CAPSTONE PROJECT REPORT

An Intelligent System for Dog Breed Identification

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CAPSTONE GROUP: KC382

UNDER THE GUIDANCE OF **DR. MOIN HASAN**

School of Computer Science and Engineering

TOPIC APPROVAL PERFORMA

School of Computer Science and Engineering (SCSE)

Program : P132::B.Tech. (Computer Science & Engineering)

COURSE CODE : CSE445 **REGULAR/BACKLOG :** Regular **GROUP NUMBER :** CSERGC0382

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Qualification : ____________________ **Research Experience :** ____________________

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SPECIALIZATION AREA : Intelligent Systems **Supervisor Signature:** ________________

PROPOSED TOPIC : An Intelligent System for Dog Breed Identification

Qualitative Assessment of Proposed Topic by PAC		
Sr.No.	**Parameter**	**Rating (out of 10)**
1	Project Novelty: Potential of the project to create new knowledge	6.69
2	Project Feasibility: Project can be timely carried out in-house with low-cost and available resources in the University by the students.	7.00
3	Project Academic Inputs: Project topic is relevant and makes extensive use of academic inputs in UG program and serves as a culminating effort for core study area of the degree program.	7.63
4	Project Supervision: Project supervisor's is technically competent to guide students, resolve any issues, and impart necessary skills.	6.69
5	Social Applicability: Project work intends to solve a practical problem.	7.06
6	Future Scope: Project has potential to become basis of future research work, publication or patent.	7.00

PAC Committee Members		
PAC Member (HOD/Chairperson) Name: Dr. V Devendran	UID: 22735	Recommended (Y/N): NA
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Final Topic Approved by PAC: **An Intelligent System for Dog Breed Identification**

Overall Remarks: Approved

PAC CHAIRPERSON Name: 13897::Dr. Deepak Prashar **Approval Date:** 08 Mar 2021

4/30/2021 11:10:17 PM

DECLARATION

We hereby declare that the project work entitled "An Intelligent System for Dog Breed Identification" is an authentic record of our work carried out as requirements of Capstone Project for the award of B.Tech degree in Computer Science and Engineering from Lovely Professional University, Phagwara, under the guidance of DR. MOIN HASAN, during the 1/1/2021_____to____25/5/ 2021. All the information furnished in this capstone project report is based on our intensive work and is genuine.

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CERTIFICATE

This is to certify that the declaration statement made by this group of students is correct to the best of my knowledge and belief. They will complete this project under my guidance and supervision. The present work is the result of their original investigation, efforts and study. No part of the work has been submitted for any other degree at any University. The Capstone Project is fit for the submission and partial fulfilment of the conditions for the award of a B.Tech degree in Computer Science and Engineering from Lovely Professional University, Phagwara.

Signature and Name of Supervisor

DR. MOIN HASAN

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We are grateful to everyone who has helped us in every way in the making our project. We would like to acknowledge with thanks the kind of patronage, loving inspiration and timely guidance, given by our course mentor **DR. MOIN HASAN** sir and we would also like to express our sincere Thanks to all of the professors whose lectures provided us with intellectual understanding and clarity of comprehension, allowing us to achieve our goals the work of the project easier. Last but not least, we express our heartfelt gratitude to our family and friends, who have served as continuous sources of inspiration and support and their valuable advice for the preparation of this project.

TABLE OF CONTENTS

1.INTRODUCTION

The aim of this project is to classify dog breeds from photographs or simply by the face of dogs. This is a fine-grained and well-defined classification issue: all Canis lupus breeds intimate share similar body features and overall structure, so identification and finding difference between breeds becomes a very huge problem. In addition, there is little inter-breed variation and a lot of intra-breed variation; in other words, there are little variations between breeds and a lot of differences within breeds, with colour, shape, and size differences. This dilemma is not only challenging, but it also has implications for other fine-grained classification issues. The methods used to solve this problem, for example, area fine-grained classification problem can be solved using any number of groups with relatively little variance within them. In the natural world, an identifier like this may be used in biodiversity surveys, saving time and money for scientists doing research on the health and abundance of specific plant populations.

2-. Profile of the Problem: -

Before starting coding on An Intelligent System for Dog Breed Identification, we first made tasks in Microsoft project 2007, so that everything can be done systematically; and we went with defining the small milestones so that the chances of missing any deadline can be avoided. Technically speaking, we have used all the modern and up to dated technologies in this project, so that the site can be faster and smooth while operating.

