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Deep Learning Framework Analysis

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Abstract – *Deep Learning Framework analysis involves exploration of machine learning frameworks. This portrays comparative analysis of the CNN model and behavior of machine learning frameworks in the field of image recognition and classification. There are many machine learning frameworks available today which could be used for classification problems. Some of the frameworks are well suitable for smaller datasets. Whereas some are better for larger datasets. Deep learning Framework Comparative Analysis will help us to get a better insight into the efficiency of the Convoluted Neural Network (CNN) models of most widely used Keras and Tensorflow machine learning frameworks.*

Key Words*: *CNN, Dataset, Pooling Layer, Optimization Function, Keras, Tensorflow, Classification

1. INTRODUCTION

Deep Learning framework analysis involves the comparative study of framework models efficiency, ease of data pre-processing and model building effort. In Machine Learning there are various competing Artificial Neural Network (ANN) implementing frameworks developed by different organizations. This work shows comparative analysis of each framework under standard test hyper parameter and test sets. This will be implemented using classification model. The independent variable values is the angle of the grating pattern of the input images and the dependent variable values (i.e. firing rate) of neurons. The final Output would be the accuracy of various models in recognizing images (cats or dogs).

2. RELATED WORK

There are existing classification problems in Kaggle to develop cats and dogs image recognition classification models using machine learning and Convoluted Neural Network (CNN). But there are no comparative studies or analysis done for the overall efficiency of the machine learning frameworks available. Authors such as, Francois Chollet has used Keras, Patrick Bue has used Microsoft Cognitive Toolkit (CNTK), Koustubh Sinhal has used Tensorflow, Emine Cengil used Caffee machine learning frameworks for the image recognition classification problems.

3. APPROACH

The stepwise approach followed in the deep learning framework analysis are given below.

1. Select the suitable dataset for the classification problem.
2. Determine preliminary set of Features and Labels
2. Clean up the dataset
3. Shuffle the training dataset
4. Save dataset into appropriate data frame after labelling required fields
5. Define the hyper parameters
6. Define the model
7. Normalize the data in data frame
8. Train Model by running epoch and passing data in batch
9. Define loss function and optimization function (Implement back propagation if needed)
10. Validate the model if necessary
11. Change the feature and or learning rate as necessary
12. Test the Model

4. IMPLEMENTATION

Python programming language and platforms such as Pycharm and Jupyter notebook are used to implement this work. Implementation steps are given below.

1. Divide the dataset into training and test datasets having 80:20 ratio of cat and dog images.
2. ImageDataGenerator of Keras image preprocessing library is used for preprocessing the datasets containing images. Also convoluted Cnov2D and Maxpooling2D features of Keras convoluted Neural Network layers are used to reshape and pool the images.

3. Implemented Relu and Sigmoid activation function, sigmoid activation function from CNN(Reference:1) for Keras framework

4. Reshape, max_pool2D, fully_connected, dropout features of Tensorflow framework are used to preprocess the datasets while analyzing Tensorflow Framework.

5. Activation function "Relu" is used in Tensorflow framework.

5. PERFORMANCE COMPARISON

Comparison of accuracy is done for image classification, (i.e. Image is dog or cat) by keeping same hyper parameters and same working platform.

Performance Comparison of the frameworks is done by following three important sections.

1. Ease of preprocessing: Preprocessing of dataset is less complicated and faster in Keras when compared to tensorflow. Keras uses sequential model, conv2D and maxPooling2D for preprocessing and shaping of the images of the dataset. These preprocessing functions are available in Keras library and easily importable functions. Whereas in Tensorflow lot of efforts to be done in converting images to tensors by using the function convert_to_tensor which is available in the tensorflow library.

2. Model building: Though it is complex building image classification model in Tensorflow (we have to convert images to tensors), model building is very much organized since it supports connected layers of Convoluted Neural Networks (CNN) better than Keras.

3. Accuracy: For the dataset having more than 10000 images, Kears will give better accuracy in predicting whether a given image is dog or a cat (classification: 1 for dog and 0 for cat) when compared to Tensorflow.

Chart -1 Shows the percentage of time required in different areas like, data preprocessing, model building, optimizing and efficiency of Keras machine learning framework implementation.

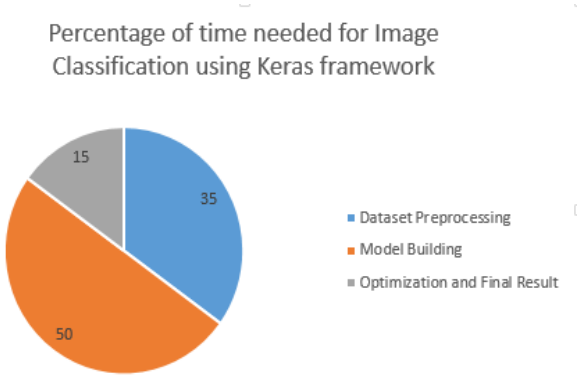

Chart -1: Time needed for the implementation of image classification using Keras framework

Chart -2 Shows the percentage of time required in different areas like, data preprocessing, model building, optimizing and efficiency of Tensorflow machine learning framework implementation and Chart -3 shows the accuracy of Keras and Tensorflow frameworks in predicting or recognizing the images.

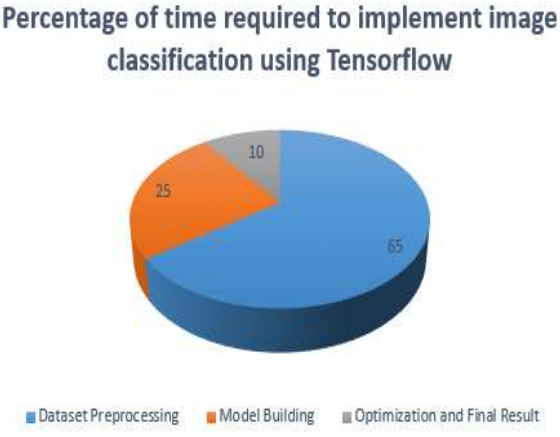

Chart -2: Time needed for implementation of image classification using Tensorflow framework

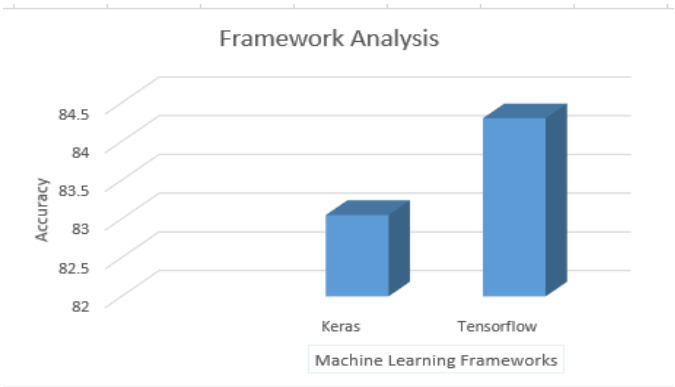

Chart -3: Accuracy comparision between Keras and Tensorflow machine learning frameworks.

6. CONCLUSION

To put it briefly, for image classification machine learning problems having more than 10000 images in the dataset, it is always better to use "Tensorflow" machine learning framework when compared to Keras framework.The accuracy obtained by using Keras framework in recognizing the images after training is 83.05. The accuracy obtained by using Tensorflow framework in recognizing the images is 84.3%.Hence, Tensorflow machine learning framework works better when dealing image recognition problem with large datasets when compared to Keras which has less accuracy in predicting the images.

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