotation.
- Allows us to verify the accuracy.
- Confidence ranges from 0 to 1

Annotation Classifier

Neural Network



Pixel Filtering



- By filtering based on color, we can find patterns in detections
- Here we see the number of separate brown regions in detections, in healthy and scorch bushes

Classifier Output

- Classifier decides whether the bush has scorch
- Simple Yes/No answer

Collaborators:

- Influential Drones (Lumberton, NJ)
- Peter Oudemans, Director, Rutgers Marucci Center for Blueberry and Cranberry Research
- South Jersey Farms: DiMatteo, Haines, Macrie Brothers, Moore, Piney Hollow, Vaccarella, Matro

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Next Steps:

- Include less symptomatic annotations to give more data to the final classifier
- Research image processing methods for the classifier