2.1 Rationale/Scope of the Study: -

When the selection of project discussion started, we researched a lot to find the best possible topic on which we can work, for our project, so that it can give us maximum learning and can give us a fair chance of growing. So, at last, we come up with the plan for building a Interface/Portal on Dog Breed Identification, as this includes all the major and minor features that we have learnt so far in our 4 years of graduation. So basically, the project is going to cover all technical aspects of a project there can be.

3.Existing System: -

3.1 Introduction: -

1) Easily accessible
2) Data-Driven
3) Secure
4) Scalable
5) Free to use

Ease of Access:

Our Project aims to be very easily accessible and user friendly, we will be trying to use as large no. of dataset of many different dog breeds for better accuracy. In future We will be also creating a very interesting front end.

Data-Driven:

a) As this project will be working with on a large no. of dog breeds and with time new breeds are being discovered, we have to make sure that we can keep up with its pace and deliver satisfactory accuracy/result. This platform will have to reflect all the changes that occur in the real world. To make sure of that, we will be collecting data from different sources.
b) Such a data-driven approach will make our interface more flexible because any changes or new discovery of new dog breed with their dataset upgradation on the interface will result high accuracy. (which will be repeated by our team)

Secure:

Since this is a dataset-driven project, the security of that data will be an utmost priority. The platform will use the dataset from trusted source. Much more data will not be shared with anyone User privacy will be considered a top priority.

Scalable:

As there is a lot of room for this project to grow beyond its limits, we design it with that in mind. The platform will be able to easily connect with new users.

Free to use:

There are no account opening costs, and all services are free.

3.2 Related Work

This section explores various research works carried out on Dog Breed Identification.

- In 2018, Wenting Shi, et al. [] proposed "Image Recognition" technique in which they used the data set from Kaggle, applied data argumentation to pre-processing the data set to increase the training data and multi-method (Dropout, weight Decay) to avoid overfitting. This model used the concept of CNN, ResNet18, VGG16, DenseNet161, and AlexNet classification network. To evaluate the performance, they used SoftMax and Cross-Entropy. The overall accuracy of this project was more than 85.14%. Some challenges of this project are the quantity of the data set is inadequate and less accurate.
- In 2018, Xinyuan Tu, Lai and Yanushkevich created a model of transfer Learning using Columbia Dataset and Stanford Dogs dataset, in which they investigated how this model can help improve identification of dogs. Applied CNN coarse-to-fine approach and focused on transfer learning. And finally, both coarse and fine stage were applied with transfer learning with GoogleNet. However, the model was not giving much accuracy with some dog breeds and could not cross the accuracy more than 83.94%.
- In 2018, Fang Wu, et al. [] developed an iOS mobile application for detection of Dog breeds using deep learning. Which was trained using 120 different breeds of dogs. Normalization of size of the images by clipping it is also supported. In order to catch the features and info from the images through CNN, transfer leaning with fine tuning was applied to the dog breed at lower rate. The final accuracy for 50 classes of images was 85% and 63% with 120 classes of images. However, there were some issues with devices with different screen sizes.
- In 2019, Aydin Ayanzadeh and Vahidnia created a project for Dog Breed Identification using Deep Neural Networks using Stanford Dog Breed dataset. In this they have leveraged and modified the state of art models on ImageNet using a pretrained model to extract the edges from the features in Dog Breed dataset. They used DenseNet-121, DenseNet-169, ResNet-50, and GoogleNet to compare the performance of the ImageNet and found the accuracy of 89.66% on Res-

Net50, 85.37% on DenseNet-121, 84.01% on DenseNet-169 and 82.08 on GoogLeNet showed the better performance to the method proposed in the previous works but accuracy remained below 90%.

