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Dog Breed Prediction Using Deep Learning and E-commerce

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ABSTRACT

This project uses computer vision and machine learning techniques to predict dog breeds from photographs and provides a trustworthy and efficient e-commerce platform for dogs. With the help of various machine learning models such as convolutional neural networks, our model gives the correct breed 90% of the time. Apart from that, our web application also provides an e-commerce platform for buying of dogs.

Keywords: Computer Vision, Machine Learning, E-Commerce

I. INTRODUCTION

Artificial intelligence enables the machine to achieve human level intelligence. Machine learning allows the machine to extract useful information from any data. Deep learning is a further subfield of ML that utilizes artificial neural networks inspired by human brain. These Neural Networks can grasp and recognize patterns in data and develop models, without being explicitly instructed on how to solve a problem. Using Deep Learning we can detect many things such as objects, animals, humans etc. There are many algorithms for image processing such as A Convolutional Neural Network. Convolutional Neural Networks (CNNs) are a popular class of deep learning algorithms that are specifically designed for processing visual data such as images and videos. Using Such Deep Learning Algorithms. [1]

The aim of this project is to classify images of dogs into their respective breeds and build a trustworthy and efficient E-commerce for buying and selling of Dogs. Classifying dog breeds from images is a fine-grained task that is complicated by the fact that many breeds share similar body features and overall structure and it is challenging due to the diversity among breeds and the high level of variation within breeds in terms of size, shape, and colour. This difficulty is further compounded by the variations in lighting and positioning of dogs within the dataset used for this project, which includes images of dogs from the same breed but in different styles.

However, the techniques used to address the challenge of classifying dog breeds from images could be beneficial in identifying breeds of cats and horses, as well as various species of birds and plants. Moreover, the methods could potentially be extended to classify models of cars or other objects. The ability to predict dog breeds from images could also benefit

veterinarians who need to provide medical care for stray or unidentified dogs. Knowing the breed of a dog can be helpful in identifying breed-specific ailments and providing targeted treatment, which could ultimately improve the health outcomes of these dogs.

There are many E-commerce platforms on the internet but there are no platforms dedicated only towards dogs. This project uses latest deep learning techniques such convolutional neural networks and artificial neural networks to predict dog breed from images of dogs.

Also, the website is made by using react libraries and mongo dB as database and we are using node.js in our backend. To carry out the e-commerce task we are using react redux which will explained in the later part of this research paper, we have used advance encryption techniques to protect the user data from threats and all the hacking techniques. Overall, the project provides a well-trained model which is trained over 120 dog breeds and gives 80% percent accuracy and it also provides a secure and trustworthy e-commerce platform for buying of different dog breed.

II. METHODS AND MATERIAL

To create a model capable of extracting data from images of dogs and discerning their breeds, you would need to use a computer vision approach. Here are the steps you can follow to build your model:

1.) Collect a large dataset of dog images with corresponding breed labels. You can use publicly available datasets like ImageNet or CIFAR-10, or create your own dataset by scraping images from the web. [2]
2.) Pre-process the images by resizing them to a fixed size, converting them to grayscale or RGB, and normalizing the pixel values. This step will help reduce the variability in the images and make it easier for the model to learn the features.
3.) Split the dataset into training, validation, and test sets. The training set will be used to train the model, the validation set will be used to tune the hyperparameters of the model, and the test set will be used to evaluate the performance of the model.
4.) Build a convolutional neural network (CNN) architecture to learn the features of the images. A typical CNN architecture consists of convolutional layers, pooling layers, and fully connected layers. You can experiment with different architectures and hyperparameters to find the best model. [2]
5.) Train the model using the training set and evaluate its performance on the validation set. You can use metrics like accuracy, precision, recall, and F1 score to evaluate the performance of the model.
6.) Once you have a good model, use it to make predictions on the test set and evaluate its performance. You can also use the model to make predictions on new images of dogs.
7.) By following these steps, you should be able to build a model that can extract data from images of dogs and discern their breeds with high accuracy. [2]

A Convolutional Neural Network (CNN) is a type of deep learning neural network that is commonly used for image recognition, object detection, and other computer vision tasks.

The basic idea behind a CNN is to use convolutional layers to extract features from the input image, and then use these features to make predictions about the image.

