



Pest Detection

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The Goal

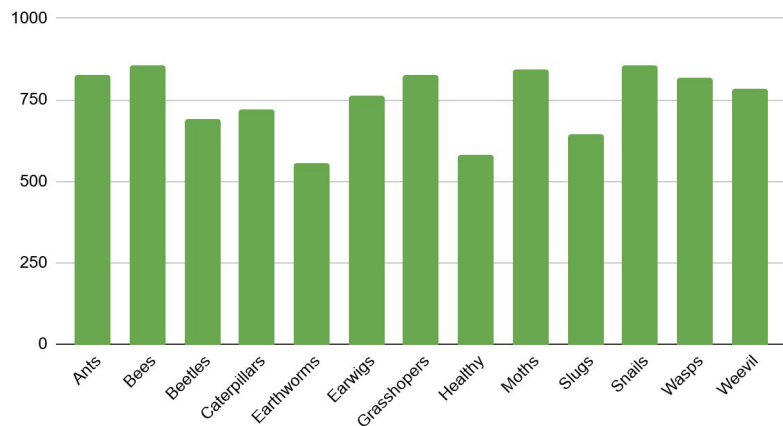
- Sort images based on what insect is present
- Applications:
 - Farming
 - Monitoring invasive species
- Model: Convolutional Neural Network
 - Well suited for spatial data



The Data

- Images were collected from two datasets
 - AgroPest-12: Image Dataset for Crop Pest Detection
 - 12 classes: Ants, Bees, Beetles, Caterpillars, Earthworms, Earwigs, Grasshoppers, Moths, Slugs, Snails, Wasps, and Weevils.
 - Agricultural crops image classification
 - Originally 30 classes which were combined into one healthy class
- training/validation/test
 - 70/15/15
 - stratified

Distribution of Training Dataset

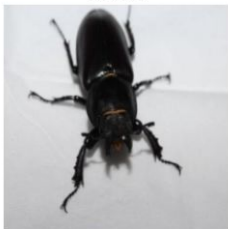


Approach

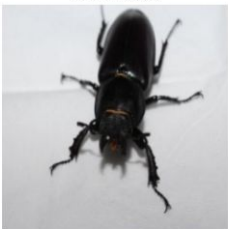
- Started with building a model based on previous work
 - Slow
 - Took about 12 hours to go through 7 epochs
 - Inaccurate
 - Had about 20% accuracy by the end
 - Surpasses random chance but disappointing
 - If other options hadn't worked I would have experimented with learning rate
- Moved onto the pretrained PyTorch model Resnet 18
 - Feature Extraction
 - Took 26 minutes
 - Plateaued around 78%, training accuracy and 82% validation accuracy
 - Test accuracy 83%
 - Fine Tuning
 - Took 39 minutes
 - Plateaued around 95%, training accuracy and 93% validation accuracy
 - Test accuracy 95%

