Dog Breed Identification Using Convolution Neural Network and Web Scraping

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Abstract: *Dogs are domesticated mammals, not natural wild animals. They have been bred by humans for a long time. Today, some dogs are used as pets, others are used to help humans do their work. It's a significant task for the owners to care and maintain their pet dog. For that, they need to know the breed of the dog to train and cure disease. The current paper presents a fine-grained image recognition problem, identifying the breed of a dog in a given image which includes convolution neural networks. Thenetwork is trained and evaluated on the Stanford Dogs Dataset. By using web scraping, the data from various websites are collected and rendered in the application.*

Keywords: Dog breed identification, InceptionResNetV2, Stanford Dogs dataset, Dog's data gathering using web scraping

1. Introduction

Dogs are a popular pet because they are usually playful, friendly, loyal and listen to humans. By 2019, There are about 340 breeds recognized by the Federation Cynologique Internationale (FCI) [1], the world governing body of dog breeds, sometimes known as the World Canine Organization. However, the American Kennel Club [2] currently recognizes only 192 breeds. So, it's necessary to know the breed of the dog before treating, training and curing. Since there are lots of breed and crossbreeds coming up every several years so, its significant task to find the desired dog breed.

In olden days, people approach the experts to identify the dog breed but, only a few experts are available and the result they provide is not much accurate. Alternatively, DNA test provides precise and accurate result but, the process is complex, expensive and hurtful.

Now a days, Neural network in deep learning become popular and implemented in various domains such as Health Care, Finance. Retail, Travel, Media etc.

The current paper presents the methodology of fine-tuning CNN which is implemented in Stanford dog breed dataset. The convolution neural network is similar to the deep neural network which has weights and biases. CNN has filters which predicts the specific features or patterns present in the original data. The usage of fine-tuned trained convolution neural network is widely used in modern technologies. There are several fine-tuned transfer learning which are widely used. In this application, Inception-ResNet-V2 [3] are implemented over the dataset.

Identifying only the breed of the dog is not sufficient, providing various characteristics and attributes of each breed is important such as origin, color, height, weight, lifespan, health, history and training.

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.

In this application, Reference websites such as Wikipedia, Dog Breed Listare utilized for gathering essential data to render in this application by using Web Scraping with legitimate user interface and user experience.

On the whole, this paper presents the various characteristics and essential details of the dog from uploaded image result. So that user not only acknowledgingthe breed of the dog but also the various properties, maintenances and traits of the dog.

2. Related Works

This segment provides the previous attempts that are related to the current research.

Kosin Chamnongthai et al. [4] solves similar problem by finding dog breed face using Coarse-to-Fine Concept and PCA.

Shanshan Guo et al. [5] solves face recognition which involves two main method Convolution Neural Network and Support Vector Machine.

Similar to the current paper Richard O. Sinnott et al. [6] provide IOS based mobile application for dog breed which makes use of CNN and utilize the big data processing infrastructure.

Middi Venkata Sai Rishita et al. [7] came up with similar solution which find the dog breed as well as the resembling dog breed of the human if supplied using CNN.

The present paper makes utilize of previous papers such a way that the Stanford dogs breed dataset has been trained using pre-trained CNN. The Major analysis of the current paper is to show case the essential data for each breed using web scraping. So that user not only identifying the breed of the dog but also the traits of the breed.

3. Dataset and Pre-processing

Convolution Neural Network is the methodology which is implemented over the Stanford dog breed dataset. This dataset has been built from ImageNet which is an image database organized accordingly. The Stanford dog breed dataset contains images of 120 breeds from around the world. Totally there are 20,580 images in the dataset. Around 150 images per breed. There are around 8,500 randomly distributed test images.

Before training the data, the dataset has to be split into train data and test data and the size of each image should be converted into 299x299 pixels because the of the input size of Inception-ResNet-V2.

