



Dogs Breed Classification Using Deep Learning

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Abstract

This paper deals with the breed identification of dogs. To classify dogs breed is a challenging part under a deep Convolutional Neural Network. A set of images of a dog's breed and humans are used to classify and learn the features of the breed. This paper deals on research work that classifies different dogs breed using Convolutional Neural Network. From the classification of Images by Convolutional Neural Network serves to be efficient method and still it has few drawbacks. Convolutional Neural Networks requires many images as training data and basic time for training the data for getting higher accuracy on the classification.

Keywords: - VGG16, Convolutional Neural Network, Pytorch, Transfer learning.

Introduction

This project helps to identify dog breeds from images. This is a fine-grained classification problem: all breeds of *Canis lupus familiaris* will share similar body features and over-all structure, so differences between breeds is a difficult problem. Moreover, there is low inter-breed and high intra-breed variation; in other words, there are few differences between breeds and large differences within breeds, difference in size, shape, and color. However, dogs are both the most morphologically and genetically diverse species on Earth. It is difficult to identify breeds because of diversity are compounded by the stylistic differences of photographs used in dataset, which features dogs of the same breed in a variation of lightings and positions.

If the image of a dog is provided then the algorithm will work for finding the breed of dog and features similarity in the breed and if the human image is supplied it determines the facial features available in a dog of human and vice-versa. The images of human beings and dogs both are considered for the breed classification to find available percentage of features in humans of dogs and vice-versa. This research paperwork has used the principal factor analysis to shorten in the most similar features into one group to make an easy study of the features into the deep neural networks. To overcome this valuable time, we use Transfer Learning. In computer vision, transfer learning refers to use of a pretrained models to train the Convolutional Neural Network. By Transfer learning, a pre-trained model is trained to provide solution to classification problem which is like the classification problem we have. In this project we are using pretrained model like VGG16.

One of the areas where deep learning is used extremely is image classification. Convolutional Neural Networks is the constantly used deep learning method for image classification. CNN is parallel to artificial neural networks which have learnable weights and biases. The difference between ANN and CNN is that in CNN's filters is process over the whole image and are the effective methods for image recognition and classification problems.

Convolutional Neural network is a deep learning algorithm which extract an input image and assigns importance to various features in the image and will be able to show difference one from the other. CNN learns from the image directly there by removing the manual feature extraction, which assemble them to serve as an excellent feature extractor by allowing end-to-end learning of all features from image data in raw form for classification. The main potential of CNNs present in its deep architecture that forms CNNs powerful.

Overview of Convolutional Neural Network

Convolutional Neural Networks (CNN) is mixed feed forward neural networks. CNNs are used for image classification and recognition because it has high accuracy. It was introduced by computer scientist Yann LeCun in the late 1990s, when he was influenced by the human visual perception of recognizing things. The CNN follows a hierarchical model which works on forming a network, like a funnel, and finally forms out a fully connected layer where all neurons are connected to each other and the output is produced.

CNN is a branch of deep learning model for handling the data that has a grid pattern, such as images, which is influenced by the organization of animal visual cortex and made it naturally and adaptively learn spatial hierarchies of features, from low to high level patterns. CNN is a mathematical construct which can be composed of three types of layers also called building blocks are: convolution, pooling, and fully connected layers. The first two, convolution and pooling layers, perform extraction, whereas the third, a fully connected layer, combine the extracted features to final output, such as classification. Convolutional Neural Networks (CNN) is alternative of Multilayer Perceptron (MLPs) which are influenced from biology. These filters are local in input space and thus better suited to feed the strong spatially local complement present in natural images. Convolutional neural networks are designed to formation of two-dimensional (2-D) image.

