Introduction

• The wild blueberry (Vaccinium angustifolium Ait.) is a naturally growing horticultural crop in Atlantic Provinces of Canada and Maine, USA.
• Canada produced around 101.95 million kg of berries in 2017, valued at $58.72 million
• Due to improved management practices, wild blueberry plant densities, plants heights and fruit yields have significantly increased
• Due to these augmented plant characteristics there is increased debris in the harvesters handling systems
• The field debris including weed, grass, wild blueberry leaf, wild blueberry stem and dirt are the major constraint for ensuring high fruit quality during harvesting
• Convolutional neural network (CNN) based debris detection systems can be a valuable addition in berry separation technology to improve quality of the fruit

Figure 1: Debris (weed, grass, leaves, stems, dirt) in side conveyor

Objectives

• Training and testing two CNNs for debris detection during mechanical wild blueberry harvesting
• Evaluation of two optimized CNNs based on debris detection accuracy

Methods

• The experimental images (~1000) were collected from two fields in central Nova Scotia using GoPro cameras mounted on the side and rear conveyors
• Debris classes (weed, grass, leaves, stems, dirt) were created and images were labelled using custom software.
• 90% of the images were used for training the CNN, and 10% were used for validation the model
• Two different neural networks (YOLOv3, YOLOv3-Tiny) were trained and validated.
• Networks were trained and tested on a GeForce RTX™ 2080 Ti @ 1665 MHz graphics processing unit (GPU) and an Intel® Core™ i5-4300U CPU @ 1.90 GHZ central processing unit-based computer
• The networks were evaluated based on detection accuracy (mAP)

Discussion and Conclusions

• YOLO v3 was able to detect debris more accurately than YOLOv3-Tiny in the testing dataset
• YOLOv3 achieved better mAP (68.08%) with few training iterations than YOLOv3-Tiny
• GPU was more efficient for training the dataset than CPU
• In future, this model could be used for real time debris detection during mechanical wild blueberry harvesting.

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