Detection on Fruits and Vegetables in 2D image

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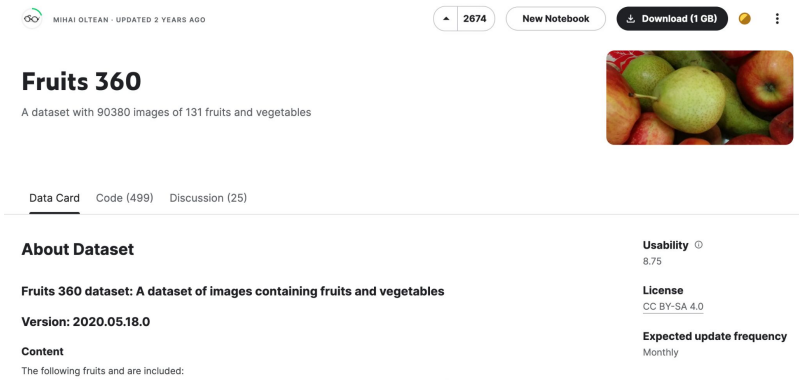
Introduction

In this final project we developed, it is able to identify different categories of fruits and vegetables and count the total number of each category in one single image, in total of 131 classes of fruit and vegetables from Fruits-360 dataset on Kaggle.

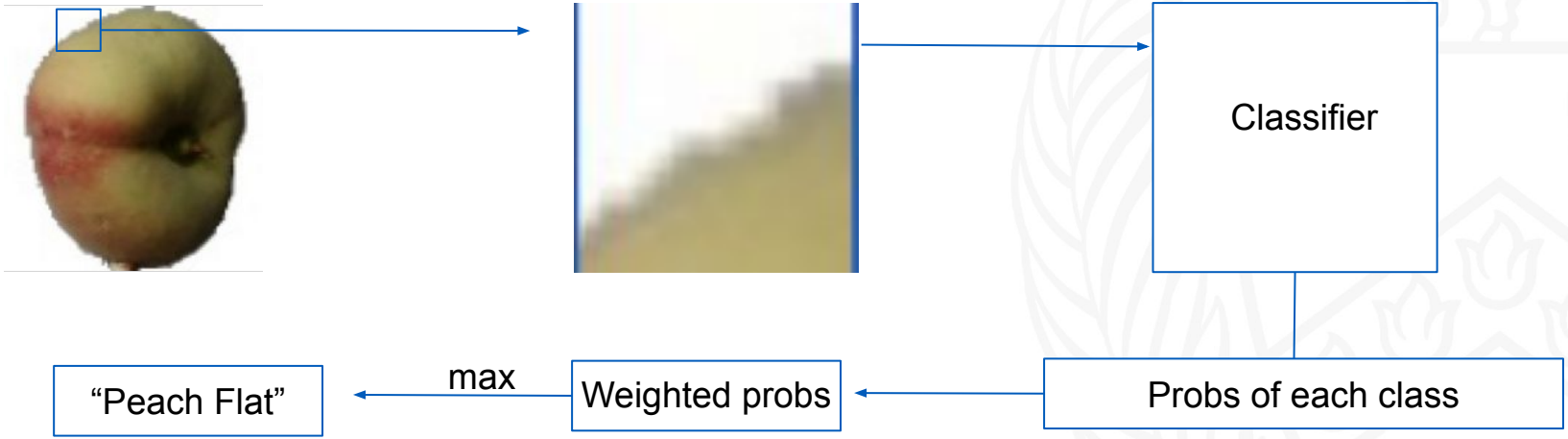


Approach

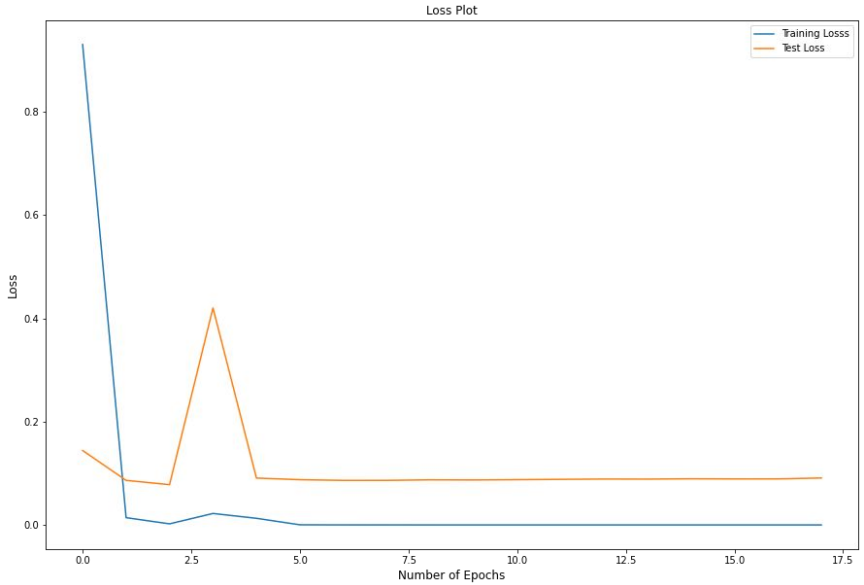
```
Fruits_CNN(
  (conv_layers): Sequential(
    (0): Conv2d(3, 16, kernel_size=(5, 5), stride=(1, 1), padding=same)
    (1): BatchNorm2d(16, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
    (2): ReLU()
    (3): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (4): Conv2d(16, 32, kernel_size=(4, 4), stride=(1, 1), padding=same)
    (5): BatchNorm2d(32, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
    (6): ReLU()
    (7): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (8): Conv2d(32, 64, kernel_size=(3, 3), stride=(1, 1), padding=same)
    (9): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)
    (10): ReLU()
    (11): MaxPool2d(kernel_size=5, stride=5, padding=0, dilation=1, ceil_mode=False)
  )
  (linear_layers): Sequential(
    (0): Flatten(start_dim=1, end_dim=-1)
    (1): Linear(in_features=1600, out_features=512, bias=True)
    (2): ReLU()
    (3): Dropout(p=0.25, inplace=False)
    (4): Linear(in_features=512, out_features=131, bias=True)
  )
)
```

