IMAGE CLASSIFICATION

Submitted by:

MOHAMMED MINHAJ

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Wikipedia, Youtube.com, google.com. The data were collected from the used car website cardheko.com. Referred in study materials of machine learning which I am studying.

INTRODUCTION

- Business Problem Framing

  In respect to data science, images are part of it. For this type of complex type of project we can use deep learning. Here in this project we detect the images using deep learning. As we are human we can say what is in the images. But in case of images it can't. so we want to use some algorithms or model for it. The data is not given we want to collect it. For this project we have to scrape the three categories of images from amazon. That is Saree, trousers and jeans. We want to collect as much data for the project. As we know more data gives more accuracy.

- Conceptual Background of the Domain Problem

  Predict the images using detecting it's features. Which category of image is present in the image.

- Review of Literature

  Deep learning is also one of the part of machine learning. The things that machine learning cannot do, will be solve or done by deep learning. So here in this project we used deep learning for our problem solving. That is deep learning can classify the image. As we are humans, we can understand what is in the image. But machine can't. it will detect the all features of the image using models and predict the image categorization. For all this process machine want to learn about data. So try to give more data for getting high performance and better accuracy. It will also results in prediction.

- Motivation for the Problem Undertaken

  As technology increases every problem have been solved by technically. Simply we can say that modern problem have modern solutions. In this project we classify the image category. Machine successfully done it. Recent days government introduced the AI

camera in roads. It helps to reduce accidents and there is a good driving in the roads because of this AI camera. So these are not futuristic these are presents. In future may be there is more technical aspects were taken for each problem.

Analytical Problem Framing

- Mathematical/ Analytical Modelling of the Problem

  In this project our aim to classify the images for three categories. We have three categories of images saree, trouser, jeans. The model can understand the image by it's features.

- Data Sources and their formats

  As we want to predict the image classification, we want the image data for prediction. For data collection I have scrapped the images from the website amazon. Around total of 3000 images were scrapped for all categories. The image is in the JPG format.

- Data Pre-processing Done

  As we are scrapped colour images we have three dimensional matrix of images. That is it contains, height of the images, width of images and RGB. If we have black and white image we have only one channel. Later resize the image by 255. Using image data generator specify the labels. That is the categories of images we have.

- Data Inputs- Logic- Output Relationships

  For better predictions, we want the good and more type of data. That is in simple words, we want better input to results the better output. As we want to predict the images classification, machine will learn all the images briefly. That is, how the each category of images differ from others. Machine will detect the basic features of

each images and try to learn the different features of different category of images.

- State the set of assumptions (if any) related to the problem under consideration

  As we want to predict the image classification we have to assume that each images have different features. These features were understand by machine while learning.

- Hardware and Software Requirements and Tools Used

  As we want to predict the image classification we have used tensor flow and keras for pre-processing and model building phase.
  Here we used layers module from keras for specifying the layers were dense or flatten. From models module from keras we have sequential and model itself. For importing each models I have used applications module from keras applications. I have used three different models, VGG16, RESNET50, INCEPTIONV3. From keras pre-processing module I have imported image data generator for specifying the classification. And image and load image for loading the image. Glob module is used for retrieving the specified pattern. Numpy module is used, Matplotlib module is used for visualization. Warning module used for ignoring the warning messages. And for this project I used google colab for using the GPU(graphical processing unit) for better and fast performance.

Model/s Development and Evaluation

- Identification of possible problem-solving approaches (methods)

  As usual, for prediction we want a clean data for learning. It results the better performance of the model gives better accuracy. Machine will understand and categorize the images by understanding the features.

- Testing of Identified Approaches (Algorithms)

  INCEPTIONV3 (Inception version3)

  VGG16 (Visual Geometry Group)

  RESNET50 (Residual Neural Network)

- Run and Evaluate selected models

  INCEPTIONV3

```
# fit the model
r = model.fit(
  training_set,
  validation_data=test_set,
  epochs=10,
  steps_per_epoch=len(training_set),
  validation_steps=len(test_set)
)
```

```
Epoch 1/10
151/151 [==============================] - 368s 2s/step - loss: 2.0344 - accuracy: 0.8639 - val_loss: 1.1045 - val_accuracy: 0.
9483
Epoch 2/10
151/151 [==============================] - 37s 246ms/step - loss: 1.6157 - accuracy: 0.9293 - val_loss: 2.4388 - val_accuracy:
0.9500
Epoch 3/10
151/151 [==============================] - 37s 247ms/step - loss: 2.1868 - accuracy: 0.9251 - val_loss: 1.1780 - val_accuracy:
0.9517
Epoch 4/10
151/151 [==============================] - 37s 245ms/step - loss: 1.9277 - accuracy: 0.9388 - val_loss: 1.9829 - val_accuracy:
0.9517
Epoch 5/10
151/151 [==============================] - 37s 245ms/step - loss: 1.8058 - accuracy: 0.9530 - val_loss: 1.1666 - val_accuracy:
0.9583
Epoch 6/10
151/151 [==============================] - 37s 246ms/step - loss: 1.7657 - accuracy: 0.9501 - val_loss: 2.7384 - val_accuracy:
0.9017
```

