Mobile-App-based Crop Estimation in Wine Grapes

Priyanka Upadhyaya and Manoj Karkee

Center for Precision and Automated Agricultural Systems, Washington State University, Prosser

Introduction

- Crop estimation helps with resources management for pre/post harvest operations
- Cost and complexity of current technologies are biggest challenges
- Lag-phase is one of the methods used for crop/yield estimation in many varieties

Lag-Phase Detection

- Berry diameter was estimated over growing season to detect lag-phase
- A polynomial equation was fitted to represent berry growth
- Model showed lag-phase start date of 7/22/2021 (Manual estimation was 7/24)

Cluster and Berry Detection

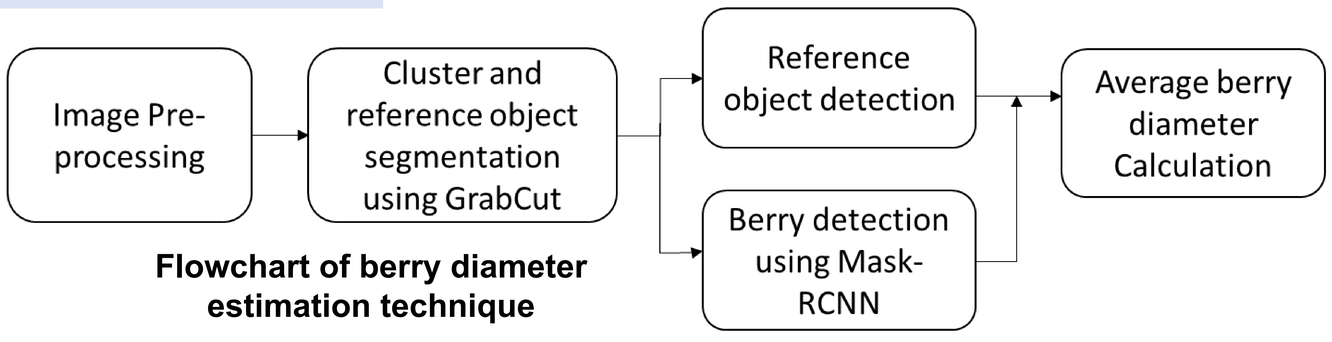
- Grape clusters and berries detected on the grape vine images (chardonnay and merlot)
- A total of 668 images were used for cluster detection; 1,971 berries from 30 different clusters were used for berry detection
- A deep learning model (Mask-RCNN) was used for this detection task
- The model achieved a detection accuracy of 79.0% and 88.5% respectively for clusters and berries.

Example cluster detection result

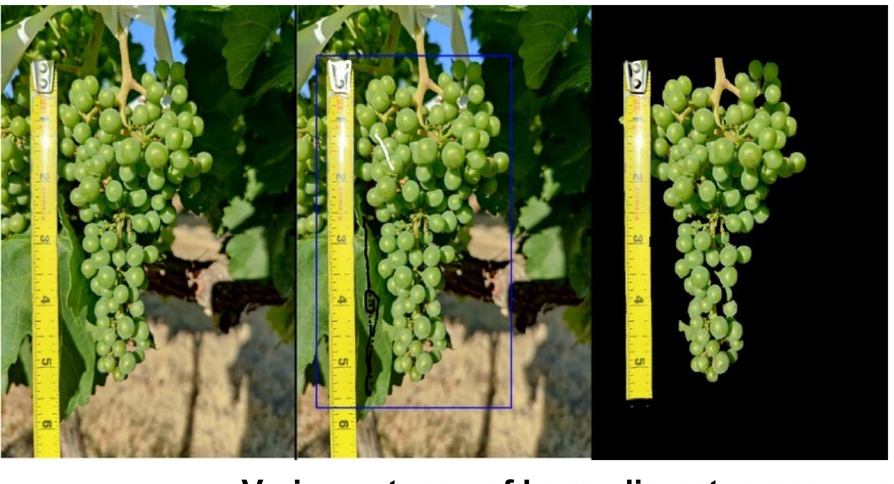
Example berry detection result

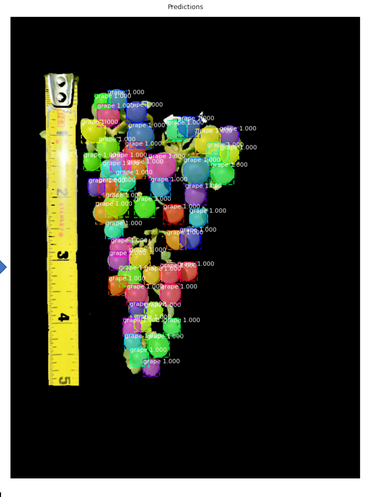
Correlation Models

- Correlation models developed to estimate cluster weight from visible berries counted automatically in images
- Predicting actual berry count in a cluster using image-based counting achieved an RMSE value of ~ 20 berries; R2 value between '# of berries' and 'cluster weight' was 96.5%

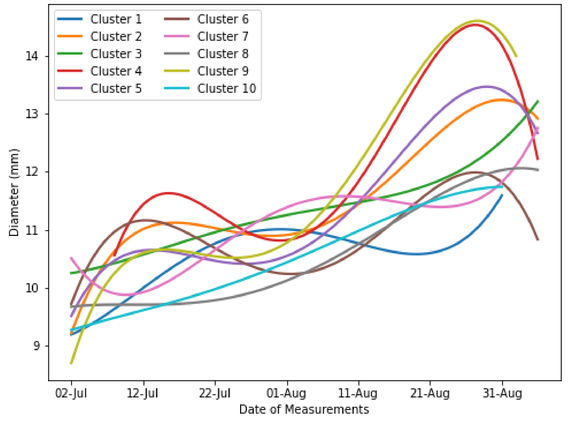


Flowchart of berry diameter estimation technique





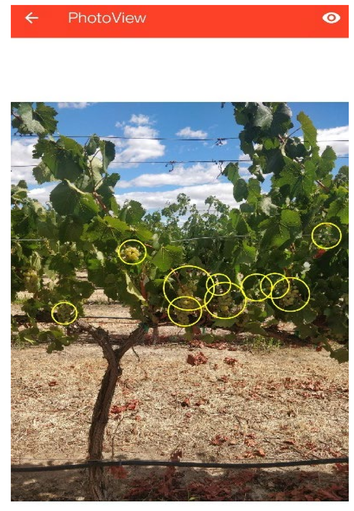
Various stages of berry diameter measurement



Growth patterns for 10 sample berries

Software Application (App) Development

- An Android Application (App) was developed where images can be taken from App and uploaded to cloud server
- Results from cloud-based computing are downloaded and displayed



Screenshot of App showing cluster detection

Summary

- Cluster and berry detection and counting was successfully achieved using a mobile App
- Lag-phase start date obtained from berry growth trend closely matched manual estimation

The funding for this work was provided by ***Washington State Wine Commission***