- In 2019, Punyanuch Borwarnginn, at al. [] used Columbia Dataset and created a model through CNN using two image processing approaches. For first approach they used conventional approach of Local Binary Pattern and Oriented Gradient. And for second process they used Deep learning by using tutored CNN. It carried accuracy of 96.75% as compared to that of HOG having 79.25% rightness. However, accuracy of the CNN model can be improved by training more dogs of the same breed to the model.
- In 2019, Hsu, David did a project to classify dog breeds using CNN by using tow network architecture i.e. LeNet and GoogLeNet. In the GoogLeNet architecture “inception layers” were included. Used open software package Caffe for learning framework. They found the highest accuracy for different layers of LeNet and GoogLeNet as: 8.9% and 9.5%. Lacking accuracy in recognizing face, eye and ear which could be increased by part localization using different filters.
- In 2020, Sneha I. Kadari et al. [] created a project with web interface for Dog Breed Prediction using CNN and web development tools. In the whole process they chose an image for input , performed object recognition to connect Tensorflow containing 1000 images. Then input image was given as input parameter to ReadImage()to convert the image into pixels. Then to convert the pixels into tensor StepInput() was executed and finally tensor the image as input parameter is passed as input which predicted the output based on the probability. The model was not much accurate because of lesser number of training images.
- In 2020, Zalan Raduly, et al. [] proposed "Image Recognition" technique using Machine learning, CNN concepts, they took the data set of Stanford. They used fine tuning of images and they have also used the mobile application called "Sniff" which determines the breed of the dog using its image eve`n when there is no internet connection. Had rightness of more than 90%, but is quite less when it comes to determining some breeds of dogs.
- In 2020, Punyanuch Borwarnginn, et al. [] applied a deep learning to identify breed of dogs. They started the process with a transfer learning by retraining a pre-trained dataset. Then, they did image augmentation on the training dataset, for improving classification performance. The suggested model's accuracy was 89.92 percent. But the model remained with a challenge for them to improve the classification.

- In 2020, Ding-Nan Zou, et al. [] developed an image dataset for classification of dog breeds named, ‘The Tsinghua Dogs Dataset’. They used CUB200-2011 fine-grained technique and had trained the dataset by using PMG, TBMSL-Net & WS-DAN. The breed classification model tested on Tsinghua Dogs dataset achieved an accuracy of 82.65% which was greater than that of

  accurcy of Stanford Dogs dataset which achieved 58.14%. However, this research is mainly focused on breeds found in china and might not perform in another region.
- In 2012, Jiongxin Liu et al. [] found an idea about a solution for identifying a dog with their face images. The method has been used in this paper is deep learning. Created a labelled dataset of 8,351 real-world photographs of 133 dog breeds recognised by the American Kennel Club (AKC). we also create mirror image of the dataset, npm so its quantity doubled. Accuracy they got is 67% which not that much good for machine learning terms. Their accuracy was decreased due to low accuracy, object stability, lower number of images, and their data only detect American dogs.

- In a paper, Voith, Ingram, Mitsouras, and Irizarry compared visual breed identifications of 20 mixed-breed dogs to DNA analysis. The Mars Veterinary Wisdom Panel MXTM was developed by Mars used to test blood samples sent to the MARS VETERINARYTM laboratory. The A statistical model that infers breed from a pattern of 300 genetic markers was used to investigate the accuracy of breed. Although they don’t have enough data to improve accuracy.
- Olson, Levy, et al. [] visual breed identification's ubiquity among experts and validity as compared to DNA analysis were investigated in a report. Blood samples from the dogs were sent to MARS Veterinary, Wisdom Panel Canine Genetic Study forDNA identification. The A DNA test found that 21% of dogs had a mutation “pit-bull type” heritageIn Overall, even with a limited goal for identification, the overall validity did not achieve a satisfactory standard. Although they have to work on different bread also, they work on limited data set.
- Kenneth Lai, et al. [] conducted an Image separation method follow a standard pipe where a collection of features removed from the image and given a split. They built a database of 8,351 new wide-angle images. Designed a complete concept app It was made available as a free iPhone app. This approach recognizes the dog's face automatically, aligns the face and removes that greyscale SIFT features and histogram color and predicts the type of the breed. Although their data-set is limited which effect their accuracy.
- In 2015, K.R. Olson, et al. [] developed a model for identification of pit bull type dog. There were 16 breed assessors and 120 dogs in this prospective cross-sectional sample. For breed

recognition, the total amount of blood sent a commercial DNA testing facility. Though DNA breed signatures identified only 25 dogs as pit bull type (21%), shelter workers identified 62 dogs as pit bull type (52%). Although they have to increase data of pit bull from various region and they have to decrease the time consumption.

