e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 6, Issue 11, November 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.54

International Journal Of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

An Android Application for Identifying Dog Breeds Using CNN

Santhosh T[1], Hemashree H C[2], Manasa G R[3], Madhuri Martis[4]

Assistant Professor, Department of Information Science & Engineering, Bapuji Institute of Engineering & Technology, Davanagere, Karnataka, India[1][2][4]

Assistant Professor, Department of Computer Science & Engineering, NMAM Institute of Technology, Nitte, Karnataka, India[3]

ABSTRACT: Dogs are domesticated mammals. Some dogs are kept as pets nowadays, while others assist people in their profession. The owners' responsibility to care for and preserve their pet dog is significant. To train and treat a sickness, they need to know the dog's breed. In this work adroid application is developed and n order to accomplish the goal of detecting the breed of a dog in a given image, convolution neural networks are used (CNN). On the dog breed data set, the network is trained and evaluated to determine the breed. To practice fine-grained image categorization, we were given an exclusively canine subset of Image-Net for this task. 120 dog breeds and a finite amount of training pictures per class.

I.INTRODUCTION

A subset of deep learning neural networks is the convolutional neural network (CNN), potent image processing algorithm. Right now, these are the best algorithms available for automatically processing images. These algorithms are widely used by businesses to do tasks like object identification in images and video recognition applications. CNN is primarily utilized for image analysis applications such segmentation, object detection, and picture recognition. Most of the dog breeds are developed to drive some specific things. Knowing the breed of dog can help us to predict and understand the behavior. This is essential when it comes to managing and training dogs for specific tasks. In this work a model is proposed

The objective is to develop a classifier that can identify a dog's breed from a picture. Convolutional Neural Network (CNN), a state-of-the-art image classification algorithm, is the used as the classifier. The following steps are involved:-

- Pre-processing images.
- Build helper functions such as human detector and dog detector.
- Train the classifier using transfer learning (Xception models).
- Predict and analyze the results.

The main library used to build CNN architecture throughout this project is Keras. To train the Convolutional Neural Networks using one of the largest databases of labeled images, we use Deep learning frameworks such as TensorFlow etc. We also need to create a Front-end android application to identify dog breeds with java and implement the built machine learning model using tflite.

Motivation:

This problem is not only challenging but also its solution is applicable to other fine- grained classification problems. For example, the methods used to solve this problem would also help identify breeds of cats and horses as well as species of birds and plants or even models of cars. Any set of classes with relatively small variation within it can be solved as a fine-

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

grained classification problem. In the real-world, an identifier like this could be used in bio diversity studies, helping scientists save time and resources when conducting studies about the health and abundance of certain species populations.

These studies are crucial for assessing the status of ecosystems, and accuracy during these studies is particularly important because of their influence on policy changes. Breed prediction may also help veterinarians treat breed-specific

ailments for stray, unidentified dogs that need medical care. Ultimately, we found dogs to be the most interesting class to experiment with due to their immense diversity, loving nature, and abundance in photographs, but we also hope to expand our understanding of the fine-grained classification problem and provide a useful tool for scientists across disciplines.

II.LITERATURE REVIEW

Dog breed identification is the recognition of the dog breed using an application. Our app aims to provide simple means of identifying a dog breed to help us predict and understand their behavior. The primary focus of this review is to analyze the advantages and disadvantages of various deep learning algorithms for image classification. Computer vision and machine learning techniques are used to predict dog breeds from images by identify dog facial key points for each image using a convolutional neural network. These key points are then used to extract features via SIFT descriptors and color histograms. We then compare a variety of classification algorithms, which use these features to predict the breed of the dog shown in the image. SVM with a linear kernel and it predicts the correct dog breed on its first guess 52% of the time; 90% of the time the correct dog breed is in the top 10 predictions. A sliding window SVM detector using SIFTS greyscale descriptors is used over each eye and nose. After the eyes and nose have been detected, greyscale SIFT descriptors around the key points are used as features by an SVM classifier.

