Knowing Your Dog Breed: Identifying a Dog Breed with Deep Learning

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***Abstract*- Dog breed identification is important for a variety of reasons, including identifying distinct breed problems, health issues, social behaviour, and natural instinct. This study describes a method for recognizing dog breeds based on photographs of their faces. To recognize their breeds, the suggested method employs a deep learning-based methodology. The process starts with transfer learning, which involves retraining previously learned convolutional neural networks (CNNs) on the public dog breed dataset. The training dataset is then subjected to picture augmentation using various parameters in order to improve classification performance. The suggested technique is tested using three distinct CNNs with varying augmentation parameters and extensive experimental comparisons. On the published dataset of 133 observations, the suggested model achieves a promising accuracy of 89.92% for bog breeds**.

Keywords: Computer vision, deep learning, dog breed classification, transfer learning, image augmentation

I. INTRODUCTION

Machine learning may be a subfield of AI. Machine learning typically aims to understand the structure of information and fit the data into models that people can use and comprehend. Despite being a branch of computing, machine learning is not the same as conventional computational methods. Algorithms are collections of deliberately coded instructions that computers use to do calculations or solve problems in conventional computing. Instead, machine learning algorithms let computers act as coaches on data inputs and employ statistical analysis to produce results that are within a predetermined range. Machine learning makes it possible for computers to create models from sample data in order to automate decision-making processes that are backed by data inputs. The majority of dog breeds have been bred to drive certain things.

Knowing a dog's breed can help us anticipate and comprehend its behavior.
And this is crucial when managing and raising dogs for particular jobs. Convolutional neural networks (CNN) are more complex than feed-forward neural networks in machine learning. Due to its extreme accuracy, CNNs are employed for picture categorization and identification.

The CNN uses a hierarchical architecture that strives to build a network, like a funnel, and finally produces a layer that is extremely related where all the neurons are connected to one another and the output is processed. A computer can learn to categorize sounds, sights, and texts. The pc is trained with large image datasets then it changes the pixel value of the image to an indoor representation, where the classifier can detect patterns on the input image. We proposed a model that uses CNN network to classify Images between Human and Dogs

II. DATASET AND FEATURES

For use in the development of visual object identification software, ImageNet is a sizable visual database. ImageNet has manually annotated over 14 million photos to describe the items they depict. We utilized the Dog Breed Identification dataset from Kaggle. There are 133 different dog breeds represented by more than 10,000 photos in this collection, all of which were taken from ImageNet. Each photograph in the dataset has a unique ID and associated dog breed. The dataset is split into a train set and a test set. A train set is there.The test set makes up the remaining 90% of the whole dataset.The center of each RGB picture, which makes up all of the data,photograph, you can see the dog's body. The functions we use are texture, form, and color. Since we can recognize manydog breeds differ in their coat colors, organ shapes, and skin textures.and so forth. Convolutional layers are used by CNN to extract thoseaspects of the pictures. Each photograph in the dataset has a unique ID and associated dog breed. The dataset is split into a train set and a test set.

We also performed some pre-processing to increase the dataset's size because the dataset's total number of photos was insufficient. All of the photographs are resized to 224x224, which is the fixed resolution. In order to improve the data, we also used random scale, random crop, and random horizontal flip.

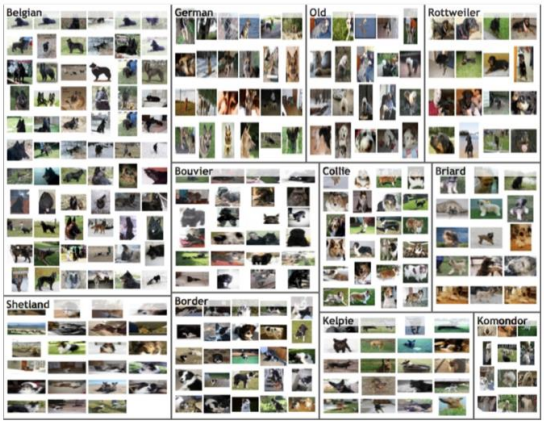

Fig.1. Overview of dataset

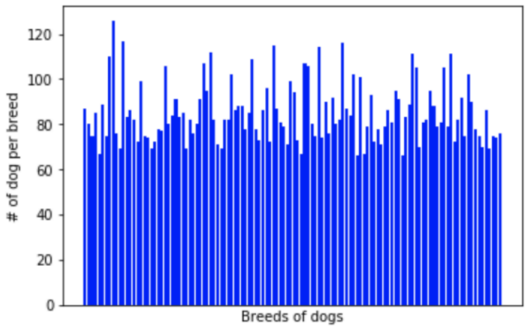

Fig.2. Distribution of images in dataset

III. METHODOLOGY

The project flow has two parts:
training
testing

Training: Pictures of different dog breeds are first gathered. JPEG or PNG format for the photos is required. Images are altered at the image processing stage. The convolution neural network's characteristic for extracting pictures is that it has 19 layers, 16 of which are neural

network layers, 5 of which are completely connected layers, a soft maximum layer, and layers for the max pool. A model file that has been encoded will be created after the training phase.

