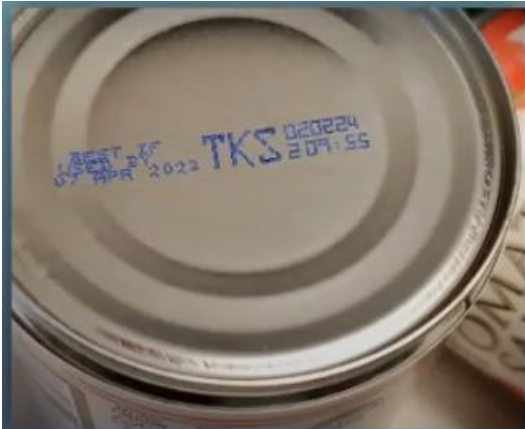# PE

Image Classification

Machine Learning Enabled Expiry Date Recognition and Object Classification of Grocery Products.

Introduction and Problem Definition

Aim to create a system to identify the grocery product and the expiry date if mentioned;

Often harder to read

BEST BEFORE:
20APR2018

BETTER BY
26OCT2017

05/07
BBE, MAY 2010

FEB102015
37450092

MFG: 020715
EXP: 020717

FEB102015
37450092

FEB102015
37450092

15JUN16
05P1205

BEST BY
04 25 12

shutterstock.com · 703939990

Not a standardized date format for all products

SO, to create this application i divided the project into two phases.

1)in the first phase we divide the product into one of the 6 classes.

2) in the second phase we will detect the expiry date.

Data Sets used

1)The dataset for image classification was obtained from "The Freiburg Groceries Dataset" which is a publicly available dataset containing 5000 RGB images of various food classes. For the first part of our project we will classify the images broadly into 5 labels: Fruits, Vegetables, Beverages, Snacks and Other .

2)The dataset for date detection was obtained from "ExpDate" dataset which is again a publicly available dataset. This dataset has images corresponding to real images of products with their expiry dates,

Preprocessing of the data

Images in the data set are of high quality,so thousands of such images would result in large usage of resources and longer model run time,

So in order to reduce the training time and increase the accuracy.i went for a image compression technique.(PCA) as they retain maximal amount of information and produce dimensionality reduction.

Results of PCA

1) 50 Components were used

Variations -98% in Blue,97.5% in Red,98% in Green.

By isolating channels, you can extract features that are clearer in one channel than in others, which can be helpful in tasks like object detection.

 how well PCA preserved the data's information across the blue, green, and red channels.

Data Augmentation

The amount of data required for this application is very large.or else model will overfit. To tackle this issue.i did image augmentation.

Tensorflow will provide multiple models, like Leftflip,Rightflip,90 degree flip,270 degree flip,Brightness, etc..

I performed all of these and increased the dataset to capture the expiry date clearly
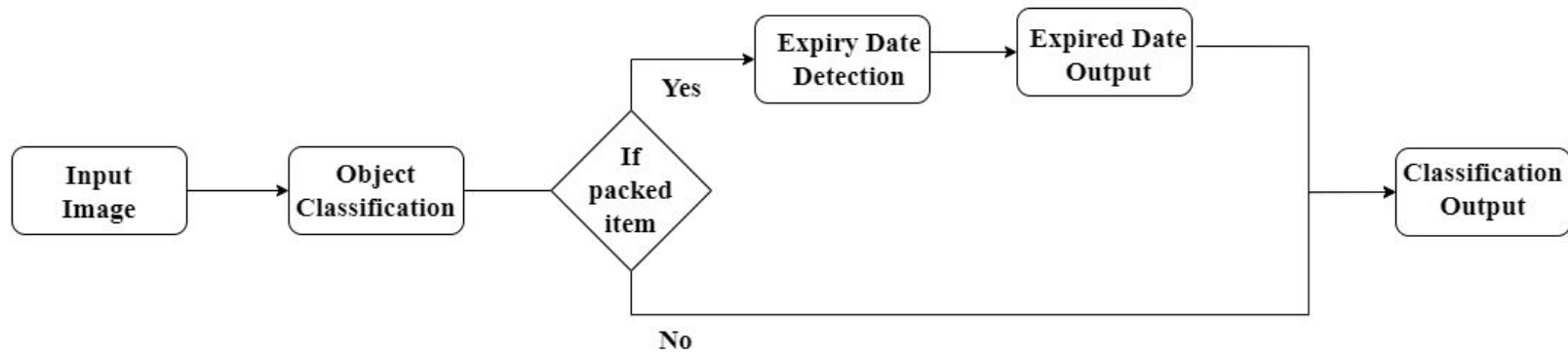
Classification Model

