Report on Binary Classifier Trained and Tested using transfer learning with Private Camera Data

Group - 10

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Abstract

This report presents the development and evaluation of a binary classifier, trained and tested using private data collected from mobile phone cameras. The classifier aims to distinguish between two classes/categories based on the images captured. We describe the dataset used, the architecture of the classifier, the training procedure, result & discussion.

1 Experiment

The goal of this experiment is to build, train, and test a model where transfer learning is applied to the model that is able to classify two image classes from an image dataset.

2 Dataset

The dataset used in this experiment is the images of two classes captured by a mobile phone camera. The images are captured in 3180x3180 resolution but for the requirement these are converted to 32x32 in the spatial domain. It consists of two image classes chili and bean. In the data set, the total number of images is 1146. It has 573 images of chili and 573 images of beans. These images are captured from different angles and from different objects. It is ensured that around 80 different chilies and beans are taken to prepare the training set, around 25 different chilies and beans are used to prepare the validation set, and around 40 different chilies and beans are used to create the test set. No object of one set of data is redundant in another set.

(a) Chili (0) (b) Chili (0) (c) Bean (1)

(d) Chili (0) (e) Chili (0) (f) Bean (1)

(g) Chili (0) (h) Chili (0) (i) Bean (1)

Figure 1: Sample Images from Training Set

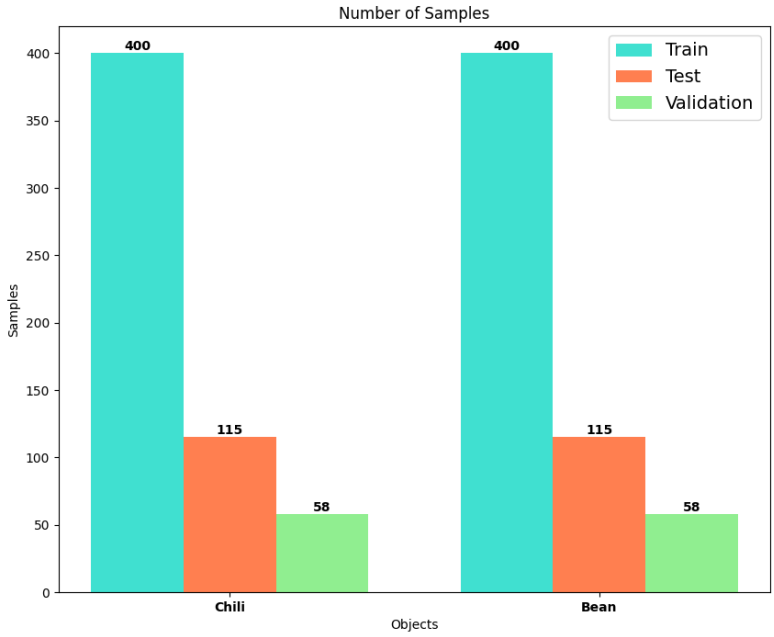

Figure 2: Dataset Stats

Figure 1 demonstrates some sample data from our training set. Where chilies are labeled with zero(0) and beans are labeled with one(1). These images are in the original resolution which we captured using the mobile phone. Figure 2 demonstrates the statistics of the dataset.

3 Classifier Architecture

A convolutional neural network (CNN) architecture is employed for image classification tasks where transfer learning is applied. The feature extraction layers from the VGG16 model with input shape 32,32,3 is used. One dense layer with 256 neurons is added. The weights are transferred from pretained VGG16 with imagenet dataset where 14 million images exist. Figure 3 demonstrates a Graphical representation of the model.

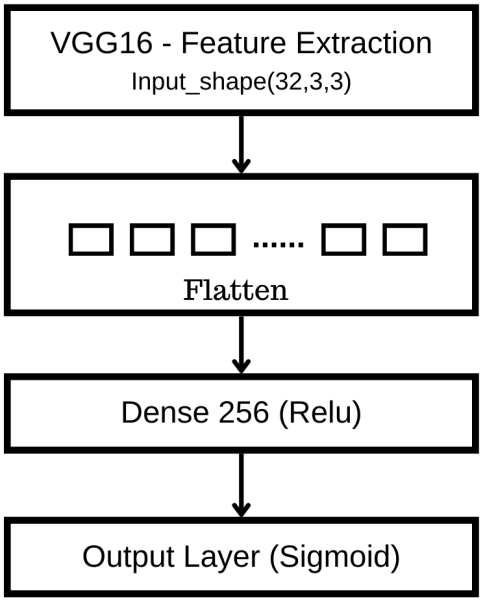

Figure 3: CNN Model with transferred weights from Pretrained VGG16

4 Training Procedure

The dataset has been split into training, validation, and test sets, with approximately 70% of the data used for training the remaining 10% for validation, and 20% for testing. The model was trained using Adam optimization with different learning rates and binary cross-entropy loss functions.

5 Results

The trained classifier achieved the following performance on different hyperparameters for the model:

Table 1 demonstrates the validation accuracy and loss in different epochs and learning rates. Figure 4 demonstrates one of the graphs of validation and training loss and accuracy. Where 10 epochs, input shape 32x32x3 are used and the number of neurons in dense layers is 32,64 and 32 respectively. The validation loss is 3.2% and the validation accuracy is 99.7%. This is the best result of this model.

Hyper Parameters		Evaluation	
Epochs	**Learning Rate**	**Validation loss**	**Validation Accuracy**
5	0.1	6.7%	96.3%
5	0.01	5.3%	97.7%
5	0.001	2.3%	99.5%
10	0.1	4.5%	98.4%
10	0.01	3.2%	**99.7%**
10	0.001	4.4%	97.8%

Table 1: `Results of the Model`

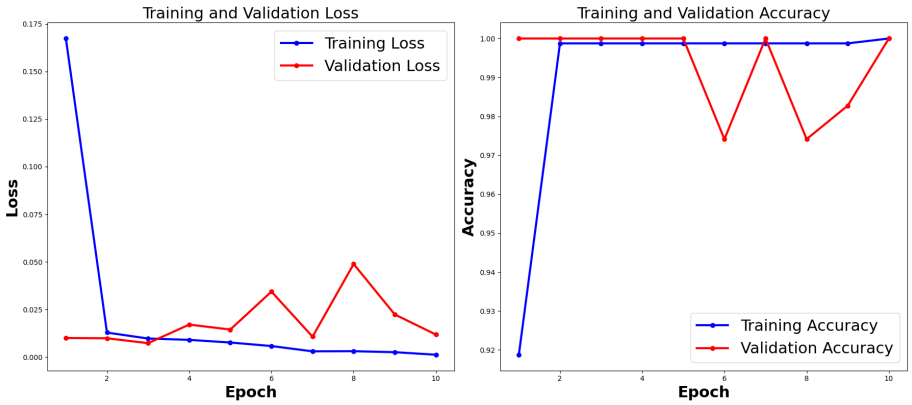

Figure 4: Validation and Training loss & accuracy of Weight transferred CNN

The test accuracy of the model : 99.13%

6 Discussion

The outcomes show how well the classifier differentiates between the photos of chili and beans. But there might be space for improvement, especially in terms of how different lighting, image quality, and object orientations are handled. The performance of the classifier may be improved by further augmentation methods and model design optimization.

7 Conclusion

In conclusion, utilizing personal information gathered from cameras, a binary classifier has been created, trained, and evaluated. The classifier correctly divides photos into two groups, demonstrating encouraging results. This work creates opportunities for machine learning model development with multiple applications using private camera data.