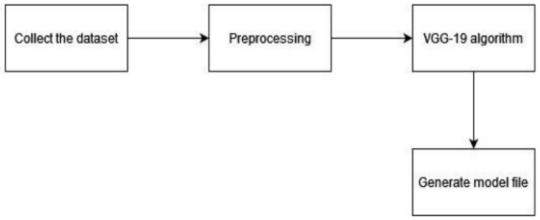

Fig.3. Training phase

Testing: The system is given the input picture. It will be adjusted and resized. This is put up against the model file created for training purposes. The outcome is then determined by comparison. The collection Convolutional neural networks are used to collect and train data on different dog breeds. the file for the training model is created. The model file is compared to the input image that has to be tested. After being pre-processed, the input picture is transformed to a NumPy array and then normalized to Gray level before being compared to the model file.

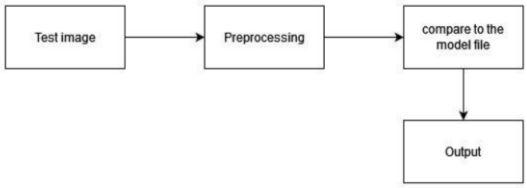

Fig.4. Testing phase

IV. PROPOSED METHOD

The graphic shows the suggested framework for classifying dog breeds. Data preparation, training, and testing are the three key stages that make up this process. The stage of preparing the data is necessary since we are focusing on dog facial photographs. Then, it is divided into sections for the testing and training processes. A model of a dog breed is what the training model produces. Breed categorization and model evaluation utilize the model.

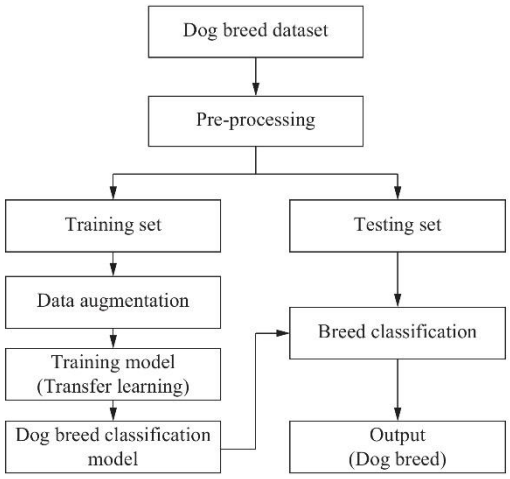

Fig. Overview of the proposed framework

V. STEPS OF ALGORITHM

In the Real-World dog breed categorization scenario, our model will become more generic since the Proposed system will be trained on 133 dog breeds.

The suggested classification system divides the creatures into broad and specific categories. Using a multi-part convolutional neural network, the animal breeds are correctly categorized. We'll do information pre-processing so that photos from the dataset are trained using humans and animals in various situations to get better outcomes.In this research, we'll think about two different datasets: dog and human. There are 8351 different dog breeds and 13243 different people photos in total.

Algorithm:

- Step 1: Start step
- Step 2: Importing the Dataset using Data Loaders of PyTorch step
- Step 3: Input the dataset to the first layer of neural networks
- Step 4: - Detect Humans using Haar Cascade Classifier
- Step 5: - Detect Dogs in the dataset using a pre-trained VGG16 model
- Step 6: Create a CNN to Classify Dog Breeds using the below steps:

i) Do Forward Propagation i.e. go from left to right of the architecture using the relu activation function
ii) Differentiation of value that we got in by doing forward propagation with the authentic value. Estimate the error which is generated by using the Loss Function.
iii) Do Back Propagation i.e. go from right to left of the architecture. Update weights and bias of your input layer simultaneously
until your model leads to convergence
iv) Perform the steps from (i) to (iii) again, but updates the parameters after a certain amount of observations.

- Step7: - Create a CNN to Classify Dog Breeds
- Step 8: Training the model
- Step 9: Testing the model and Algorithm
- Step 10: Stop

VI. MODELING AND ANALYSIS

One of the 19-layer convolution neural networks, which includes the layers convolution, fully connected, SoftMax, and max pool. The vgg19 resizes RGB images to (224, 224, 3) when they are entered into the network. Its size is set. The RGB mean value is subtracted during pre-processing.

The kernel assists in processing the pixels in photographs. In order to distinguish between the variations in the pictures by spatial padding, the spatial resolution procedure is essential. The last layer, known as the "soft max layer," will produce results dependent on the number of classes.

The vgg-19 has flowing layers
1. Convolutional layer
2. Max pooling
3. Fully connected

1. Convolutional layer

CNN's first building block is the convolutional layer. It takes the features from the input image and extracts them. Convolution mathematically combines the two sets of data. Convolution can be applied to the input data. The future map is created using convolution.