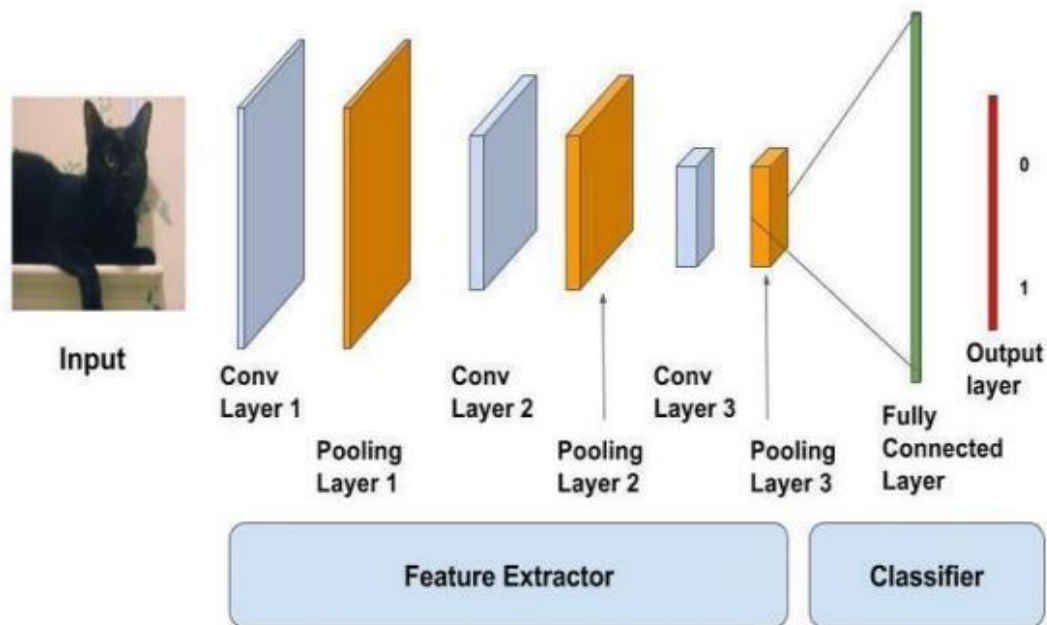


Figure 1: Convolutional Neural Network Model

Objectives

In this paper our main objective is to implement an Image Classification with Deep Learning and Convolutional Neural Networks.

IN Computers vision nowadays cannot only acknowledge pictures; however, they will additionally describe the assorted parts in photos and create transient sentences. This is done by CNN that learns patterns that occur in pictures. To train the Convolutional Neural Networks using one of the largest databases of labelled images. Deep learning frameworks such as Jupyter notebook and PyTorch etc.

Methodology

A. Neural Network:

An Artificial Neuron Network (ANN), is highly known as Neural Network. And it is a computational model based on the structure and functions of biological neural networks. For example, it is like an artificial human nervous system for receiving, processing, and transmitting information in phase of Computer Science.

Basically, there divided into 3 different layers in a neural network: -

1. Input Layer -All the inputs are grazed in the model through this layer.
2. Hidden Layers -There can be more than one hidden layer which are used for processing the inputs received from the input layers.
3. Output Layer -The data after processing is made available at the output layer.