Here we have tried 10 epochs and we can observe that in each epochs the loss and accuracy of t6raining and validation is increasing. I have given categorical cross entropy, optimizer adam and metrics accuracy. for all models I have specify to not to train the existing layer as we all know it is already trained. Using image

data generator rescale the images and gives the range. And batch size given as 32. Gives the dense layer and activation function softmax.

RESNET50

```
# fit the model
res = model_resnet.fit_generator(
  training_res,
  validation_data=test_res,
  epochs=50,
  steps_per_epoch=len(training_res),
  validation_steps=len(test_res)
)
```

```
Epoch 1/50
76/76 [==============================] - 41s 492ms/step - loss: 2.4803 - accuracy: 0.5685 - val_loss: 0.9329 - val_accuracy:
0.6167
Epoch 2/50
76/76 [==============================] - 36s 470ms/step - loss: 0.7647 - accuracy: 0.7004 - val_loss: 0.3740 - val_accuracy:
0.8600
Epoch 3/50
76/76 [==============================] - 36s 469ms/step - loss: 0.4659 - accuracy: 0.7919 - val_loss: 0.3517 - val_accuracy:
0.8400
Epoch 4/50
76/76 [==============================] - 36s 471ms/step - loss: 0.4252 - accuracy: 0.8202 - val_loss: 0.5092 - val_accuracy:
0.8533
Epoch 5/50
76/76 [==============================] - 36s 471ms/step - loss: 0.3644 - accuracy: 0.8348 - val_loss: 0.2813 - val_accuracy:
0.8683
Epoch 6/50
76/76 [==============================] - 36s 473ms/step - loss: 0.3842 - accuracy: 0.8394 - val_loss: 0.3875 - val_accuracy:
```

Here we have tried 50 epochs and we can observe that in each epochs the loss and accuracy of t6raining and validation is increasing. I have given categorical cross entropy, optimizer adam and metrics accuracy. for all models I have specify to not to train the existing layer as we all know it is already trained. Using image data generator rescale the images and gives the range. And batch size given as 32. Gives the dense layer and activation function softmax.

VGG16

```
# fit the model
vg = model_vg.fit_generator(
  training_vg,
  validation_data=test_vg,
  epochs=50,
  steps_per_epoch=len(training_vg),
  validation_steps=len(test_vg)
)
```

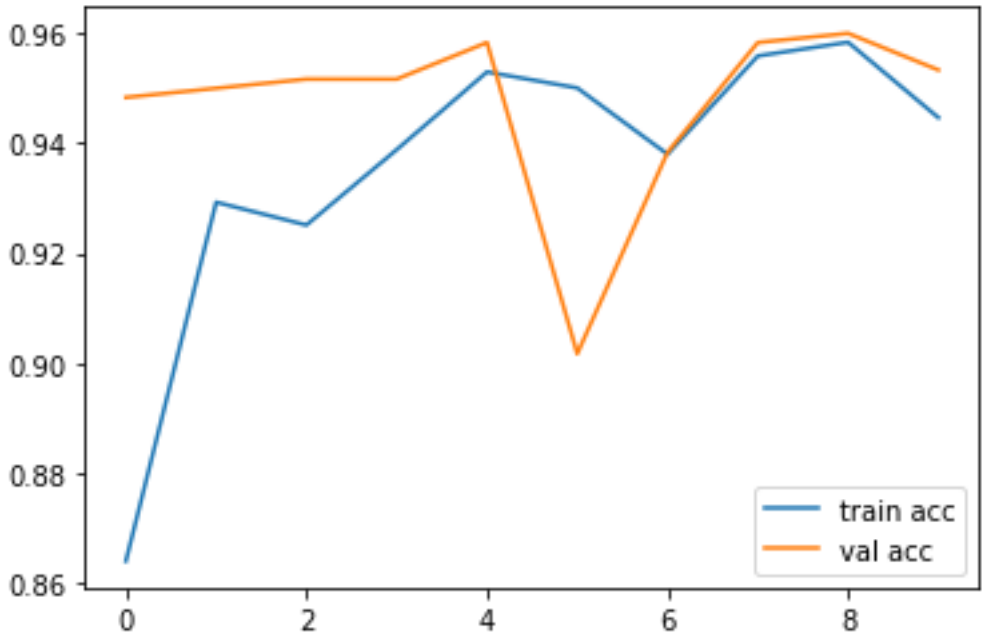
```
Epoch 1/50
76/76 [==============================] - 43s 531ms/step - loss: 0.3728 - accuracy: 0.8477 - val_loss: 0.3622 - val_accuracy:
0.9467
Epoch 2/50
76/76 [==============================] - 37s 491ms/step - loss: 0.2240 - accuracy: 0.9367 - val_loss: 0.1542 - val_accuracy:
0.9600
Epoch 3/50
76/76 [==============================] - 37s 489ms/step - loss: 0.1520 - accuracy: 0.9580 - val_loss: 0.2409 - val_accuracy:
0.9583
Epoch 4/50
76/76 [==============================] - 37s 490ms/step - loss: 0.1908 - accuracy: 0.9546 - val_loss: 0.1815 - val_accuracy:
0.9600
Epoch 5/50
76/76 [==============================] - 37s 488ms/step - loss: 0.1509 - accuracy: 0.9638 - val_loss: 0.1668 - val_accuracy:
0.9400
Epoch 6/50
76/76 [==============================] - 37s 490ms/step - loss: 0.2084 - accuracy: 0.9571 - val_loss: 0.2133 - val_accuracy:
0.9533
```