1) My classification model basically classifies each product into two categories Packed or unpacked.

2) A supervised learning approach was used for image classification of the grocery data set, where it classifies items like diary,beverages etc.
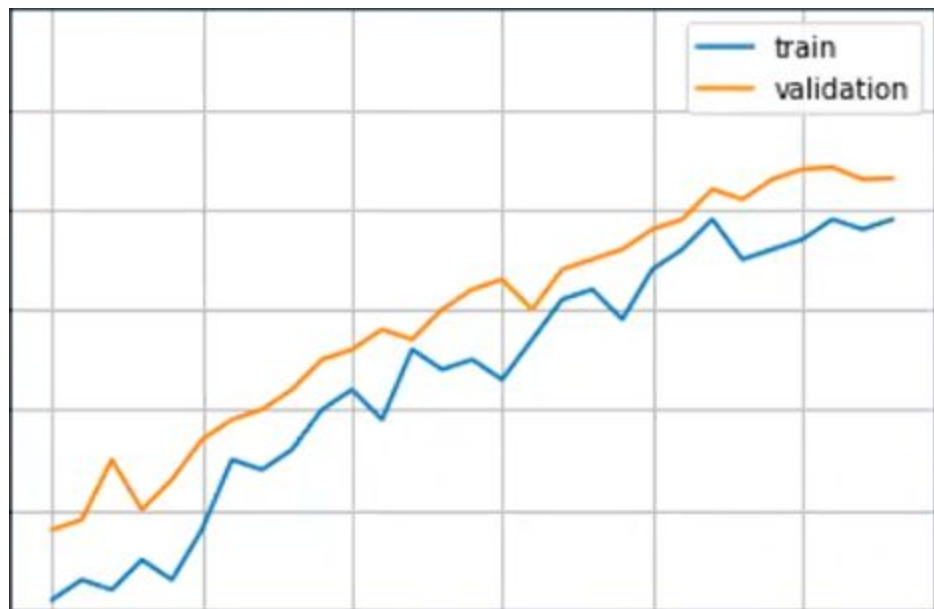
3) I used pretrained resnet 50 model, which was trained on the **imagenet** dataset ,which is a huge dataset contains 100,000 images.
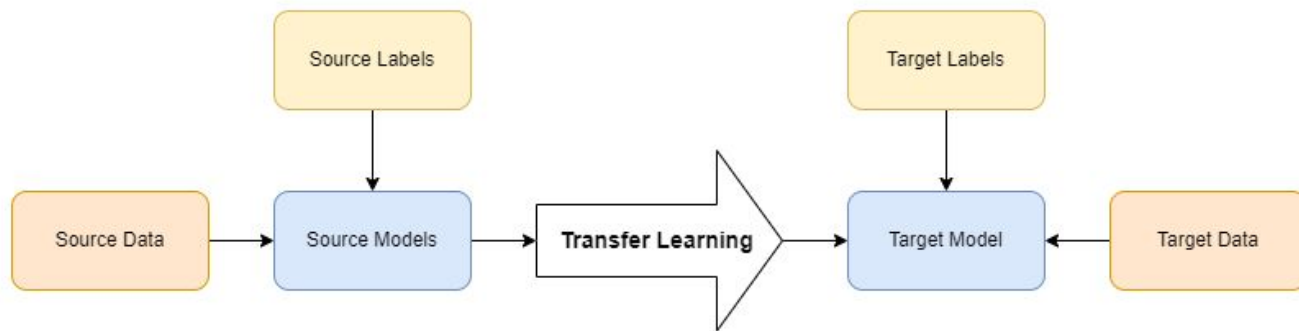
4) i did fine tuning of the model on the dataset i used.