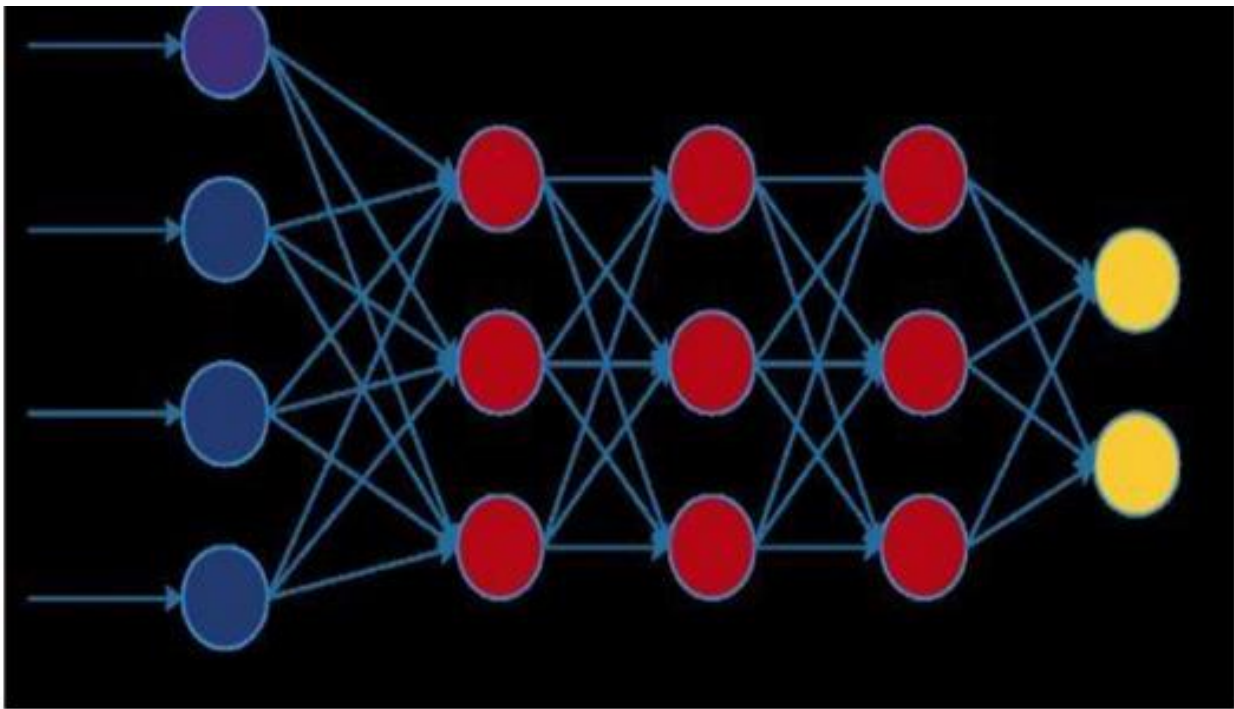


Figure 2: Artificial Neuron Network

B. Convolutional Neural Network:

Convolutional Neural Network is an exceptional kind of strengthened to advancing artificial neural network, which stimulated through visual cortex. In CNN, the neuron in a layer is solely related to a small area of the layer earlier than it, alternatively of all the neurons in an entirely related manner, so CNN manage fewer quantities of weights and much smaller number of neurons. A convolutional neural network has an input layer, hidden layers, and an output layer. In any feed-forward neural network, any middle layers are known as hidden because their inputs and outputs both are masked by the activation function and final convolution. In a convolutional neural network, the hidden layers consist of layers that will perform convolutions. Mostly this layer consists of multiplication or other dot product. This is accompanying by layers such as pooling, fully connected and normalization layers.