Here are the key steps involved in how a CNN works:

Convolution: The input image is passed through a set of convolutional filters, which slide over the image and perform element-wise multiplication and summation operations. The result is a set of feature maps that capture different aspects of the input image. [3]

Non-linearity: A non-linear activation function such as ReLU (Rectified Linear Unit) is applied to the output of each convolutional filter to introduce non-linearity into the model.

Pooling: The feature maps are then down sampled using a pooling operation, which reduces the size of the feature maps while preserving their important features. This helps to reduce the computational complexity of the model and make it more robust to variations in the input image.

Fully Connected Layers: The resulting feature maps are then flattened and passed through one or more fully connected layers, which perform a weighted sum of the features to make the final predictions.

SoftMax: The final layer of the CNN uses a SoftMax activation function to produce a probability distribution over the output classes. The class with the highest probability is then chosen as the predicted output.

Backpropagation: The model is trained using backpropagation, which calculates the gradient of the loss function with respect to the model parameters and updates the parameters using an optimization algorithm such as stochastic gradient descent (SGD).

By iteratively updating the model parameters using backpropagation, a CNN can learn to extract relevant features from input images and make accurate predictions about their contents.

III. RESULTS AND DISCUSSION

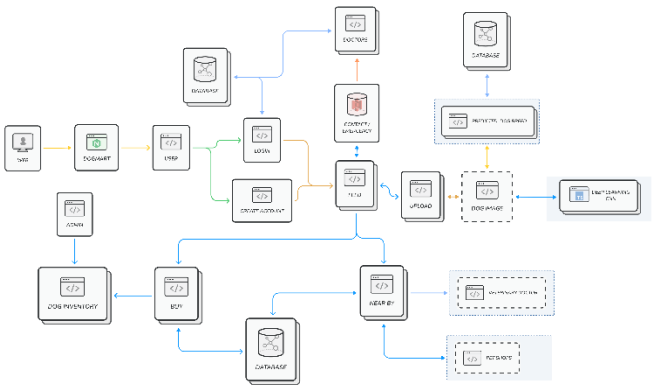

Fig. 1. Architecture of DogMart

It will a web application which will provide the following features:

A. It will have an Admin panel through which we can add products in the Dog Inventory and Take the Orders made by the Customers.
B. The Web Application Will have a login page through the customers can access the following features such as:
    1.) Predict a Dog Breed: The user can easily predict any dog breed, by uploading the dog's image in the website. The CNN model will run and the output of the prediction will be printed.
    2.) E-commerce Website: The user can buy any dog of his/her liking from the website.
    3.) Search Nearby Veterancy Doctor: The app also provides a feature of searching nearby veteran doctor.
    4.) Search nearby Pet Shops: The user can also search nearby pet shops through the website.

To Overcome the cyber threats, we are using password encryption using bcrypt library in node.js. The admin panel is made using stripy which is a headless CMS and we have used MySQL as the database. React is used in the frontend along with

html and CSS. We have also kept a filter products option in which the user can filter the product list based on his preferences and liking. We have used react redux which is a library that combines the React UI library with the Redux state management library. It provides a way to connect the Redux store to React components, allowing them to access and manipulate the application state in a predictable and efficient manner. Payment Gateway is done using stripe which provides us a customized payment page.

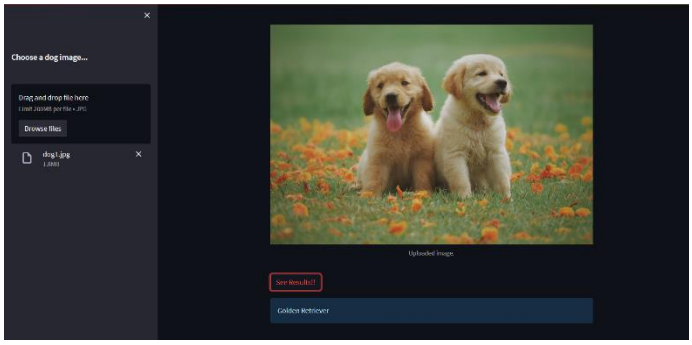

Fig. 2. Dog Breed Prediction

The Web Page takes the image of the dog as input and run the model which is trained on 120 Difference Dog Breeds.

After uploading the dog images the prediction process works like this:

1.) Data preprocessing: The new dog image is preprocessed to ensure it is in the correct format and size for input to the CNN model. This may involve resizing, cropping, and normalizing the image.