4. CNN Architecture

Transfer learning has several benefits which saves lots of time and provides better performance. It comes in handy where the data need not to train a neural network from scratch. In this present paper, Inception-ResNet-v2 has been utilized in order to fetch the better performance. This network is 164 layers deep and classify images into 1000 objects [8].
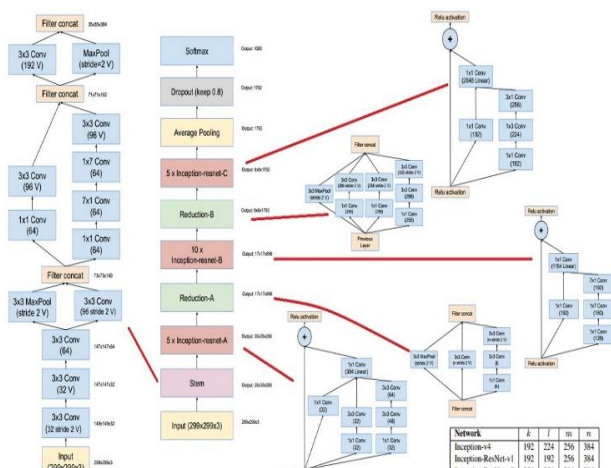
Figure 1: This diagram shows various layers of the Inception-Resnet [9]

The model has been trained under the Google Colab environment [10] which provides free cloud platform to process Machine Learning and Deep learning Application. The Environment has been set to Tensor Processing Unit (TPU) which enhance the training process.

After Training the neural network, the data model has to be saved for the further usage. HDF5 [11] is a data software library and file format to manage, process and store heterogeneous data. HDF5 is built for I/O processing and storage.Now, the trained model is stored using this file format (HDF5).
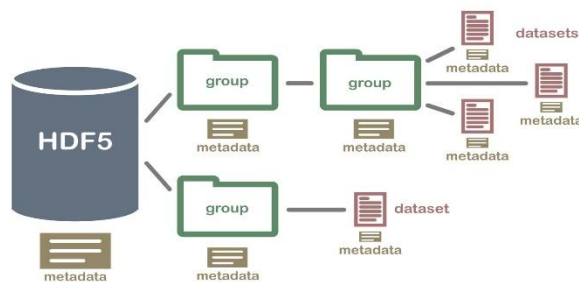
Figure 2: The pictorial representation of HDF5 file architecture [12]

5. Web Data Extraction

Web scraping also know as web data extraction, is the process of retrieving or scraping data from a website. Web scraping uses intelligent automation to retrieve billions of data points from the internet.

In this present paper, the data about each breed is gathered and rendered in this application from various websites.

Each breed has specific traits so, extracting each breed data is significant. Wikipedia[1] to extract data such as History, Training and Health Care. Dogbreedlist[2] to extract data such as origin, size, lifespan, height, weight, colour and so on. Dogtime[3]also used.

All those raw data are extracted from each website and stored in the CSV file. Those raw data then cleaned and pre-processed. Based on the dog breed the data from the CSV file displayed in the application.
[1]source: https://www.wikipedia.org
[2]source: https://dogbreedlist.info
[3]source: https://dogtime.com

Figure 3: Scraped Data stored in CSV file

Figure 4: Scraped Data stored in CSV file

6. The Software System

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.

a) System Architecture

Figure 5: Architecture diagram of the application which show case the front-end and back-end segments

The overview of the application and the complete integration of data model along with extracted data is pictorially represented in Fig.5

b) Deep Learning Integration
After training and storing the data model in the HDF5 file. The file should be integrated with the appropriate user interface, in which Flask is utilised as a backend. After user uploading the image, by clicking the predict button flask acts as a middleware and fetch appropriate metadata classes i.e. the dog breed name from the data model file (HDF5).If the image is not come under the dog breed name, it shows invalid image.

c) Data Rendering from Web Scraping
After scraping all the data from desired websites, the data which stored in the CSV file is integrated.Pandas is the library that could manipulate the data stored in CSV file, by making use of it the data will rendered and passed to the Flask which could render the desire data in the application where user can view it.