Dog breed Identification using DenseNet, by WentingShi and MuyunLiu: This project is based on PR which is to identify the dog's breed. Dataset contains 10,000+ images of 120 breeds of dogs, we use 4 methods to do the identification. Each method has a different training model. The four models are ResNet18, VGG16, DenseNet161, and AlexNet. Based on our models, we also make some improvements on the optimization methods to increase our identification accuracy. This paper proposes DensNet model is best with accuracy of 89.14%.

Table 1: Comparison of different models (50 EPOCHS)

Model	Loss (Train/Test)	Accuracy (Train/Test)
ResNet18	0.0056/0.8782	0.8013/0.7542
DenseNet161	0.0031/0.5522	0.8954/0.8514
AlexNet	0.0131/1.6958	0.5419/0.5556
VGG16	0.0067/0.7371	0.7630/0.2667

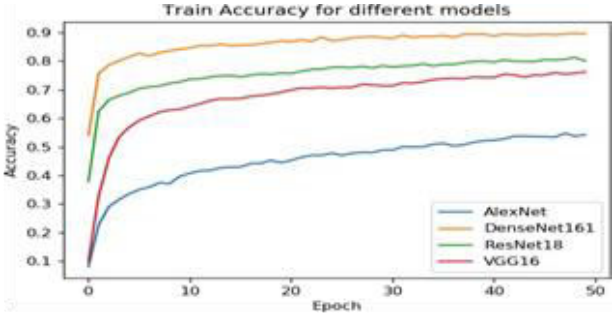


Figure 1: Train Accuracy for different models

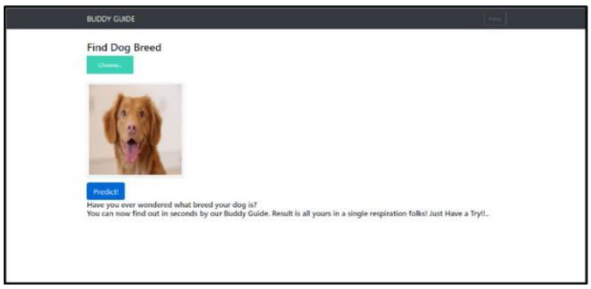
| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

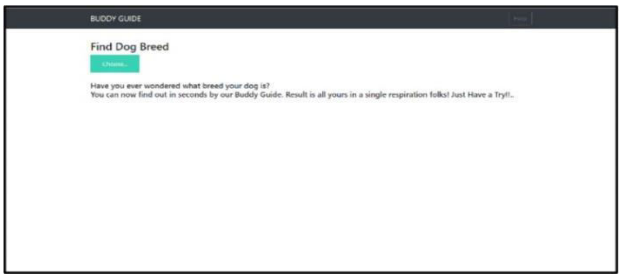
| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

Dog Breed Identification using CNN and WebScraping, by Praveen: The current paper presents the methodology of fine-tuning CNN which is implemented in Stanford dog breed dataset. There is several fine-tuned transfer learning which are widely used. In this application, Inception-ResNet-V2 [3] is implemented over the dataset. Web Scraping or Web Data Extraction is a technique employed to extract large amount of data from websites. It automates the process, so that instead of manually copying the data from websites, the web scraping will perform the same task within a fraction of the time. The Stanford dog breed dataset contains images of 120 breeds and there are 20,580 images in the dataset.

In this present paper, Inception-ResNet-v2 has been utilized in order to fetch the better performance. This network is 164 layers deep and classifies images into 1000 objects. The data model has to be saved for the further usage. In this current paper, the flow of the application has split majorly into 2 segments. Firstly, image processing using neural network. Secondly, data rendering using web scraping.





Literature Review Conclusion:

By going through the above research papers, we conclude that CNN is best for image classification related tasks due to its excessive accuracy. We define a CNN based approach for spotting dogs in perchance complex images and due to this fact reflect inconsideration on the identification of the one of kinds of dog breed.