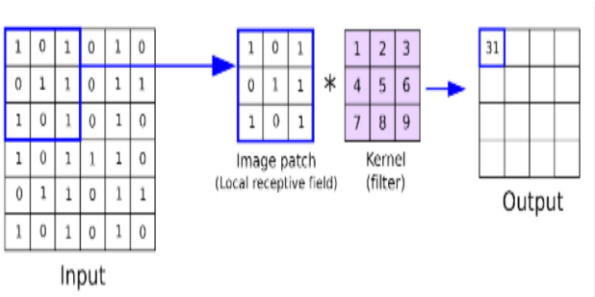

Fig.1. Convolutional layer

2. Max Pooling

Feature maps are obtained using the convolution layers. By using the pooling layers dimension of the feature maps are reduced by 50%. There are two types of pooling layers i.e average pooling and maximum pooling.

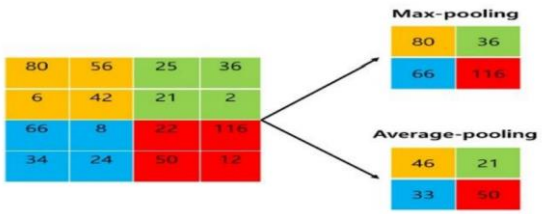

Fig.2. Max pooling

3. Fully connected

The final feature map outputs or max pooling layer matrix outputs are the input to the fully connected layer. Inputs of the fully connected layers are flattened to one column vectors.

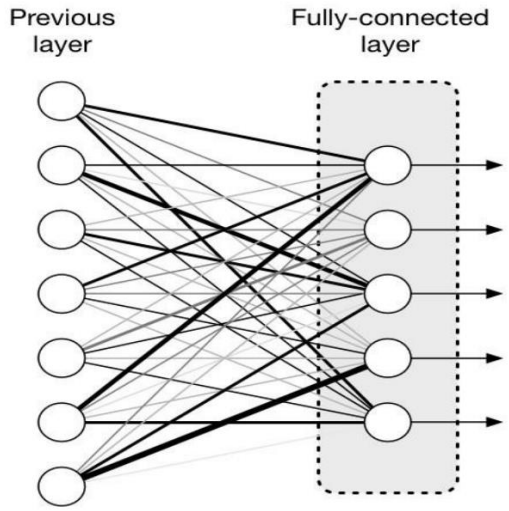

Fig.3. Fully connected

Steps:

1. Collect the dataset.
2. Train the dataset.
3. Generate model file.

The input image to be tested is pre-processed and is compared to the model file which gives suitable results.

VII. LIMITATION OF EXISTING SYSTEM

The VGG16 gives less accuracy compare to other algorithm for classifications problems. VGG16 offers more training time and deals with vanishing gradient problem. The obtained accuracy for VGG16 is between 81.20% to 84.08%.

Dog breed image classification application supporting object detection that utilized deep learning. The dog breed recognition model supports the classification of 120 dog breeds. The results are higher because it was trained on less breeds of dogs.

The system was trained on only 27 dog breeds but in real world there are more than 27 breeds of dogs to classify so the model will not become more generalized.

VIII. FUTURE SCOPE

The model may then be published as an app on the Google Play Store for anybody to download and use at the dog store. Use this software to identify the dog breed at the dog store if you want to know the breed without even asking the business owner. Knowing the dog's breed can help people learn more about the dog, including if the breeds that have been identified have a history of illnesses, whether the dogs that have been identified eat more or less, and whether they behave well or poorly. These items and details are all helpful. This device may even be used to locate a lost dog using cameras and CCTV. With the help of this model, we will search dogs only on the detected breed types rather than identifying the whole dog breeds data.

There are three directions we can go. First, in our project, we only use CNN to implement classification. To make a better choice, we can compare it with other train models like SVM and PCA. Second, in our model, we only add two FC layers after pre-trained model. To improve the accuracy, we can try to add more layers. Third, our accuracy is still not large enough. To improve accuracy, we can try other methods to avoid overfitting and tune the parameters.

IX. CONCLUSION

In this system 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 of deep learning developed using convolutional neural network is to predict the breed of hundred images in taking their images as input. Usage transfer learning on the way to build model that make output and around to hundreds of dissimilar dog types. The results were pretty good for the images the model was shown. The algorithm was able to identify dog breeds quite exactly. Transfer learning takes an excessive choice in the upcoming in joining a pre-built model by the model we created.

So, in the model, we have used Convolutional Neural Network (CNN) along with Transfer Learning of ResNet50, which gives us the accuracy of around 86% on 133 breeds of dog. The Transfer Learning and Convolutional Neural Network techniques an area unit still within the analysis space. We have used transfer Learning which gives higher accuracy. World Health Organization can even use this model to separate the dangerous dogs who have disease problems and who can spread diseases from other less harmful dogs.

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