d) Prototype of the Application
Step 1: User will open the application through browser with provided application URL.
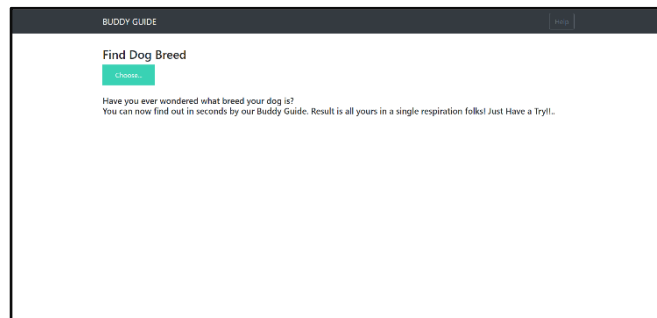**Step 2:** User will be asked to upload the image from the local storage.

Figure 6: Home page of the application

Step 3: After Uploading the image, User should click the predict button and the desire result will be fetched. If the image is not proper it will show "invalid image"
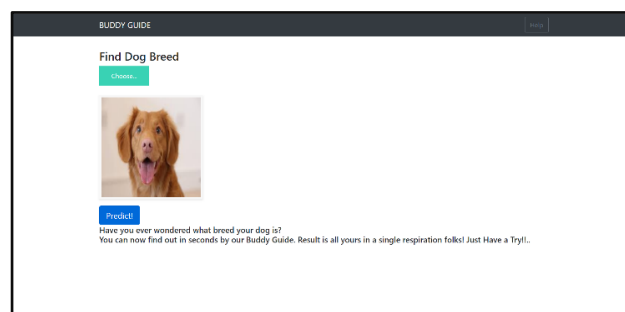
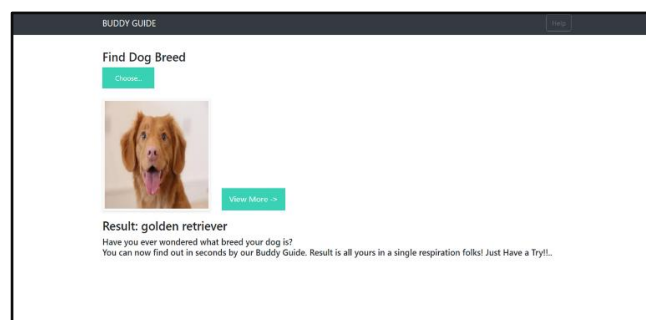**Figure 7:** Interface after uploading the image
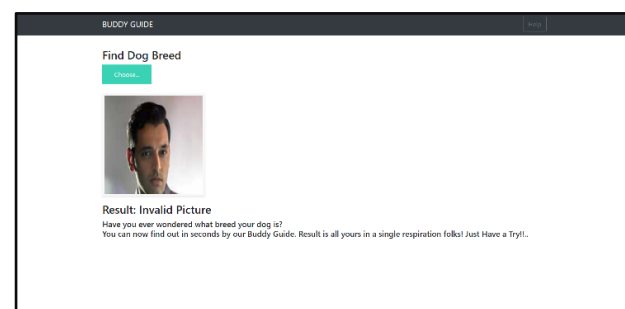
Figure 8: Predicted result of the dog breed

Figure 9: Result of uploading Invalid image

Step 4: The result will be fetched along with the "View More" button.

