Dog Breed Identification with Products Classification and Assisted Services

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Abstract **— The demand for having a pet at home has been increasing drastically over a few years. People are considering pets to be an important addition to the family. As a pet owner, one would want to do everything they can to care for their pet; this involves regular, everyday activities to ensure they stay happy and healthy. The population of pet dogs in India amounted to around 19.5 million in the year 2018. The population was forecast to reach over 31 million by the end of the year 2023. The growth in the number of pet dogs in India had led to an increase in pet food sales, from approximately 139 million U.S. dollars in 2014 to approximately 285 million dollars in 2018. The demand for having a pet at home has been increasing drastically over the past few years. People are considering pets to be an important addition to the family. Therefore we aim to develop an application that recognizes the breed of the dog, serves as a platform that sells pets' food and accessories, helps the pet owner take appointments and consult the veterinary doctor during emergencies using the consultancy that we aim to provide, and serve as a portal to find lost pets.**

Keywords — Image Recognition, Breed Classification, Consultancy, YOLO object detection using Python, Python, React.

I. INTRODUCTION

When a full time working individual has to take care of the pet, he/she will have a million other things to do in their every day busy schedule. This is where technology can come to their rescue and make the process of owning a pet very easy. A lot of pet care apps have cropped up recently allowing better caretaking of pets. These pet care services offer different types of services such as grooming, pet care, finding lost pets, buying food online, booking appointments with the veterinary online to the pet owners. But that problem with the existing application is that all these services are not available to pet owners at one place, that is all these services are not centralized. Pet owners usually have to switch between many applications in order to get these applications. We aim to develop an application that makes the process of looking after a pet easier.

There is no centralized platform for products and services classified specifically according to the breed which is necessary for the following reasons:

Food and accessories are specific to a breed. A particular type of food can be only fed to one category of dogs but if other categories are made to consume the same food, then this could affect the dogs' health. For example, puppies are not given the normal Pedigree consumed by adult dogs but are given a special type of soft food that digests easily. Similarly certain accessories are also very specific to certain breeds. For example, electrocuting collars can only be sustained by pit-bulls.

Selling pets that look similar in the puppy stage in place of expensive dogs is a major fraud committed nowadays. For example, Rs. 9000/- Pomeranian puppies are sold as chow chows that are worth about Rs. 70,000/-.

Finding pets that are lost are now easier because the pets that are lost are again classified according to the breeds, that make the entire process for finding the dogs easier.

These are some main key highlights of the application that we aim to develop.

Fig. 1. Identifying Breeds

II. PROPOSED SYSTEM

We propose a system that will take in an image as the input from the user. Based on the image that has been uploaded the following functions will be performed:

1) Breed classification: Identification of the breed of the dog. Image processing and classifier will be added. This is mainly for the users who do not know the breed of their pet and struggle with the upbringing of the pet. They can identify the breed of their pets. A small box of general information about that breed will be displayed to educate the user regarding the same.

2) Vet and grooming services: We aim to develop an application that makes the process of looking after a pet easier. Veterinarian visits play a vital role in looking after the pets. Regular visits to the vets ensure that pets are in healthy condition. Our application allows the registered users to book appointments with the vets when it is required. We also aim to have a chat box which can be used by the pet owners to talk to the vets when it is an emergency or whenever they feel the need for an immediate consultancy. Vaccinating pets is a vital component of responsible pet care. The application also sends email reminders to pet owners asking them to get their pets vaccinated if any vaccination is due. This helps the pet owners to avoid missing any vaccination to their pets. These four factors discussed above (appointments, consultancy, push notifications, online chat) avoids confusion and makes pet consultancy easier.)

3) Food and products specific to breed and age: Elements of pet ownership include providing them with fresh, cool water and healthy food at all times that is specific to the breed. With so many meal options to choose from, one might often get confused with what to feed their pets. This application helps to buy food for pets based on their breed, age and nutrient contents. Along with food, pet accessories are also available to the users who wish to shop from our application. Categorizing these accessories will also be done to make sure that the user gets the best product specific for the breed of their pets.

4) Lost and found pets : Images of Dogs that are lost are classified based on the breed and location so the users can recognize them easily and facilitate fast return of the dog. The centralized structure can facilitate the process.

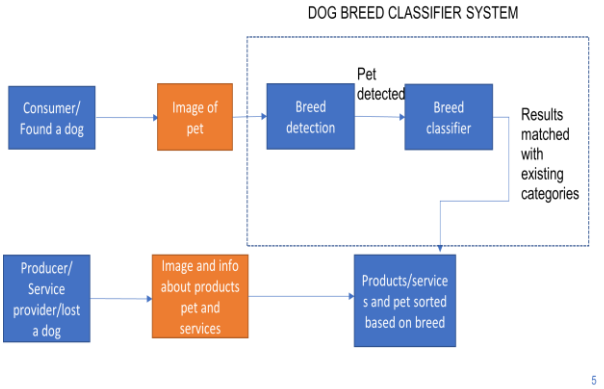

Fig.2. Flow Diagram

A. *Pre-processing*

The breed detection is a 2 step process

1) Extracting a target image- YOLO is used to crop out the excess in a image to obtain only the target image.