III.METHODOLOGY OF PROPOSED SURVEY

This paper hopes to identify dog breeds from images. This is a fine-grained classification problem: all breeds of Canis lupus familiaris share similar body features and overall structure, so differentiating between breeds is a difficult problem. Furthermore, there is low inter-breed and high intra-breed variation; in other words, there are relatively few differences between breeds and relatively large differences within breeds, differing in size, shape, and color. In fact, dogs are both the most morphological and genetically diverse species on Earth. The difficulties of identifying breeds because of diversity are compounded by the stylistic differences of photographs used in the dataset, which features dogs of the same breed in a variety of lighting and positions.

The proposed system is an android application which enables users to up snap the picture of dog that they want to identify the breed of. It also provides feature to upload image of the dog to identify its breed. Instructions are also provided on how the application is supposed to be used. The application also enables users to view the database for descriptions or information regarding various breeds of the dog.

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

The image if that is snapped is fed to the deep learning model. The dog breed classification model is constructed by using transfer learning techniques. With transfer learning, we can train the model with a small dataset (Stanford dog dataset) by using existing pretrained CNNs from a large dataset such as ImageNet. Dog face images in the testing set are fed into the dog breed model, and then the model output is a predicted dog breed.

$$Loss = \frac{1}{N}\sum_{i=1}^{N} -\log\left(\frac{e^{f_{i,y_i}}}{\sum_{j=1}^{C} e^{f_{i,j}}}\right) \quad (1)$$

$$f_j(z) = \frac{e^{z_j}}{\sum_{k=1}^{C} e^{z_k}} \quad (2)$$

N = total number of training examples
C = total number of classes

The high level design can be classified based on 4 main components i.e., upload, take photo, view and instruction. These are the features included in the android application. The main purpose of Uploading and Taking photo is to get the picture of the dog that we need to predict the breed. The picture which we get is then passed through the model CNN model and then predicts the breed of the dog along with the accuracy. View represents the description of 120 breeds. An instruction lets the users on how to use the application.

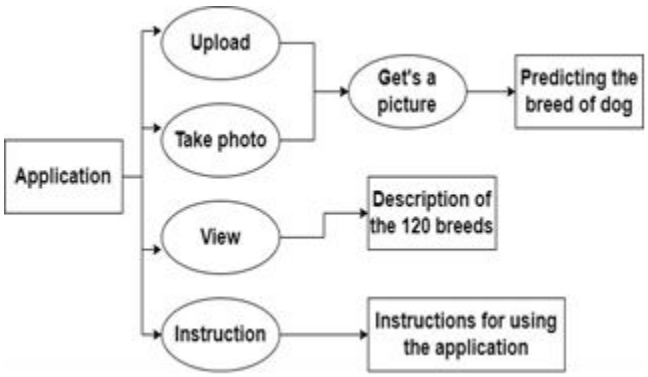


Figure 2: The high level design classification

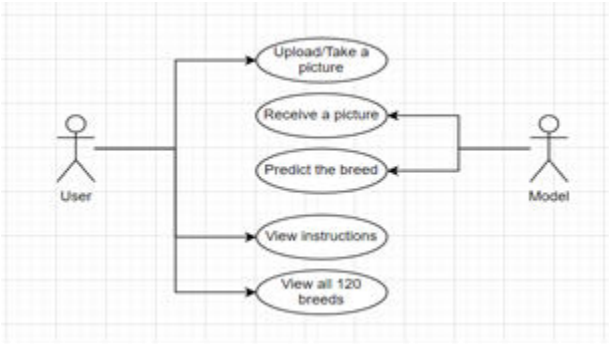


Figure 3: Use case diagram

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

Dataset:

The data set used for this project is the Stanford Dogs Dataset, which was obtained from the Kaggle website. The dataset contains about 120 different dog breeds with atleast 150 images under each breed. The author had a dataset which accommodated a total of 20 thousand images of dogs to work with for this project. We used the Stanford Dogs Dataset, which had 12,000 training images and about 8580 test image. There were 120 breeds represented, and a roughly equal number of data points of each breed.