Data Augmentation

Original



Horizontal Flip



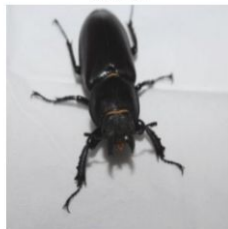
Rotation



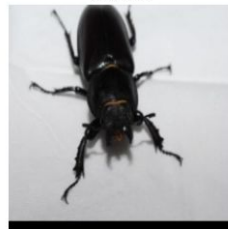
Brightness



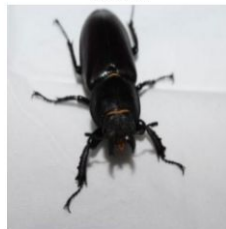
Contrast



Translation



Saturation



Random Erasing



Combined Aug 1



Combined Aug 2



Combined Aug 3



Combined Aug 4



Combined Aug 5



Combined Aug 6



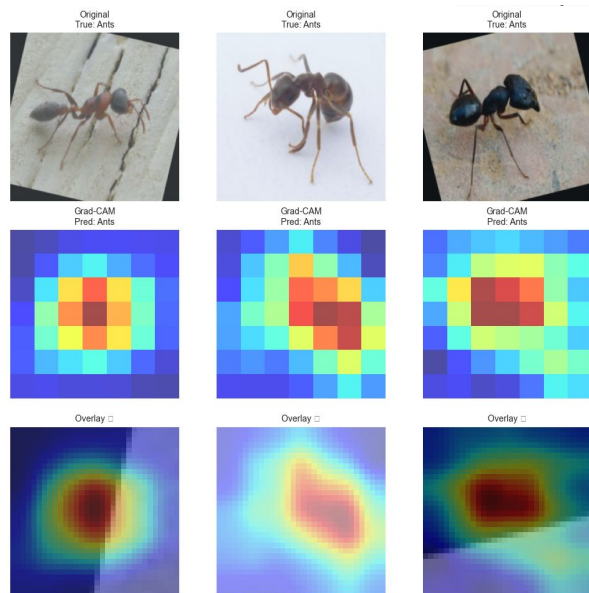
Combined Aug 7



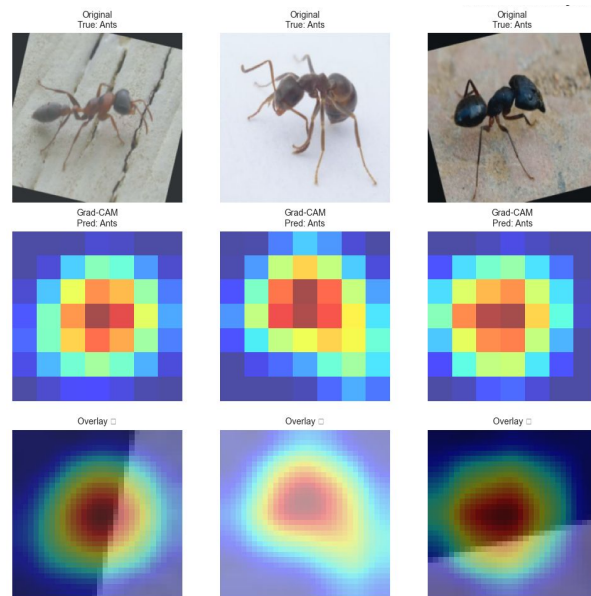
Combined Aug 8



Grad-Cam Analysis

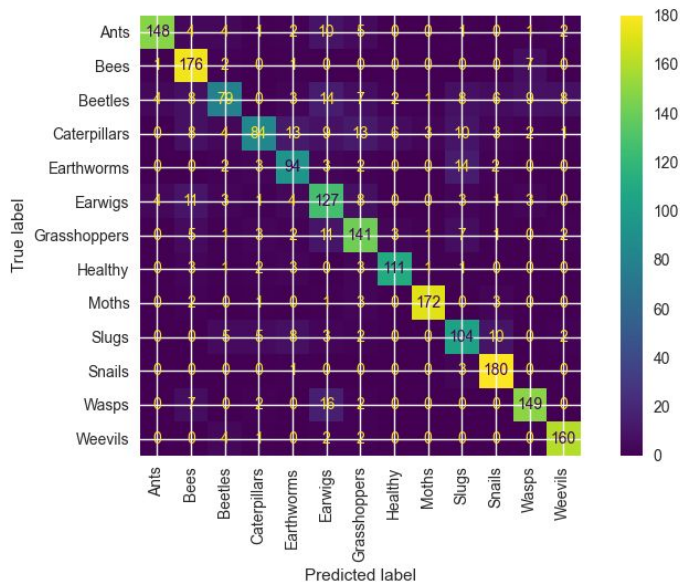


Feature Extraction

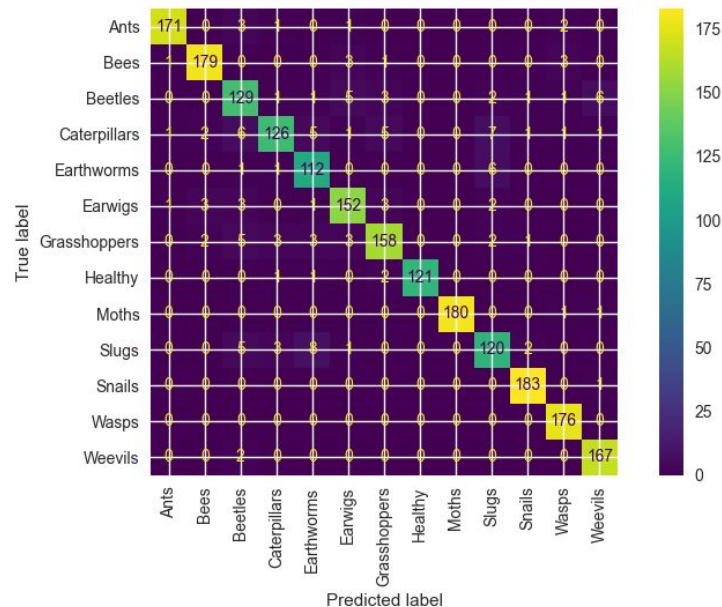


Fine tuning

Results



Feature Extraction
Accuracy: 81.87



Fine tuning
Accuracy: 93.69



Takeaways

- Pre-trained models can be very powerful
 - Can be fast and accurate
 - Might have issues with licensing depending on application
 - Feature Extraction
 - Faster but less accurate
 - Fine tuning
 - Slower but more accurate
- Possible improvements
 - Use more a more powerful computer to train a more specific model
 - Collect more data of insects in desired context