Fruit Classification using Transfer Learning

Computer Vision

Domain

Food Industry, Commodities

Business Context

Fruit Classification is a popular task that is being widely researched upon by top e-commerce companies such as Walmart, Amazon, etc. Segregating fruits using their images helps in inventory management for e-commerce companies.

In this practice case study, we will use transfer learning for the purpose of fruit classification.

Objective

Classify the fruits using traditional CNNs and then compare its performance using Transfer learning.

Dataset description

The following fruits are included:

Apples (different varieties: Crimson Snow, Golden, Golden-Red, Granny Smith, Pink Lady, Red, Red Delicious), Apricot, Avocado, Avocado ripe, Banana (Yellow, Red, Lady Finger), Beetroot Red, Blueberry, Cactus fruit, Cantaloupe (2 varieties), Carambula, Cauliflower, Cherry (different varieties, Rainier), Cherry Wax (Yellow, Red, Black), Chestnut, Clementine, Cocos, Corn (with husk), Cucumber (ripened), Dates, Eggplant, Fig, Ginger Root, Granadilla, Grape (Blue, Pink, White (different varieties)), Grapefruit (Pink, White), Guava, Hazelnut, Huckleberry, Kiwi, Kaki, Kohlrabi,

Kumsquats, Lemon (normal, Meyer), Lime, Lychee, Mandarine, Mango (Green, Red), Mangostan, Maracuja, Melon Piel de Sapo, Mulberry, Nectarine (Regular, Flat), Nut (Forest, Pecan), Onion (Red, White), Orange, Papaya, Passion fruit, Peach (different varieties), Pepino, Pear (different varieties, Abate, Forelle, Kaiser, Monster, Red, Stone, Williams), Pepper (Red, Green, Orange, Yellow), Physalis (normal, with Husk), Pineapple (normal, Mini), Pitahaya Red, Plum (different varieties), Pomegranate, Pomelo Sweetie, Potato (Red, Sweet, White), Quince, Rambutan, Raspberry, Redcurrant, Salak, Strawberry (normal, Wedge), Tamarillo, Tangelo, Tomato (different varieties, Maroon, Cherry Red, Yellow, not ripened, Heart), Walnut, Watermelon.

A few examples from the dataset are as follows:

Apple Eggplant Guave

- Total number of images: 90483.
- Training set size: 67692 images (one fruit or vegetable per image).
- Test set size: 22688 images (one fruit or vegetable per image).
- Multi-fruits set size: 103 images (more than one fruit (or fruit class) per image)
- Number of classes: 131 (fruits and vegetables).
- Image size: 100x100 pixels.

Filename format:

imageindex100.jpg (e.g. 32100.jpg) or

rimageindex100.jpg (e.g. r32100.jpg) or

r2imageindex100.jpg or

r3imageindex100.jpg.

"r" stands for rotated fruit.

"r2" means that the fruit was rotated around the 3rd axis.

"100" comes from image size (100x100 pixels).

Different varieties of the same fruit (apple for instance) are stored as belonging to different classes.

Steps

1. Load the data : Read the zip file fruits.zip and extract it's contents.

2. Initialize ImageDataGenerator Class
   Train data generator
   - Re-scale the images
   - Specify shear intensity
   - Specify range for random zoom
   - Randomly flip inputs horizontally

   Test data generator
   - Re-scale the images

3. Get training & testing data from ImageDataGenerator
   - Give directory path
   - Give target size
   - Give batch_size
   - Specify classes, to use less number of classes we need to give class names in a list(we are using less classes to reduce the execution time)
   - Specify class_mode
   - Specify color_mode

4. Check class mappings

5. Visualize the data

6. Build Pretrained model

- Load ResNet-50 with the Imagenet weights
- Remove the top layers so we can add our own layer according to the number of classes
- Add our own layers to complete the model architecture

7. Compile and fit the model
8. Compare the pretrained and Vanilla models by plotting loss and accuracy

Further Explore:

1. Can you try using other pre-trained models for this problem statement and compare against the ones already tried out
2. Can you change the number of classes and see if there's difference in performance of model

Learning Outcomes

- Transfer Learning
- Image Classification
- CNNs