Figure 4: Snapshot of the Stanford Dog Data Set

Feature Extraction:

We have extracted the features of images using pre-trained models, which are trained on image-net and sent to a fully connected layer. We have used different pre-trained models namely VGG16 and Xception to extract the features of the images. When VGG16 and Xception are used for extraction of features from an image, accuracy percentages of 1.24% and 98.7% are obtained respectively on the testing data.

Identification of the breed:

To use a Keras model on an android application, we will first, run the Keras model on a server. We then convert the model into a Tensorflow protobuff (pb) file. The following steps are involved in converting a Keras model to a Tensorflow pb file:

1. Run the Keras model on the server
2. Convert the model to a Tensorflow pb file.
3. Save the latest checkpoint.
4. Freeze the graph.
5. Finally, optimize the saved model.

Steps 1 and 2 can be done using Tensorflow whereas steps 3, 4 and 5 are done using bazel. Bazel is a build and test tool. We have used it to freeze the graph and optimize the saved model which is in the format of Tensorflow protobuff.

To add TensorFlow dependencies to android, we compile 'org.tensorflow:tensorflow- android:+' and load the protobuff file to assets folder. A Tensorflow inference interface has been created to send the uploaded image pixels to the network and get the predictions. Fig. 2 depicts how a prediction is obtained when an image is passed.

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

Fig. 5 Android app calls from JAVA to TensorFlow. The architecture given in Fig. 5 comprises of two repositories, namely Android Standard Development Kit (android SDK) and Android Native Development Kit (android NDK.).Android SDK is

written in Java. It is designed for interfaces and useful for characteristics like activities, fragments, event listeners etc. On the other hand, android NDK is coded in C++ and is used for working with C++ files. NDK can be useful for working with Tensorflow models, as Tensorflow itself is written in C++. Initially, the Bit-map input image is sent from SDK to NDK Tensorflow wrapper for Android (written in C++). It takes the given image and resizes it, i.e. to tensor and gives the obtained tensor to a pre-trained model (protobuff file), which is a pre-trained convolutional neural network. The model puts out a tensor (C++ file) which is returned to the SDK.

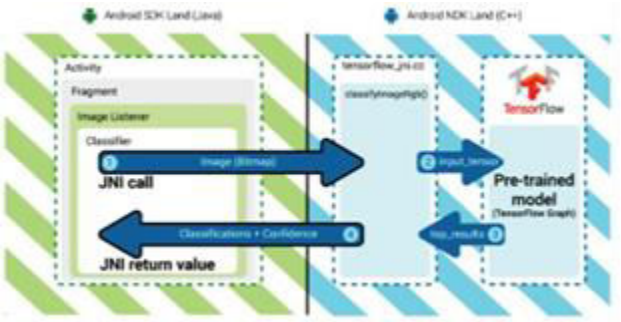


Figure 5: Android app calls from JAVA to Tensorflow

Traditional classification methods use hand engineered and hand-crafted features or contains large amount of prior knowledge and contains multiple pipelines for processing. So the feature extraction plays vital role than classification, which makes classification less effective. In order to overcome this traditional classification problem pre-trained CNN's are used, as their feature embedding is significantly appreciated. In this paper the pre-trained CNN models are trained over 1000 images and then a multi- class classifier is applied on the top of the features that are obtained by using these pre-trained models. Thus, finally obtain the classification accuracy. The flow diagram represents the methodology used for classification in the figure below, each block of the flow diagram clearly shows the processing steps. Using this methodology, we obtain the validation accuracies obtained by these different pre-trained models.

