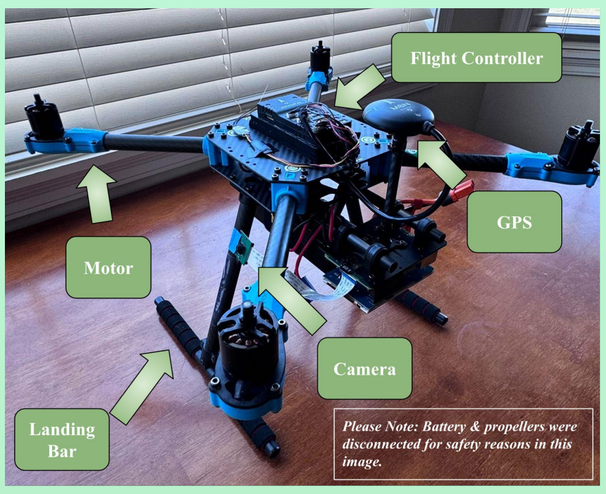
Implementing a Novel Multimodal Neural Network Approach using Dynamic Hyperparameter Selection within an Unmanned Aerial Vehicle for the Early Detection of Crop Diseases

Phase 1: Proposed Solution

This project is a proposed solution to detect crop disease by equipping a **UAV** with a novel **multimodal neural network** (utilizing image and video data) that uses dynamic hyperparameter selection.

Phase 2: UAV System



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- UAV allows for images/videos of crops to be captured
- Multimodal network analyzes UAV-captured data

Phase 3: Data Collection & Preparation

- Two modal branches
- 2000 field-based images/videos
- Data was split into 80%/20% for training and testing
- Feature extraction applied for focus on symptoms

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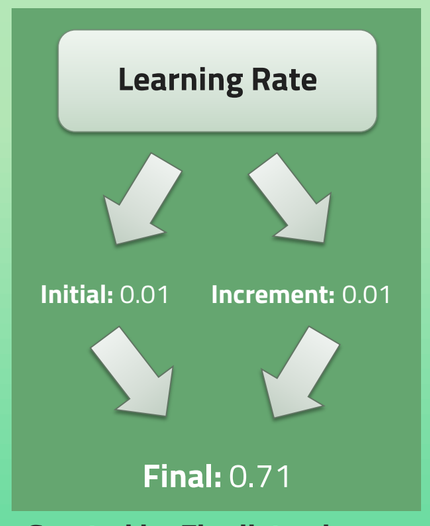
Frog-Eye Leaf Spot
Apple Black Rot

Phase 4: Parameter Selection System



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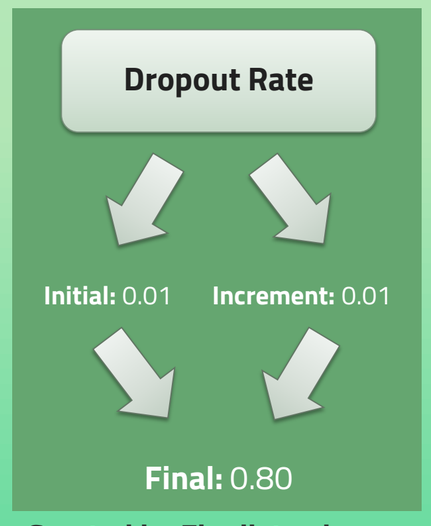

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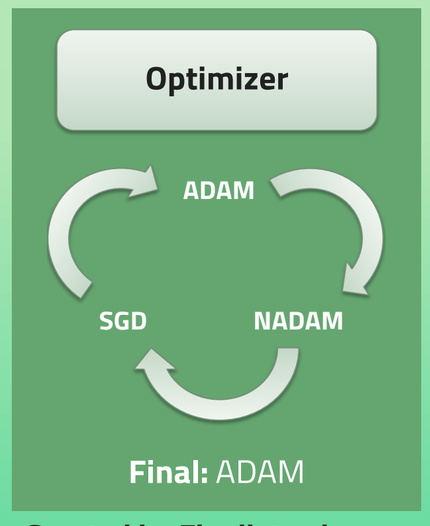

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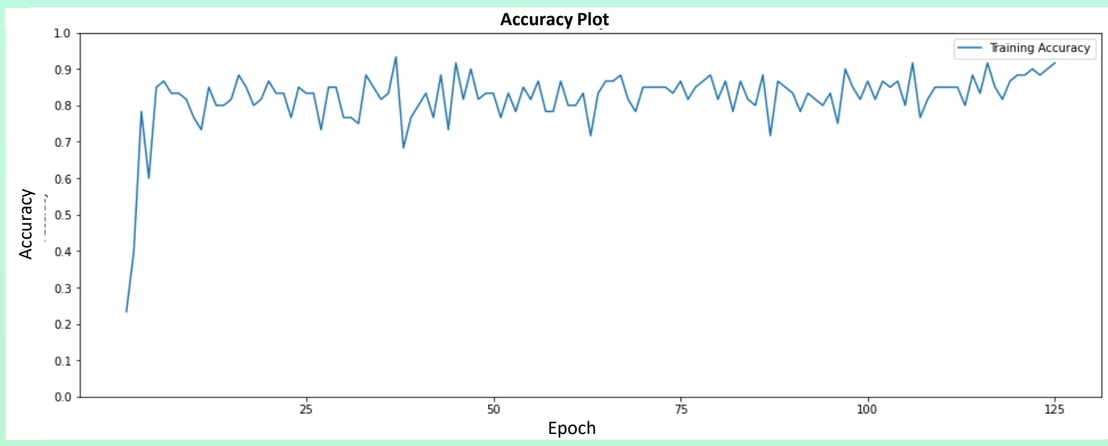
- Dynamic selection allows continuous updating with addition of data and self-select hyperparameters
- Selection run beginning 11th epoch of training stage
- If epoch accuracy was > 85%, hyperparameters would be altered by an increment (learning & dropout rate) or switched (optimizer)