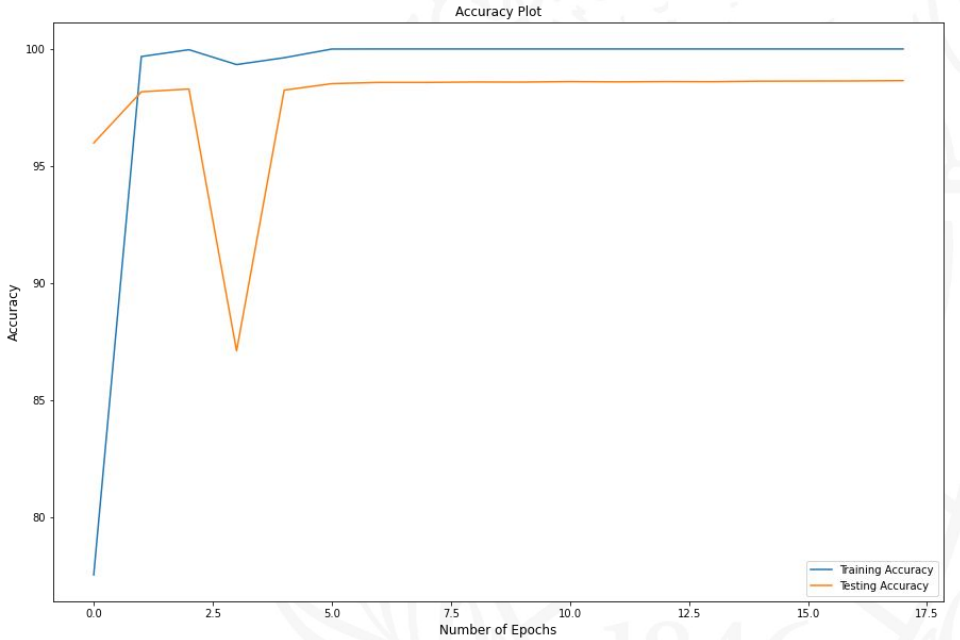
Approach

Image->apply kernel -> classify-> apply weight -> prediction



Train & Testing Analysis





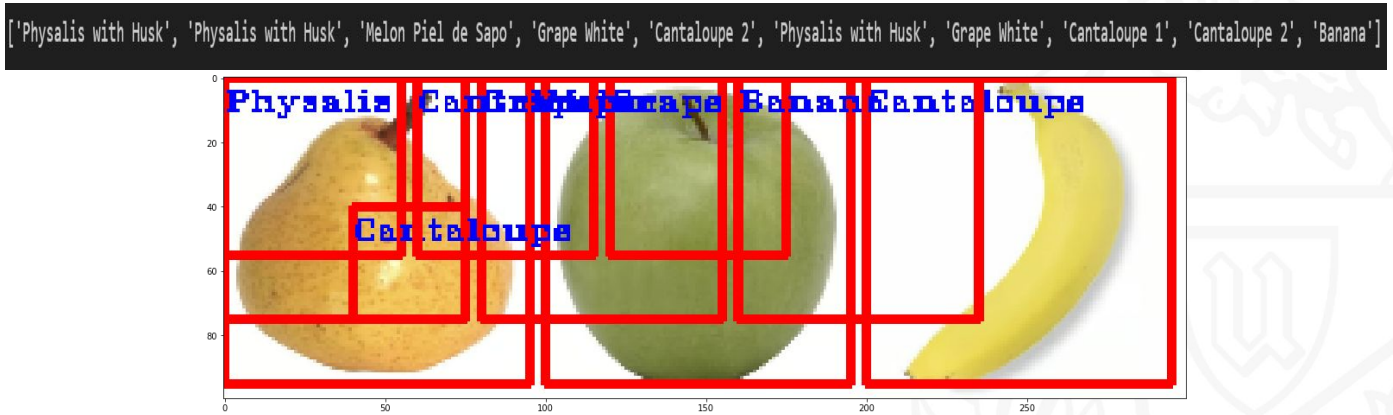
Fruit Detection on multi-fruit image

{'Watermelon': 1, 'Pepper Green': 2, 'Pear': 1, 'Apple Braeburn': 1, 'Blueberry': 1, 'Potato Sweet': 1}

Pros:
Good in classify samples that originally in test and training samples

Cons:
Some of the fruit class is not able to identify its type without given the name for our human eyes to recognize from dataset

Result on images outside dataset



‘Physalis with Husk’, ‘Melón Piel de Sapo’, ‘Grape White’, ‘Cantaloupe 2’, ‘Cantaloupe 1’, ‘Banana’

Limitation

- Some labels in dataset refers to fruits that looks similar to other in real life
- There are too many labels in the model and there is a lack of clear distinction between them.
- Our algorithm has no promising performance on images with greater scale or non-white background
- The classifier exists multiple box detection.

Lessons We Learned

From this final project, we are able to learned how to apply computer vision knowledge to solve real life problems. It could also be a big potential application for deeper development on the image processing part, it could be very beneficial for people who work in the orchard. With our application, they can take photos from the whole orchard just one single image that can help them recognize and count the total number of different categories of fruit and vegetables in orchard, instead of taking photos one by one.

Thank you

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