

Machine Learning Engineer Nanodegree

Capstone Proposal

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Proposal for Capstone Project

Dog Breed Classification

Domain Background

In Dog Breed Classification, we see the dataset contains images of dogs and humans to which we have to classify dogs based on their breeds. Then why Humans? the images of the humans are used to see what category of dog breeds will they be classified (for fun purpose) Also, when observed, we categorise such works to the field of Computer Vision and Machine Learning, to which there are various works carried on in the above project.

Recently in 2019, Punyanuch Borwarnginn et al proposed the work on dog breed classification using the different approaches to classify them based on their breeds to tackle population control, disease breakout, vaccination control and legal ownership. He and his co workers used 1. Histogram Oriented Gradient and 2. Convolutional Neural Network using Transfer Learning for the classification purpose. On making a comparative study, they found that the Neural Nets had a better performance compared to the HOG descriptor.

(### Breakthrough Conventional Based Approach for Dog Breed Classification Using CNN with Transfer Learning)

Looking into the work carried above, we see how the dog breed classification can be used for determining various information. This can be further expanded to determine information on the 1. Types of Dog Breeds preferably chosen by humans 2. Demographic Needs for the Dogs 3. Behaviour analysis of Dogs at different demographic locations, etc.

Problem Statement

Here the goal is to create a Dog Breed Classifier and build an application for the same. The tasks involved are: 1. Download and Process the Images of the Dogs and Humans 2. Detect the Dogs and Humans using the Pre-Trained models such as Haarcascade and VGG-16 3. Build and train a classifier to classify dog breeds from scratch 4. Also, train the model using transfer learning with an efficiency to be used for application too. 5. Using the App, predict the breed of the dog and also the category of dog breed the human resembles to.

It is application which can be quite handy to recognise the breeds of unknown dogs for the user and also have fun by creating a resemblance of a dog to the given human images.

Datasets and Inputs

Here, in the Dog Breed Classification, the dataset contains the images of Dogs and Humans. There are a total of 133 breeds, 8351 images for dogs and 13233 images for humans. Using these images as data, it has to be processed according to our needs and a model has to be designed to train our machine.

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The input to the neural net is either an image of a dog or human to which we expect the output as the breed of the dog (for dog input) or type if dog the human resembles to (for a human image input).

Solution Statement

The user end application will be designed which will be useful to identify the dog breeds. To tackle this, we need to train our model to identify the dog based on the certain features. The convolutional neural network can be used to train the model and based on the evaluation and performance of the model, an application will be built for the user experience.

Benchmark Model

To tackle such data, it is preferably good to go with neural networks. The extraction of features for an image data is quite tedious. However, on using the convolutional neural networks, the features are easily extracted through it. Neural nets try to find a pattern to recognise features for each category of data and classify them based on the similarity measures.

As observed the input is expected to be a dog image or a human image. The output is the class of breed the dog belongs, and the type of dog the human resembles.

Evaluation Metrics

The evaluation metrics that can be used to evaluate the performance of the machine learning model are:

Accuracy: The ratio of correct predictions to the total size of the data (i.e. $(TP+TN)/\text{Data Size}$)

Confusion matrix:

Recall: The ratio of true positives to the true positive and false negative (i.e. $TP/(TP+FN)$)

Precision: The ratio of true positives to the true positive and false positive (i.e. $TP/(TP+FP)$)

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Project Design

The following project can be designed according to the below workflow.

1. Data loading and exploration
2. Data augmentation and processing
3. Detect the Dog and Humans using the given detector algorithms
4. Build a CNN training model from scratch using Deep Learning framework - Pytorch
5. Build a training model using the Transfer Learning

6. Evaluate the performance of the model
7. Design and build an application using the above model for the user experience
8. Test the working model of the application using user inputs

The above steps are structured for the implementation of the project and any additional steps carried will be reported after the project implementation.