5)so this whole mechanism is called transfer learning.

6) added dropout layers to overcome overfitting

7) and i got around 83% accuracy.

Source Labels

Source Data → Source Models → **Transfer Learning** → Target Model ← Target Data

Target Labels

```
output_class=class_names[np.argmax(pred)]
print("The predicted class is", output_class
```
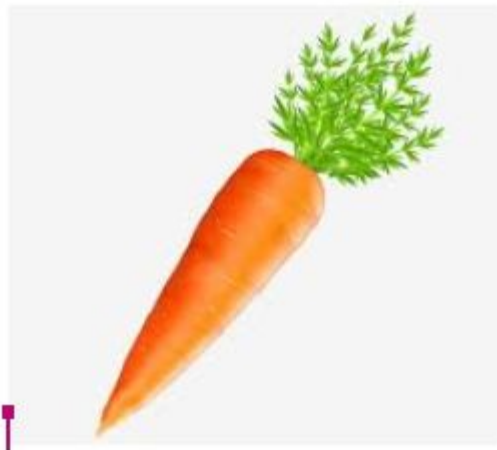
The predicted class is fruits


```
output_class=class_names[np.argmax(pred)]
print("The predicted class is", output_class)
```

The predicted class is packed

```
output_class=class_names[np.argmax(pred)]
print("The predicted class is", output_class)

The predicted class is packed
```
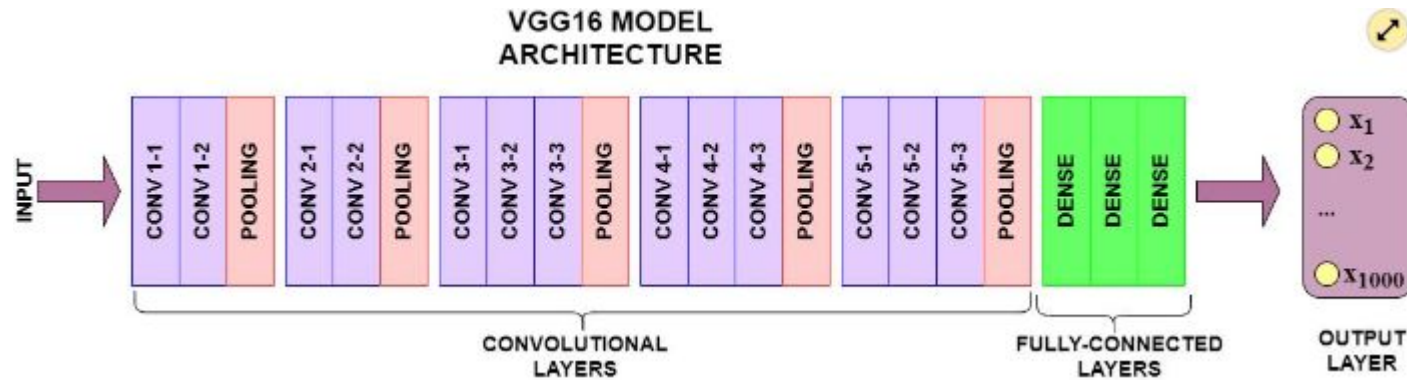


```
output_class=class_names[np.argmax(pred)]
print("The predicted class is", output_class)

The predicted class is vegetables
```

Date Region Detection

VGG

- I detected the bounding box coordinates of the probable region where expiry date could be present.

- Used supervised regression model that was trained on **X date** data set using VGG 16 as a base and transfer learning.

- The output of the below image is the X and Y coordinates of the detected region.