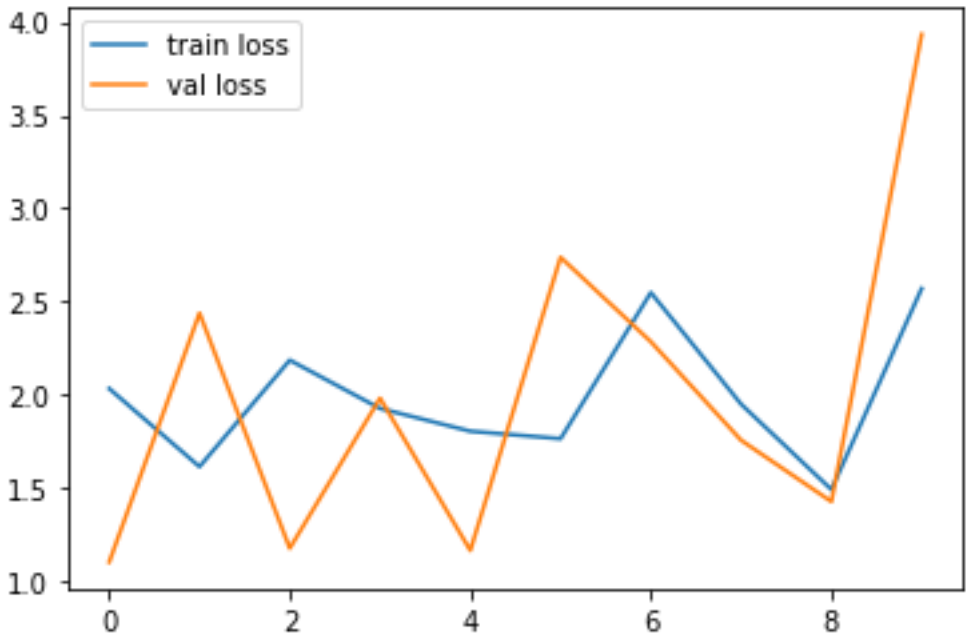
Here we have tried 50 epochs and we can observe that in each epochs the loss and accuracy of t6raining and validation is increasing. I have given categorical cross entropy, optimizer adam and metrics accuracy. for all models I have specify to not to train the existing layer as we all know it is already trained. Using image data generator rescale the images and gives the range. And batch size given as 32. Gives the dense layer and activation function softmax.