Phase 5: Network Training



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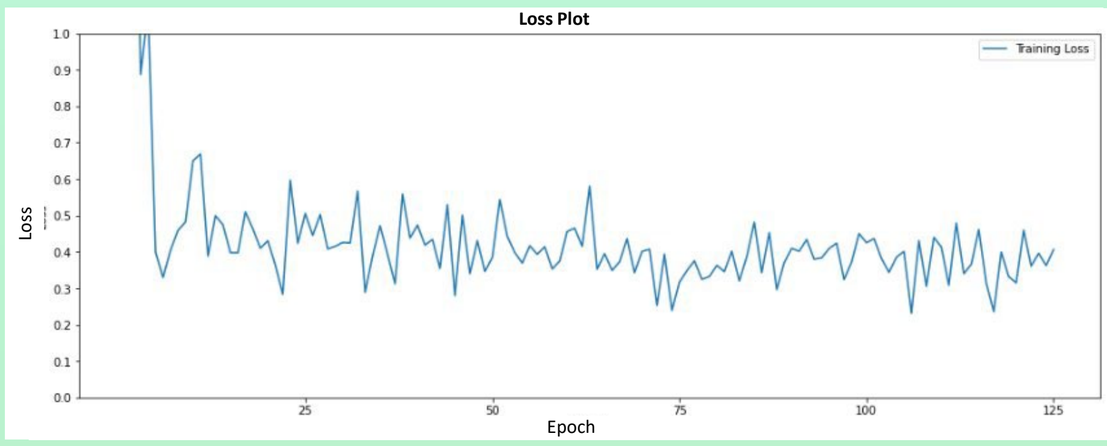

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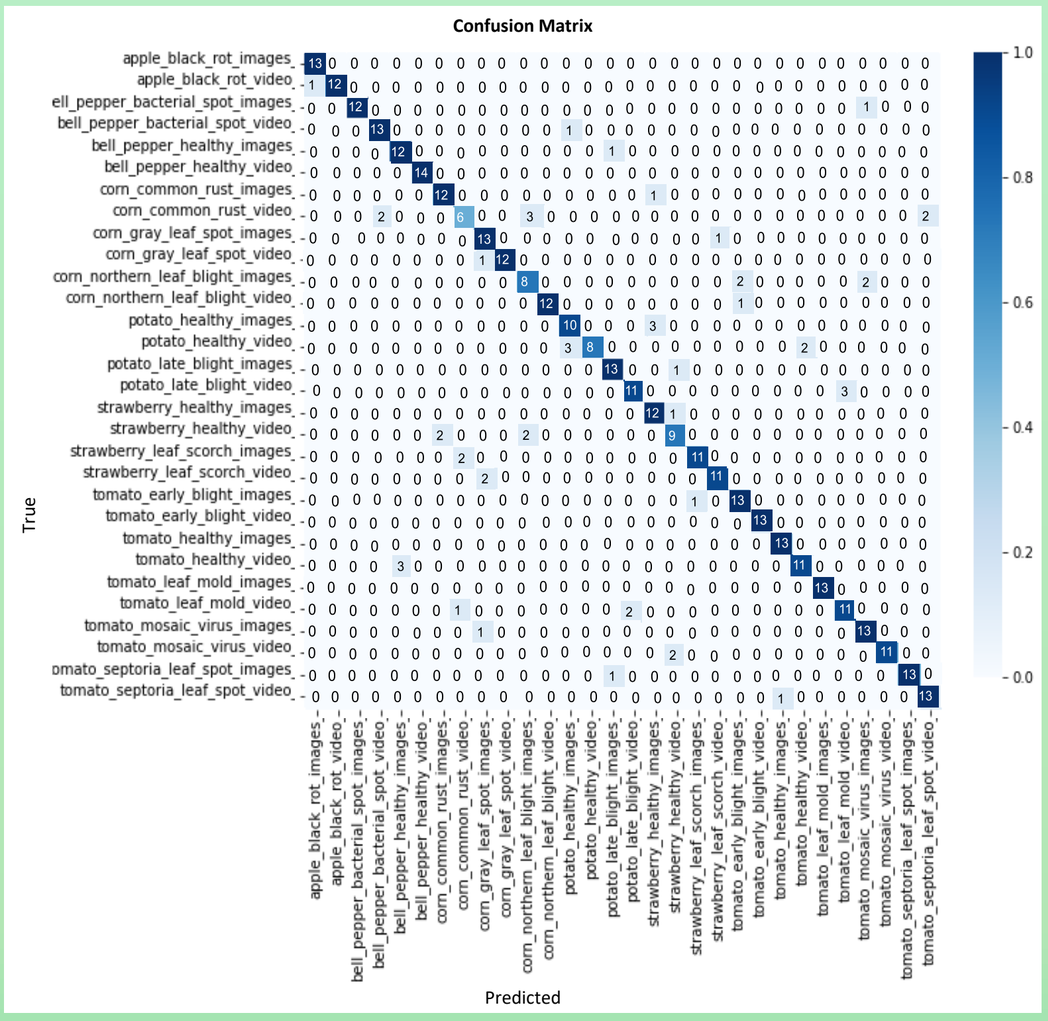
- Run over 125 epochs
- Final training accuracy - 92%

Phase 6: Network Testing



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- Final accuracy was 87%
- Above the accuracy threshold of 85%

Phase 7: Future Development

- Expand data to detect more diseases
- Advance from the use of a CPU to a GPU
  - GPU - faster data processing
- Release network into public domain
- Deployment of UAV device in Ohio for initial beta testing