2.) Prediction: The preprocessed image is fed through the trained CNN model, which generates a probability distribution over all the possible dog breeds. The predicted breed is then chosen as the one with the highest probability.

3.) Post-processing: The predicted breed may be further processed or displayed in a user-friendly format, such as a text or image output.

Overall, the prediction process involves taking a new dog image, passing it through the trained CNN model, and using the output to predict the most likely breed of the dog in the image.

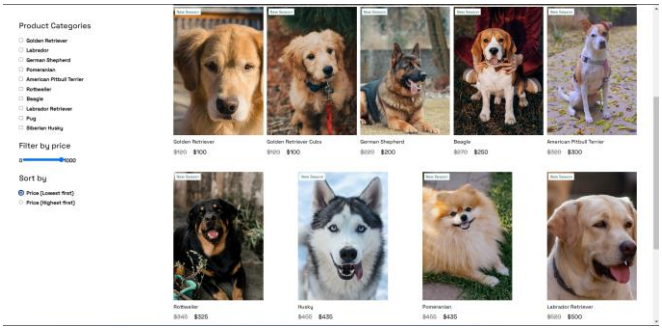

Fig. 3. E-commerce of Dogs

Fig. 4. Product and Cart

As Shown in Fig.3 the products will be listed on the web pages and each product page will have parts such as title, description and price. The user can buy the dog of his choice. After the payment has done a request will be send to admin. After Receiving the request, the admin will verify the transaction and will complete the order.

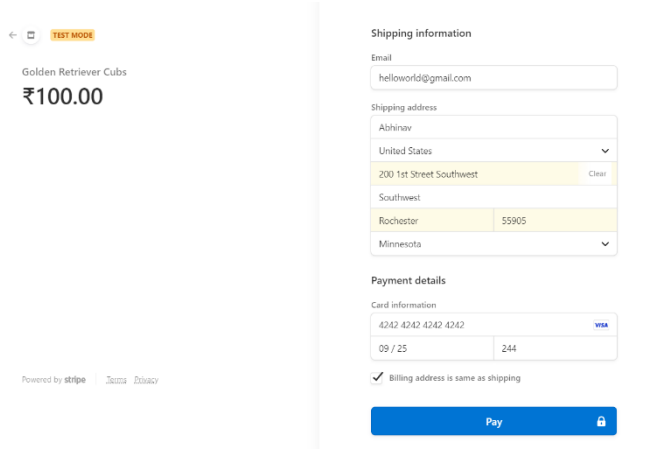

Fig. 5. Payment Page

IV.CONCLUSION

Dog breed prediction has numerous practical applications, including:

1.) Animal welfare organizations: Animal shelters can use breed prediction to identify the breed of stray dogs and improve the adoption process. Knowledge of the breed can aid in matching potential adopters with dogs that match their lifestyles and preferences.
2.) Veterinary medicine: Veterinarians can use breed prediction to diagnose certain breed-specific health conditions and customize treatments accordingly.
3.) Law enforcement: Police and other law enforcement agencies can use breed prediction to identify the breed of a dog involved in a crime, such as an attack or bite incident.
4.) Improved breeding practices: Dog breeders can use a prediction system to ensure that they are breeding dogs with desirable traits and characteristics. This can help to improve the overall health and temperament of dog breeds over time.
5.) Pet insurance: Pet insurance companies can use breed prediction to determine the likelihood of certain health issues based on breed, and adjust their coverage and premiums accordingly.
6.) Dog shows: In dog shows, breed prediction can help determine which dogs are eligible to participate in certain categories and competitions.
7.) Better understanding of dog behaviour: By analysing patterns in the data, a dog breed prediction system can provide insights into the behaviour of different breeds. This can help researchers to better understand the underlying genetic and environmental factors that contribute to a dog's behaviour.

In conclusion, dog breed prediction can provide valuable insights for dog owners, breeders, veterinarians, and other professionals involved in the care and management of dogs. Finally, we decided to focus our experiments on dogs because we found them to be a fascinating subject for several reasons. Firstly, dogs display an incredible diversity of breeds, sizes, and physical features. Additionally, their loving and loyal nature has made them popular companions for humans across the world. Lastly, there are a vast number of photographs of dogs available, making them an ideal subject for our research. Our ultimate goal is to improve our understanding of fine-grained classification and create a useful tool that can benefit scientists in various fields.

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