Farm Produce Classification Using A Robotic Arm And Computer Vision- (Edge Intelligence)

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Introduction

With the ever growing Increase in demand for agricultural products, there is a need to increase farming efficiency and production while reducing time and cost. Harvesting is one of the key agricultural stages that requires farmers to manually separate bad farm produce from the good ones during or before storing which requires a lot of manual labor. To better address this with the use of Artificial Intelligence, our goal is to build a robotic arm that could be used in separating bad farm produce from good farm produce via the use of computer vision in real time. To better demonstrate this, we built a computer vision model that could identify various farm produces like onions, peppers, grapes, oranges, apples, bananas and others; and then separate the good from the bad into their respective barns before selling. As a simple demonstration, this experimentation was restricted to peppers and onions. Future work in line with this focuses on building the robotic arm while infusing the computer vision model for on-edge device identification of farm produce.

Fig 1

Fig 2

Methodology

Data Gathering

In this project, the data (images of onions and peppers) were gathered using a mobile phone.The total number of images gathered is 104. The images contain both single instances of onion or pepper and samples with multiple onions/peppers.To ensure diversity in the dataset, the images were manually augmented with various backgrounds, orientations, and alignments, in order to enhance model generalization.

Data Annotation/Labelling

Data labeling is a technique used generally in data science to allow an algorithm to map input data to the expected output. In order to do this efficiently, we used a labeling GUI called labelImg. This generated the labelled images as .xml files which were then exported as TensorFlow records for the object detection API. This is as shown in fig 2.

Data Modelling

The exported Tensorflow record data was trained on an object detection architecture called EfficientDet. EfficientDet is a neural network architecture for object detection. It's one of the TensorFlow object detection APIs from the various model zoos, like CenterNet, MobileNet, ResNet, and Fast R-CNN. EfficientDet was trained on this dataset and was able to outperform existing architectures used like MobileNet, RetinaNet, MaskR-CNN, and YOLO-v3. The Architectural framework is as shown in fig 3.

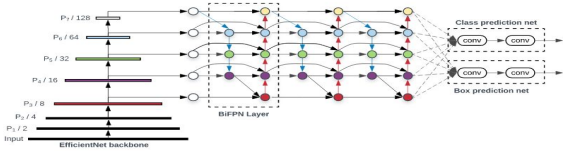

Fig 3

Results/Conclusion

After 5000 training steps the architecture was able to learn and accurately separate peppers from tomatoes just as shown below. This was then deployed on raspberry pi3 as an on edge device predictive modelling. Fig 4 and 5 speaks of the computer vision result and training progress.

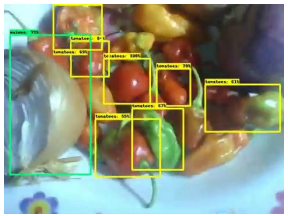

Fig 4 (Video link)

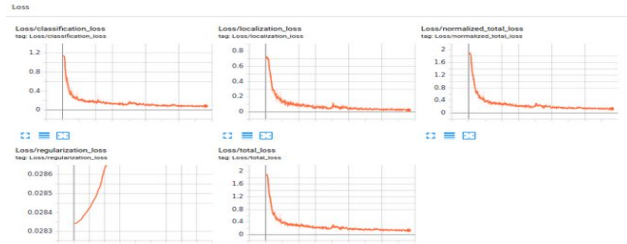

Fig 5