Step 5: By clicking view more button, the scraped data from various websites on the resultant breed will be displayed elaborately.
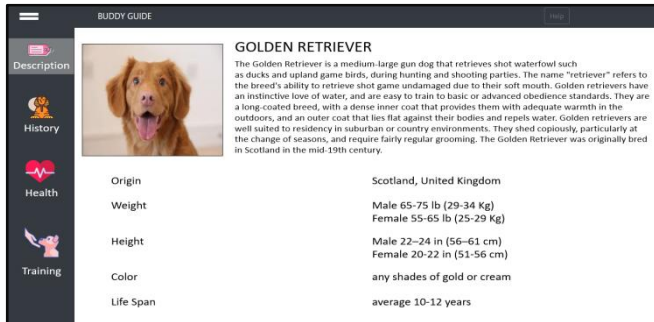
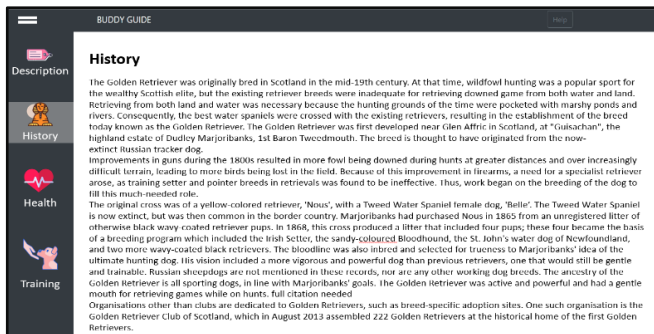**Figure 10:** Shows breed description after clicking view more button
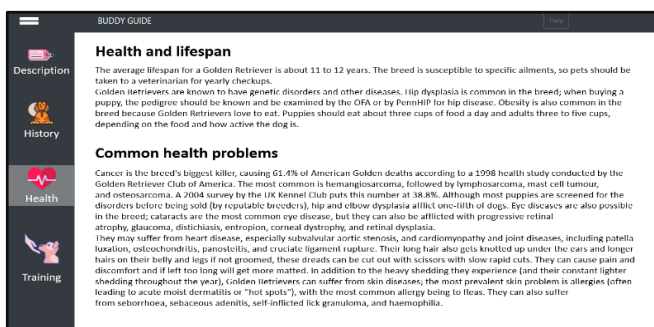

Figure 11: Shows breed History

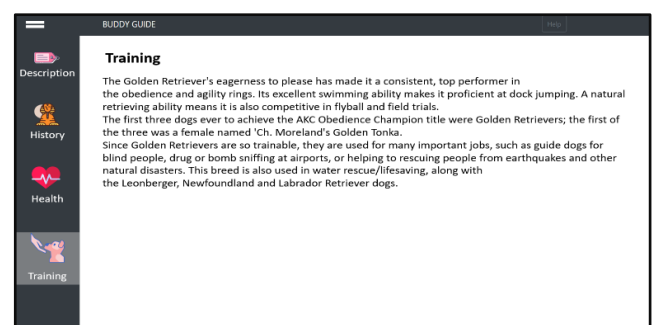
Figure 12: Shows breed Health, lifespan and issues

Figure 13: Shows Breed Training

7. Conclusion and Future Work

The application is properly tested with all sort of dog images which provides faithful and precise result. As of now this application provides a simple scraped data for each dog breed. In future the data will be collected in depth especially in Health, Medicine and Maintenance such a way that this application will be an encyclopaedia for users who pet a dog.

References

[1] Federation Cynologique Internationale (FCI)an international federation of a number of national kennel Club www.fci.be

[2] American Kennel Club (ACK) is the recognized and trusted expert in breed https://www.akc.org

[3] https://keras.io/applications/#inceptionresnetv2is the source which provides documentation of InceptionResNetV2.

[4] Kosin Chamnongthai et al. "Face Recognition Based Dog Breed Classification Using Coarse-to-Fine Concept and PCA" in Proc. Asia-Pacific Conference on Communication 2007, pp.25-29

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[9] Image from http://yeephycho.github.io/2016/08/31/A-reminder-of-algorithms-in-Convolutional-Neural-Networks-and-their-influences-III/

[10] Google Colab Platform https://colab.research.google.com/

[11] Referred website https://www.hdfgroup.org/solutions/hdf5/

[12] Image from https://www.neonscience.org/about-hdf5