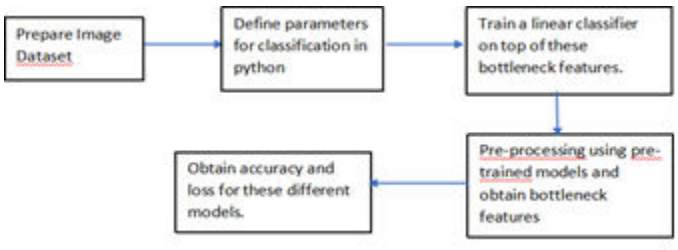


Figure 6: Proposed Methodology

Fine Tuning Pre-trained CNN model

We use ImageNet as a basic source domain for the pre-trained models for our dog breed identification task.

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

IV. RESULTS

Figure 7.1 shows the splash screen which is the first screen visible to the user when the application is launched. It is one of the most vital screens in the application since it's the user's first experience with the android application.

Figure 7.1: Splash Screen of the Application

The purpose of a Splash Screen is to quickly display a beautiful screen while the application fetches the relevant content if any.

Fig 7.1.2 shows the Home Page of the android application. The home page contains 2 features i.e a '+' button and an instructions button. The home page also includes a text '+ Add some dogs' which indicates and helps the user that '+' button at the bottom right is used to add dog pictures either through the camera by clicking in real time or through the image which is already saved.

Figure 7.1.2: Home Screen of the Application

When the user clicks the '+' button which is present at the bottom right corner of the home page, a pop-up screen will appear with two options as shown in the fig 7.1.3

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

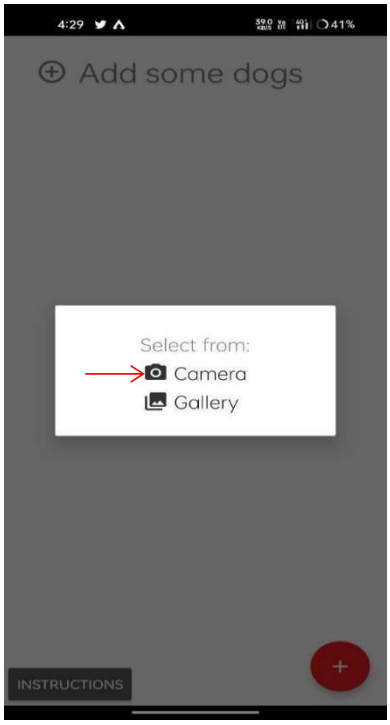


Figure 7.1.3: Image uploading options

Figure 7.1.4: Camera User Interface

Figure 7.1.3 depicts two image uploading options that is select the dog image from the gallery or snap the picture of the dog by using the smartphone's camera. In this way the application provides two ways to identify breed of the dog that user want's to know. Figure 7.1.4 shows the user interface of the built in camera app of the smartphone. When the user clicks on the 'Camera' option of Figure 7.1.3, the built in camera opens and allows the user to click the picture of the dog.

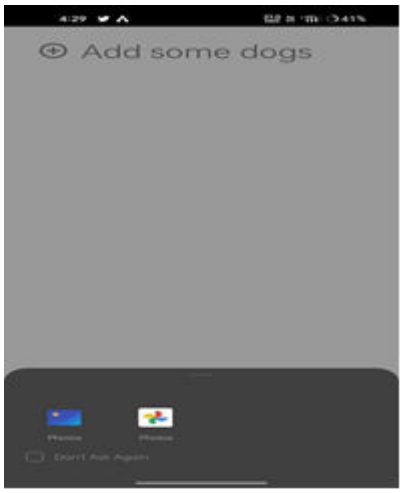


Figure7.1.5: To select built in images saved in gallery

Figure 7.1.6: Instructions

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

Figure 7.1.5 allows the user to select and upload the images of the dogs that were saved in the gallery. Figure 7.1.5 is popped when the user clicks on 'Gallery' option of Figure 7.1.3 Figure 7.1.6 contains the basic instructions on how to use the android application. The user can access this by clicking on the 'Instructions' button in the home page (Figure7.2).