- Kenneth Lai, et al. [] conducted an investigation of the division animal in the image. They introduced a new pet database with new annotations which includes 37 species of cats and dogs. The model includes the make-up, which is taken up by the appearance, taken by word bag model describing animal fur. Second, they compare two distinctions. They might got good result if they have more data from different places.
- In 2020, Rakesh Kumar, et al. [] have used a fine-grained image cataloguing. To begin, the image is divided into parts several lattices, and the size of the training batch is determined accordingly, after which An algorithm is employed in order to separate and merge the descriptors, as well as image's knowledge about the channel was obtained as the convolutional neural network's data, and finally. Although the Data train on prediction which may decrease accuracy.
- Kenneth Lai, et al. [] conducted investigation on two different possible structures. The upper part of the frame is designed for type separation and performance. Depending on the portion of the selected network, the output of the program is by it can be a predicted dog ownership or a limited breed dog. In this paper, they suggest using coarse-to-fine how to improve the accuracy of predicting identity dog based on the use of "soft" dog-like biometrics give birth.

3.3 What's new in the system to be developed:

The following are the system's latest features: -

A. To improve precision, a large number of datasets are used.

B. We have the ability to make changes such as edit and remove. and create and edit dataset images.

C. We can check accuracy of a dog N number of times.

D. Accuracy of a picture not having dog will always be less and vice versa.

E. Large no. of different dog breeds is taken into consideration.

4-Problem Analysis: -

4.1 Product definition: -

For this project, we have decided to use the latest most technologies used today, i.e., ResNet18, AlexNet, Data augmentation, Stochastic Gradient Descent, Breed Identification and Face Parts Localization These components provide developers with an end-to-end environment in which to function.

4.1.1 ResNet18

The term "residual neural network" refers to a network that contains residual information the use of a residual learning framework can make it easier to train networks that are much deeper than those previously used. The output of one layer and the input of the previous layer are combined as the input of the next layer in a residual block.

ResNet18 was used in this case, and it was trained using ImageNet.

$$y = F(x, +Wi) + x \tag{1}$$

$F(x, +Wi)$ is represented as the residual mapping function that we need to train.