2) Classification-inception transfer learning is used to compare the target image and return the breed of the dog. Keggle dataset is used to train and test the machine.

B. *Using YOLO Algorithm for Image Recognition*

Processing images with YOLO is simple and quite straightforward. The system resizes the input image to 448X 448, runs a single convolution network on the image, and thresholds the resulting detections by the model's confidence.
This is shown in the figure below:

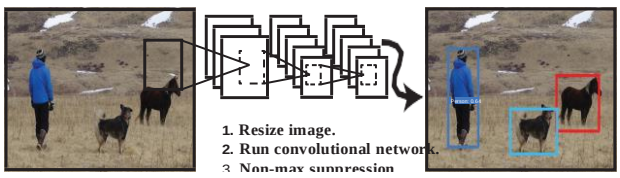

Fig. 3. Face Detection and Cropping Process

C. *Why we use YOLO?*

First, YOLO is extremely fast. Since we frame detection as a regression problem we don't need a complex pipeline. The base network runs at 45 frames per second with no batch processing on a Titan X GPU and a fast version runs at more than 150 fps. This means a streaming video in real-time can be processed with less than 25 milliseconds of latency.

Second, YOLO makes less than half the number of background errors compared to Fast R-CNN.

Third, YOLO learns generalizable representations of objects. Since YOLO is highly generalizable it is less likely to break down when applied to new domains or unexpected input.

D. Unified Detection

The separate components of object detection are unified into a single neural network. This network uses features from the entire image to predict each bounding box. It even predicts all bounding boxes for an image all at once. This means that the network reasons globally about the full image and all the objects in the image. The YOLO design enables end-to-end training and real-time speed while maintaining high average precision.

Working:

This YOLO system divides the input image into a $S X S$ grid. If the center of an object falls into a grid cell, that grid cell is responsible for detecting that object. Each grid cell predicts B bounding boxes and confidence scores for those boxes. These confidence scores reflect how confident the model is that the box contains an object and also how accurate it thinks the box is that it predicts.

Formally we define confidence as Pr(Object) IOU. If no object exists in that cell, the confidence scores should be zero. Otherwise we want the confidence score to equal the intersection over union (IOU) between the predicted box and the ground truth.

Each bounding box consists of 5 predictions: x, y, w, h, and confidence. The (x, y) coordinates represent the center of the box relative to the bounds of the grid cell. The width and height are predicted relative to the whole image. Finally which gives us class-specific confidence scores for each box. These scores encode both the probability of that class appearing in the box and how well the predicted box fits the object.

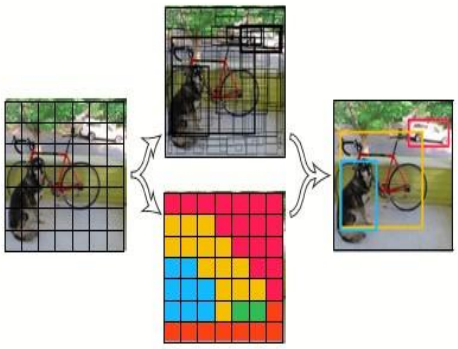

Fig. 4. Process of Identifying Images

The fig. 4, this system models detection as a regression problem. It divides the image into an even grid and simultaneously predicts bounding boxes, confidence in those boxes, and class probabilities. These predictions are encoded as an $S \times S \times (B * 5 + C)$ tensor.

For evaluating YOLO on PASCAL VOC, we use $S = 7$, $B = 2$. PASCAL VOC has 20 labeled classes so $C = 20$. The final prediction is a $7 \times 7 \times 30$ tensor.

III. DEVELOPMENT ENVIRONMENT

A. Requirements

The minimum hardware requirements are 4 GHz minimum, multi-core processor, memory (RAM) of 4GB, preferably higher and a hard disk space of 10 GB or above. Python 3 will be used as the programming language for developing the application.

The softwares that are being are MongoDB, JavaScript, HTML, CSS, Node.js, React.js, Express.js, and Mongoose.

B. Dataset

We plan to use the Kaggle dataset. This dataset is known for it's use of image recognition. We plan to identity 120 breeds of dogs currently. So the dataset we planned will comprise of 120 breeds data set with 5000 distinct images.

Fig. 7. Images from Dataset

CONCLUSION

We propose a trained model which uses some techniques to detect the breed of the dog. This classification is important because we are using this criteria to sort out food and accessories, and lost dogs.

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