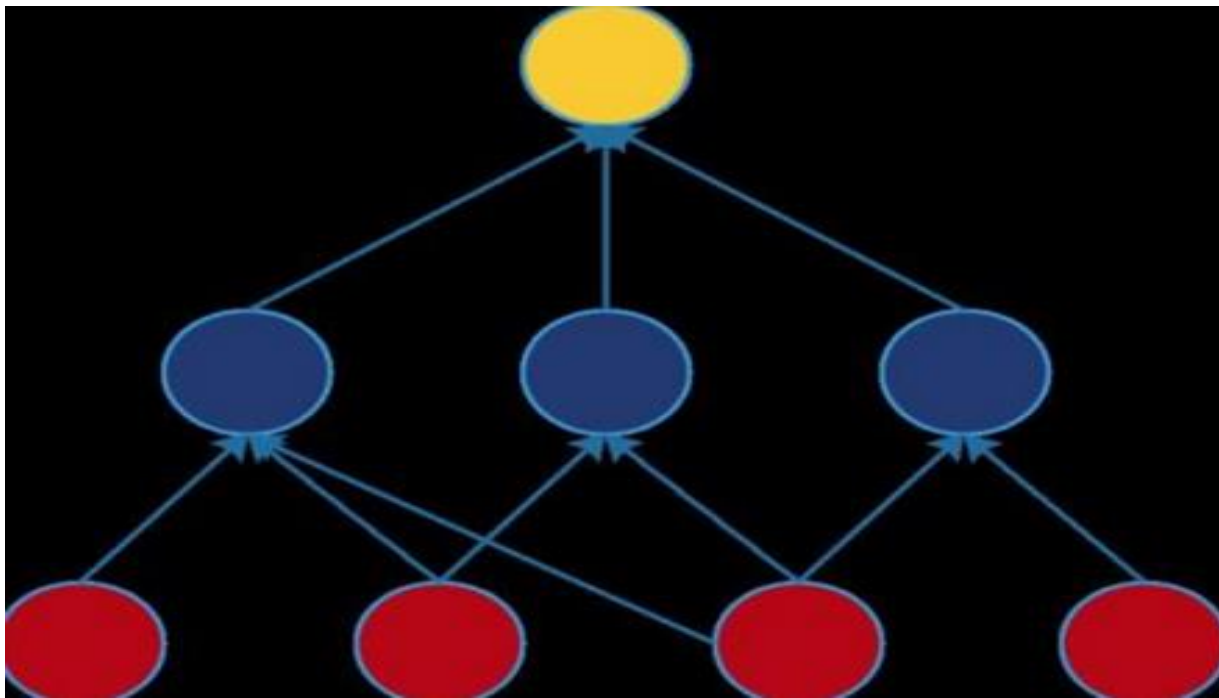


Figure 3: Convolutional Neural Network

Pytorch Technique

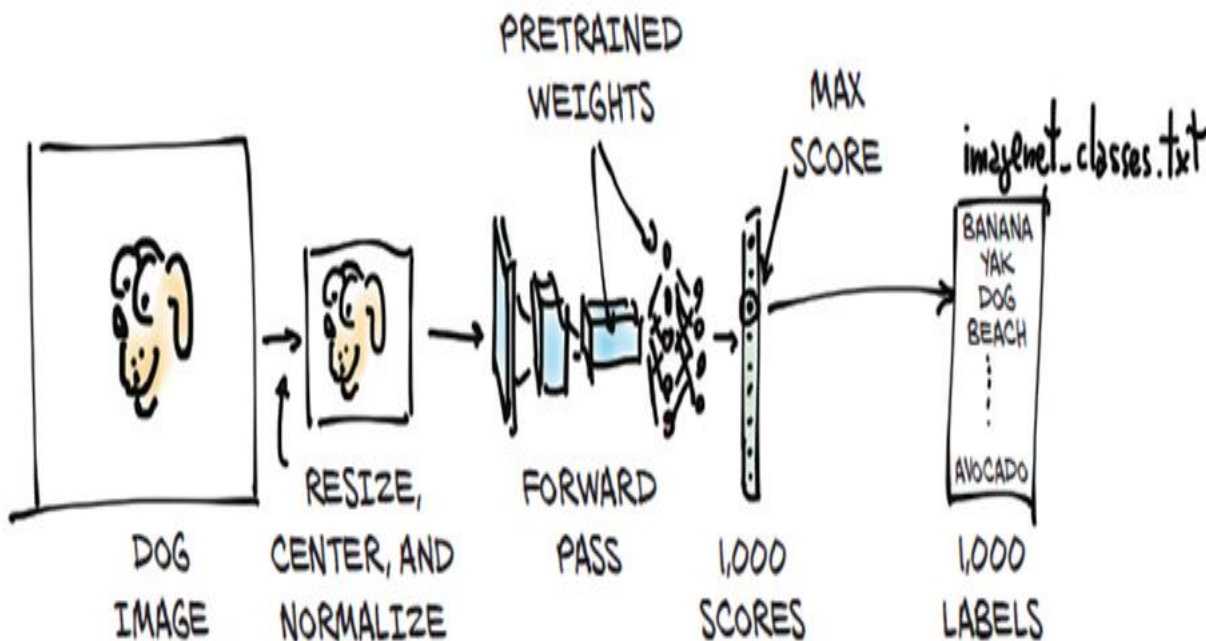


Figure 4: Pytorch Technique

PyTorch is basically library in Python program which can facilitates to deep learning projects. It highlights flexibility and allows deep learning models to express in idiomatic Python. This accessibility and ease of use found early adopters in the research community, and in the years since its first release, it has matured into one of the most noticeable deep learning tools across a broad range of applications. When Python does for programming, PyTorch provides an admirable introduction to deep learning. In the equal time, PyTorch has been proven to be completely qualified

for use in professional connection for real-world, high-profile work. We accept that PyTorch's clear syntax, streamlined API, and easy debugging make it a perfect choice for introducing deep learning.