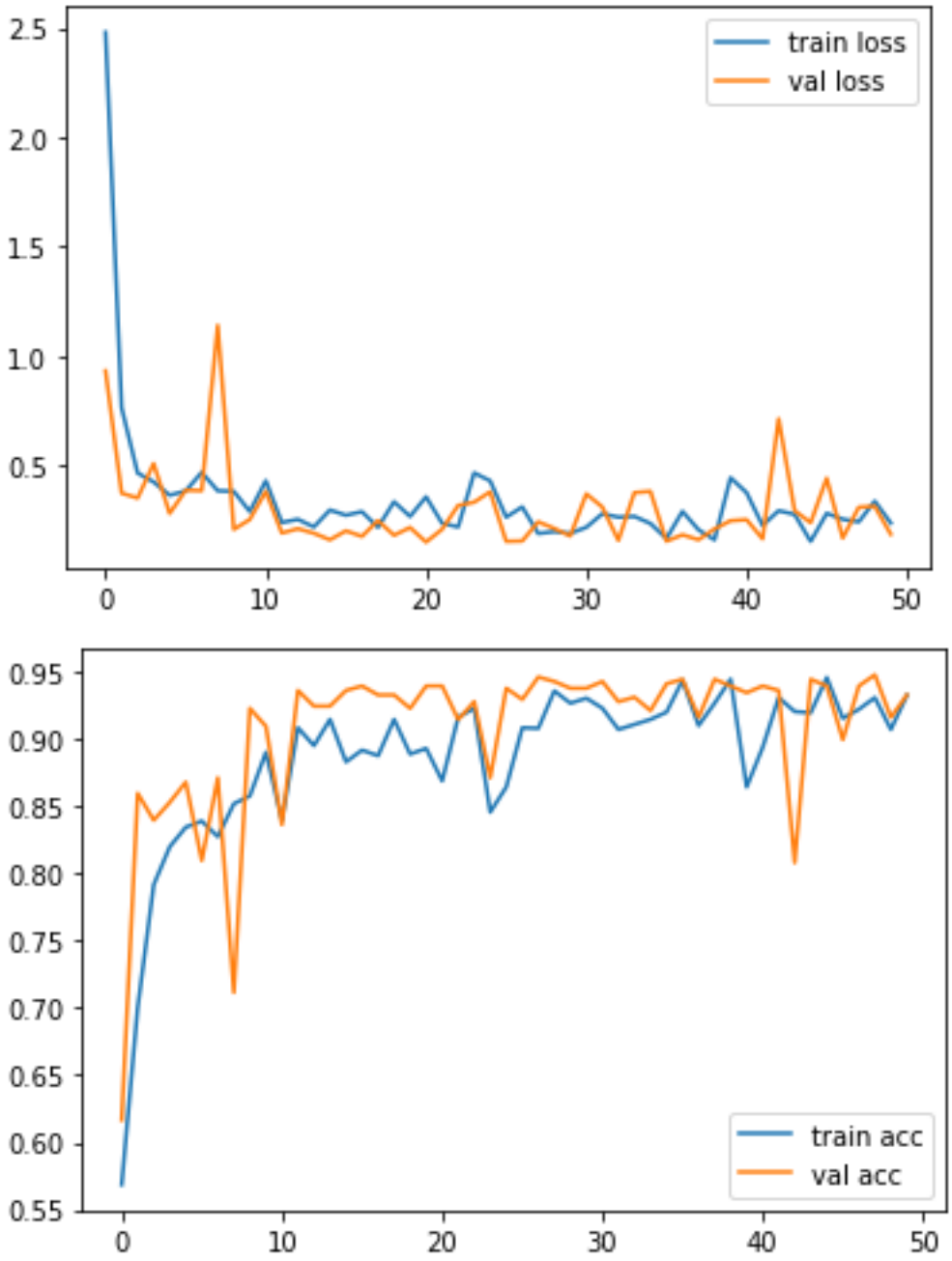
- Key Metrics for success in solving problem under consideration

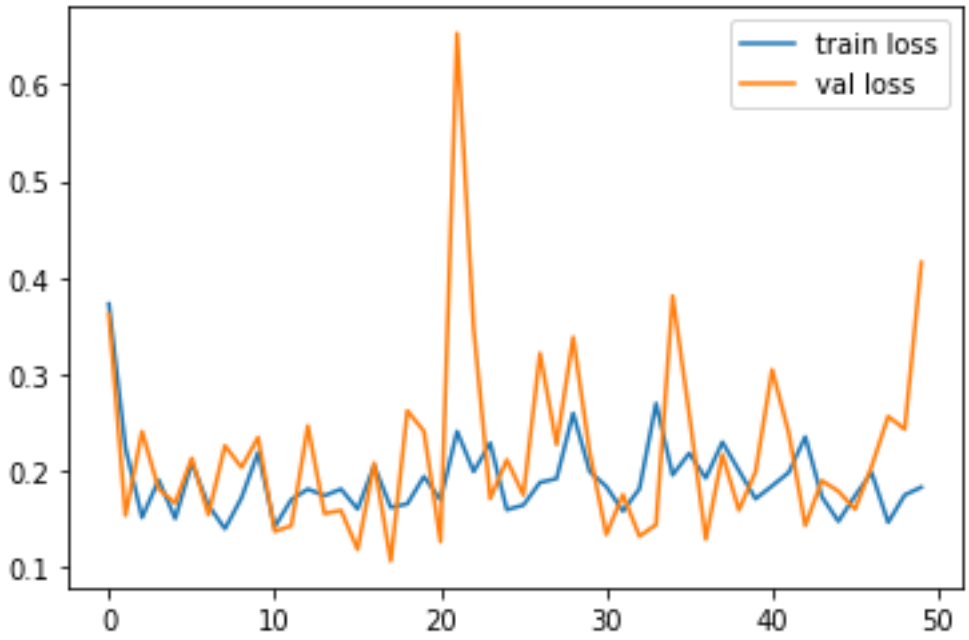
  Here I used the metrics accuracy. A model's performance is evaluated by the accuracy. it gives the result of how many percentage or how good the model can predict.