VGG16 MODEL ARCHITECTURE

INPUT → CONV 1-1 | CONV 1-2 | POOLING | CONV 2-1 | CONV 2-2 | POOLING | CONV 3-1 | CONV 3-2 | CONV 3-3 | POOLING | CONV 4-1 | CONV 4-2 | CONV 4-3 | POOLING | CONV 5-1 | CONV 5-2 | CONV 5-3 | POOLING | DENSE | DENSE | DENSE → x_1 x_2 ... x_{1000}

CONVOLUTIONAL LAYERS — FULLY-CONNECTED LAYERS — OUTPUT LAYER

- Custom layer architecture.

| 4 neuron layer for top-left and bottom-right coordinates | Sigmoid function for scaling between 0 & 1 | Mean-squared error loss function for training box detection |

Bounding Box Regression Loss on Training Set

With the help of hyperparameter tuning got: 91% validation accuracy and around 0.01 loss. On relu activation function. → 30 epochs
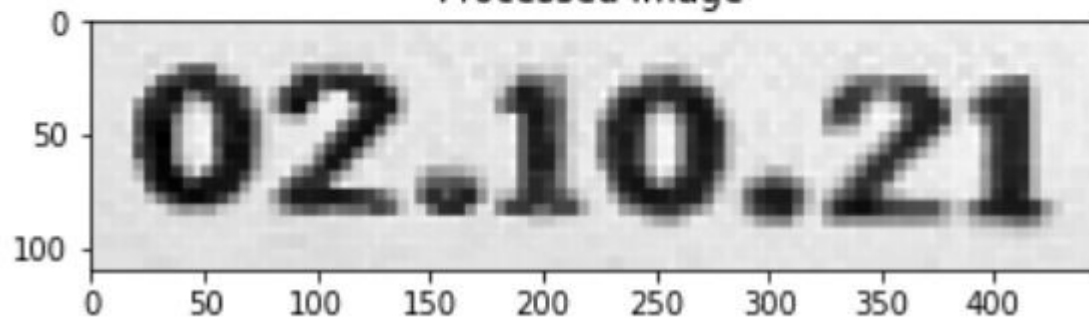
OCR

- Crop Image according to bounding box coordinates to get Region of interest.

- Apply Image Processing Techniques to cropped image:
  - Convert to grayscale
  - Resize
  - Morphological Transformation.

- Used EasyOCR to extract date from cropped image.

Original Image
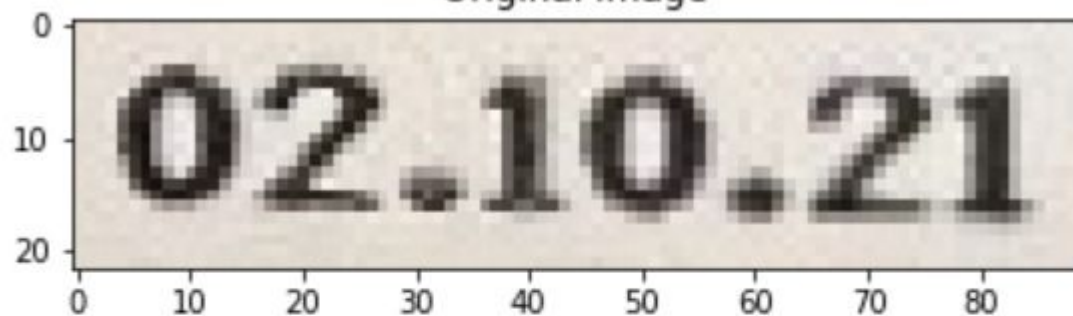
02.10.21

Processed Image

02.10.21

OCR output : 02.10.21

Results

```python
print("The predicted class is", output_class)
print("Detected expiry date is", date)
```

The predicted class is Packed
Detected expiry date is 2021.03.17

```python
print("The predicted class is", output_class)
print("Detected expiry date is", date)
```

The predicted class is Packed
Detected expiry date is Sep/10 11

Thank You