Dog breed prediction using CNN

In first step, we choose an image as an input in which we want to predict the object. In the second step, we perform object recognition which will connect to the Pytorch which contains 1000 images of different objects used for training as mentioned in third step. In the fourth step the MobileNet Model is loaded which is CNN (convolution Neural Network) model. CNN with two convolutional layers, pick out special combination of activation features and classifiers for comparison purpose. Test the system with training datasets respectively. Then in fifth step the input image is given as input parameter to ReadImage() which converts the image into pixels. In the sixth step Input() is executed which converts the pixel image into tensor and in final step this tensor image is given as input parameter to classify function which predict the output based on the probability from which we consider the highest probability value as a best predicted object.

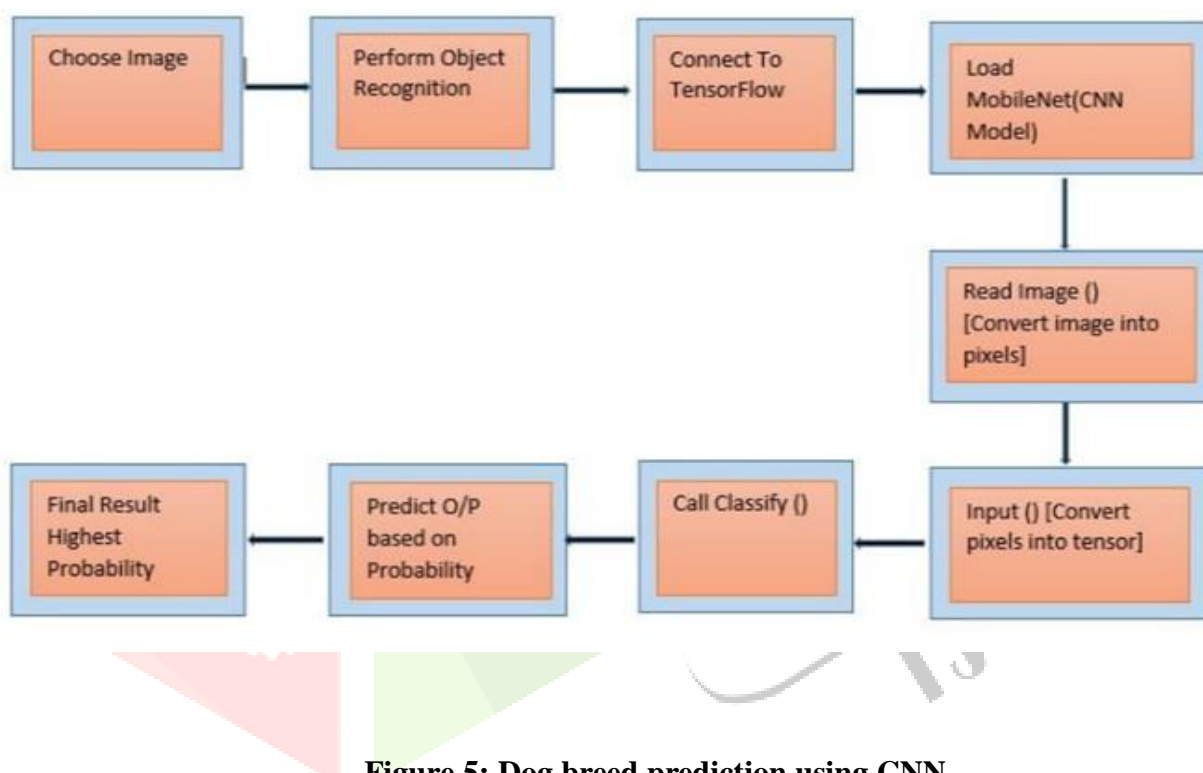


Figure 5: Dog breed prediction using CNN

Conclusion

The main aim of this model is to learn that how to use a machine learning classification tool to classify images, namely, dog breeds. The application is properly proved with all sort of dog images which gives faithful and precise result. As of now this application gives a basic scraped data for each dog breed. Convolutional neural network is a learning method for data analysis and predictions, now a days it is become very famous for image classification problems. Dog breed classification of deep learning developed using convolutional neural network is to predict the breed of number of images in taking images as input. We use transfer learning on the way to build model that make output and around to number of dissimilar dog types. The results were pleasant good for the images the model was shown. The algorithm was able to identify dog breeds quite perfectly.

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