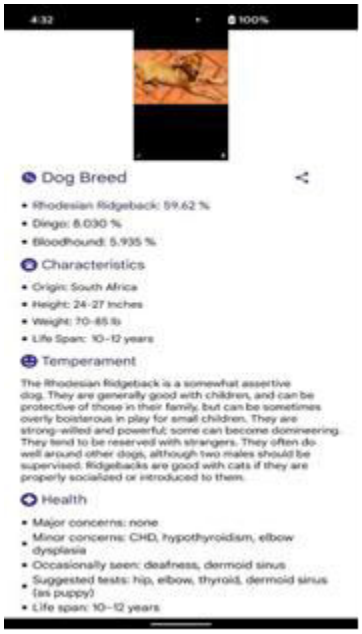


Figure 7.1.7: Prediction of the dog breed

In Figure 7.1.7, the image of the dog is clicked through the camera app of smartphone(Figure 7.1.4) and the trained CNN model that was built which has collection of 120 different breeds of dogs has predicted the breed. As we can see in Figure 7.1.7, it predicts the top 3 breeds and displays their corresponding accuarcy and displays the characteristics.

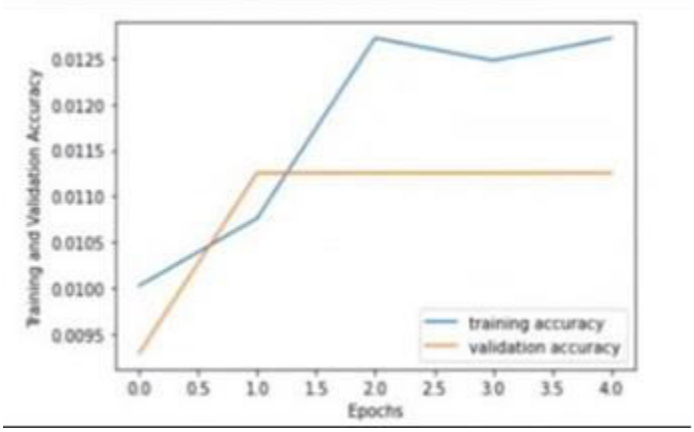


Figure 8.1: Training and validation accuracy (VGG16)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

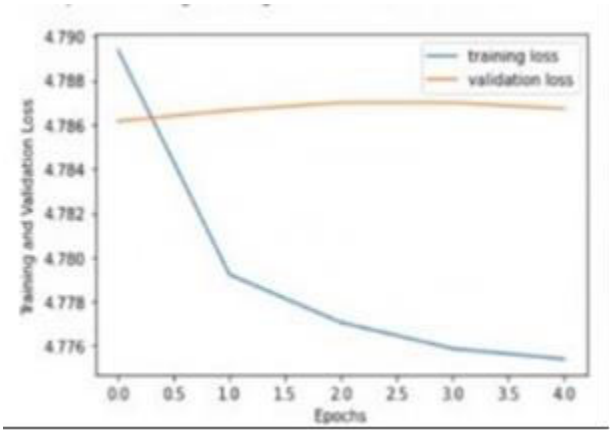


Figure 8.2: Training and validation loss (VGG16)

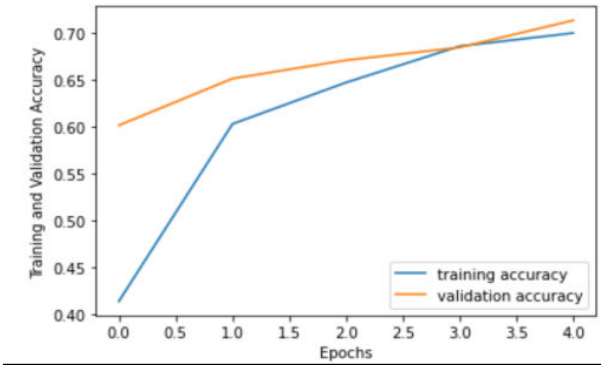


Figure 8.3: Training and validation accuracy (Xception)