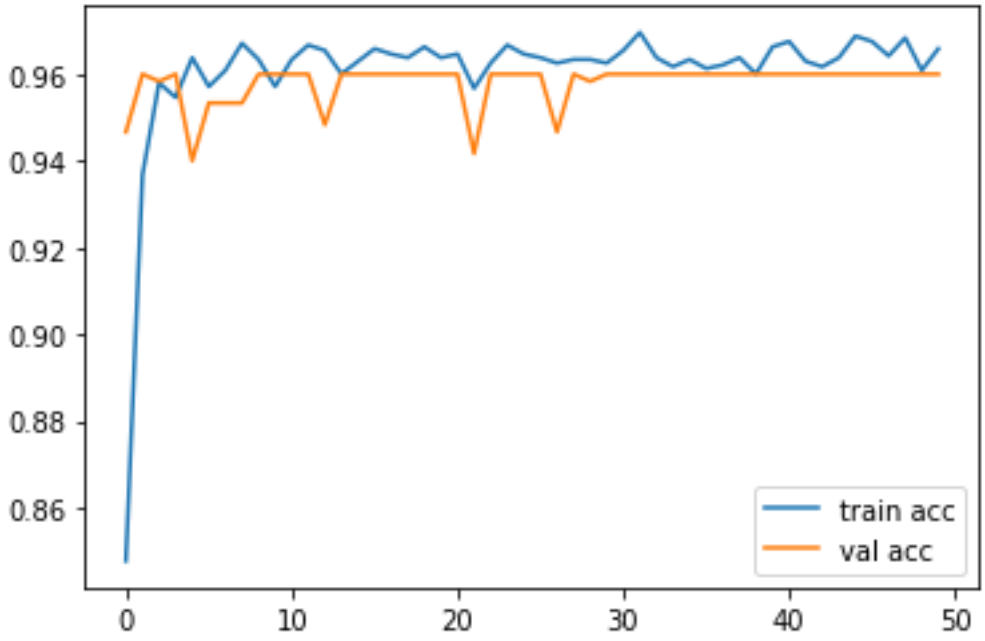
- Visualizations


0.96
0.94
0.92
0.90
0.88
0.86
0
2
4
6
8
train acc
val acc


4.0
3.5
3.0
2.5
2.0
1.5
1.0
0
2
4
6
8
train loss
val loss


train loss
val loss
2.5
2.0
1.5
1.0
0.5
0
10
20
30
40
50
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
train acc
val acc
0
10
20
30
40
50





Here using this visualizations we try to evaluate the loss and accuracy of each models in each epochs.

- Interpretation of the Results

  For a better understanding of data we can use different type of visualization techniques. After cleaning data machine can learn it wisely and deeply about data and gives a better results. Three categories of images were classify by the machines. Machine learn about the features in each images and different category of images have different features and machine try to learn it and categorize it.

CONCLUSION

- Key Findings and Conclusions of the Study

  I have created different folders to categorize the images and stored images in different categories. Deep learning is introduced for solving the complexity of the problem in machine learning. And the problem which machine learning cannot do can be done by deep learning. As we all know these all are part of the artificial intelligence. The purpose is almost same but for different processing.

- Learning Outcomes of the Study in respect of Data Science

  Visualization gives a basic understanding of data. How it is related among other features and how features related to target. A cleaned data gives better performance. Here for this project I used three different models. All models gives better performance. Here deep learning models purpose or aim is same. But processing time differs for each model. Each model have the capability solve the other models disadvantages. Here I finalize the model by evaluating it’s accuracy and loss. Here for this project VGG16 have almost equal loss and accuracy for each epochs.

- Limitations of this work and Scope for Future Work

  Deep learning is introduced for solving the limitations of machine learning. In simple words deep learning is the sub set of the machine learning. If there is any limitations in deep learning in future there will be solution for that. As we know technology is growing every day. New technologies are introducing in daily life.