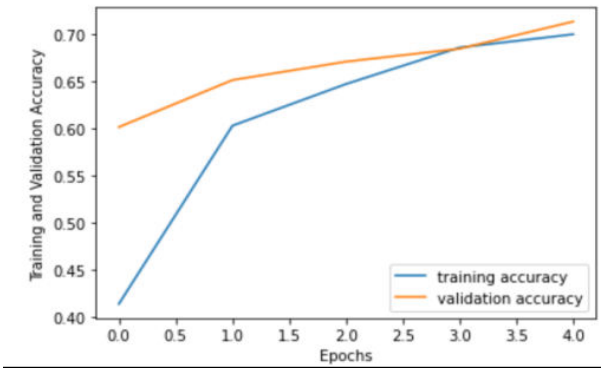


Figure 8.4: Training and validation loss (Xception)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54| Monthly Peer Reviewed & Referred Journal |

| Volume 6, Issue 11, November 2023 |

| DOI:10.15680/IJMRSET.2023.0611004 |

V.CONCLUSION AND FUTURE WORK

Convolutional neural network is a learning method for data analysis and predictions, now days it also become very popular for image classification problems. Dog breed prediction developed using convolutional neural network is to predict the breed of hundred images in taking their images as input. The results were pretty good for the images the model was shown. The algorithm was able to identify dog breeds quite exactly and displayed top 3 breed predictions along with their corresponding accuracy. The system that we have currently developed has some features that benefit the user while interacting on the android application. Further we want to focus more on making the application more user-friendly and appealing to the user of smaller ages to find the process more fun and engaging. We plan to focus on improving the overall performance of the system. Further we want to improve the security of the android application as android is open source and it is vulnerable to a lot of attacks. Creation of a discussion forum that would be the base for the interaction between the customer and the shopkeeper on the android app.

REFERENCES

[1] Francois Chollet, “Xception: Deep Learning with Depthwise Separable Convolutions”, arXiv: 610.02357v3, Apr, 2017.
[2] Alex Krizhevsky, IlyaSutskever and GeoffreyE. Hinton, “ImageNet classification with deep convolutional neural networks”, In Neural Information Processing Systems, pp.1106-1114, 2012.
[3] Christian Szegedy, Vincent Vanhoucke, Sergey Ioffe, Jonathon Shlens, ZbigniewWojna, Rethinking the Inception Architecture for Computer Vision, arXiv: 1512.00567v3
[4] Christian Szegedy, Sergey Ioffe, Vincent Vanhoucke, Alex Alemi, “Inception-v4, Inception-ResNet and the Impact of Residual Connections on Learning”, arXiv: 1602.07261v2, Aug, 2016.
[5] Barret Zoph, Vijay Vasudevan, Jonathon Shlens, Quoc V.Le, “Learning Transferable Architectures for Scalable Image Recognition”, arXiv: 1707.07012v3, Dec, 2017.
[6] Karen Simonyan and Andrew Zisserman, “Very Deep Convolutional Networks for Large-Scale Image Recognition”, arXiv: 1409.1556v6, Apr, 2015.
[7] Dylan Rhodes, “Automatic Dog Breed Identification”.
[8] J. Liu, A. Kanazawa, D. W. Jacobs, and P. N. Belhumeur, “Dog breed classification using part localization”, in Proc. European Conference on Computer Vision, 2012.
[9] C Szegedy, W. Liu, Y. Jia. P. Sermanet, S. Reed, D. Anguelov, D. Erhan, V. Vanhoucke and A. Rabinovich, “Going deeper with convolutions”. CoRR abs/1409.4842, 2014.
[10] A. Ahmeda, H. Yousifa, R. Kaysb and Z. Hea, "Semantic region of interest and species classification in the deep neural network feature domain", Ecological Inform., vol. 52, pp. 57-68, Jul. 2019.

Impact Factor
7.54

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com