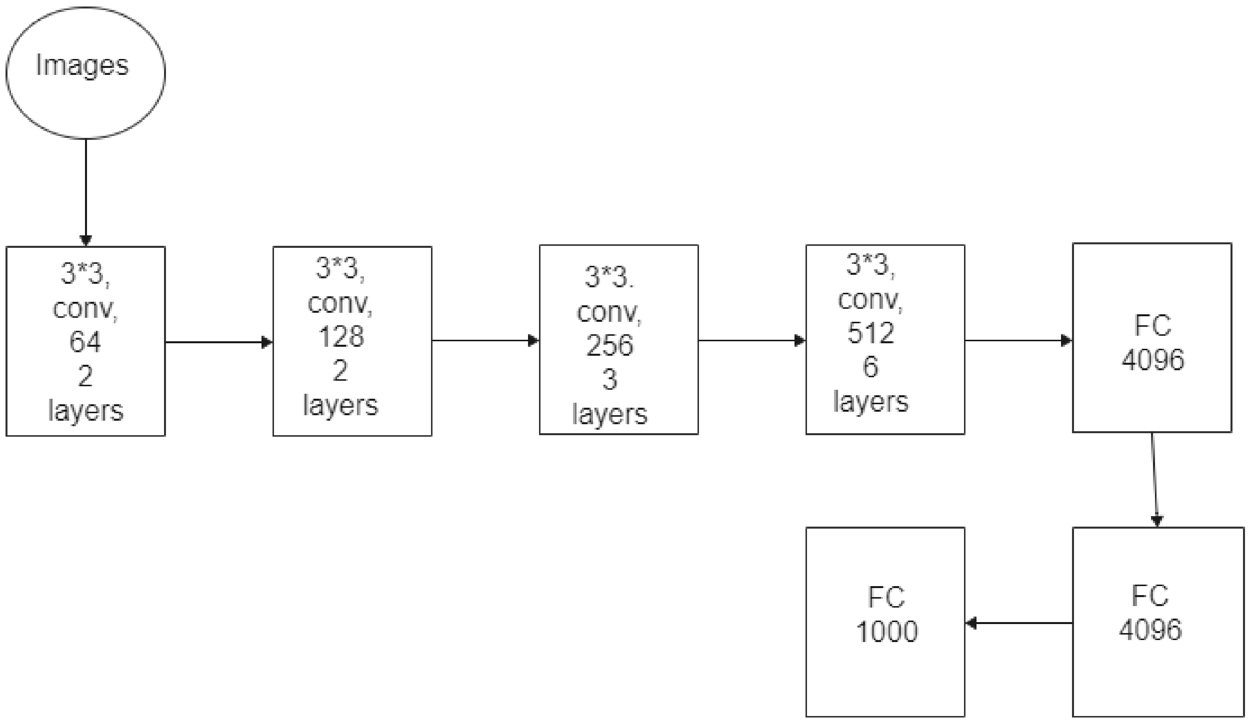


Fig 1: ResNet Block

4.1.2 AlexNet

AlexNet consists of 5 convolutional layers, 3 full connected layer, few of them are max pooling layers and lastly with a final 1000-way SoftMax. It has 60 million parameter and 650000 neurons. To minimize overfitting in the fully connected layer Dropout is used.

We used AlexNet, which was trained on ImageNet, in this case

$$c_{y,z}^{j} = b_{y,z}^{j}/(l + b\sum_{k=\max\left(0,j-\frac{m}{2}\right)}^{\min\left(M-1,J+\frac{M}{2}\right)}((b_{y,z}^{j})^{2}))^{\beta} \quad (2)$$

$b_{y,z}^{j}$ is the output of ReLU of the I'th channel's at (y,z), l, m, b, β are constants.

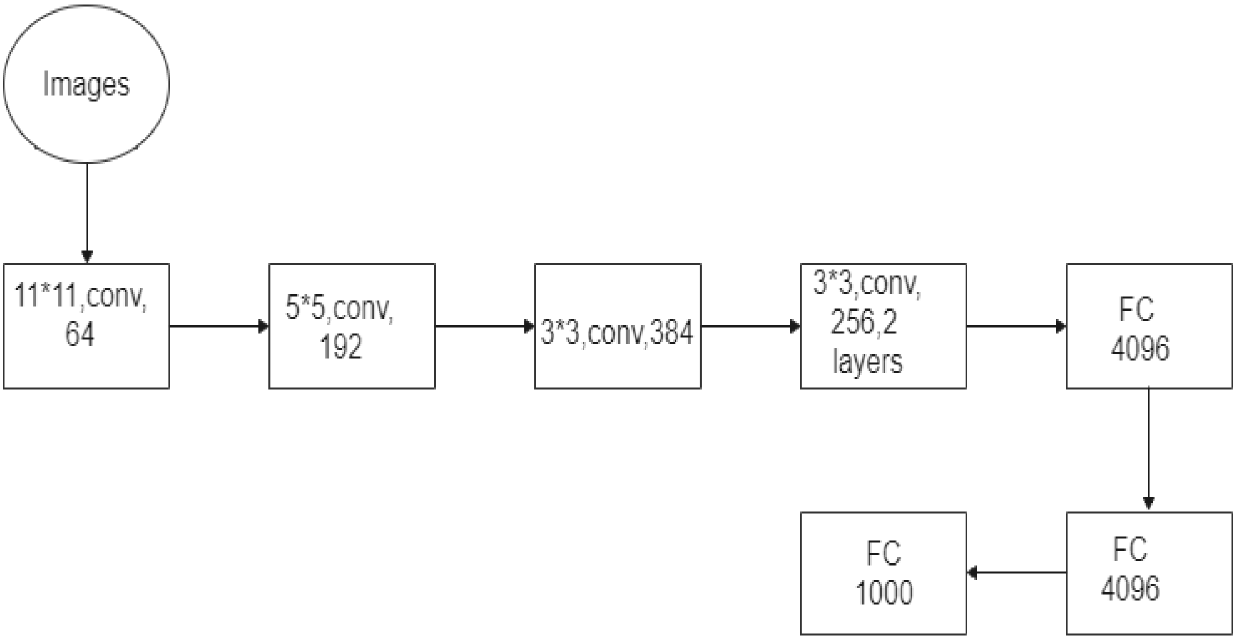


Fig 2: AlexNet Block

4.1.3 Data augmentation

Data augmentation is common method for minimizing overfitting on data which is been trained by taking help of different transformations earlier than the feedforward pass while training.
Here: - g(y) represents the function and y represents image.

(3)

$$g(y) = P\left(\frac{y}{255.0} - 0.5\right) * 2.0$$

4.1.4 Stochastic Gradient Descent (SGD)

Stochastic gradient descent is one of the well-known optimization algorithms. The SGD algorithm is a significant reduction in complexity.

Because the gradient of $En(fw)$ is not computed exactly. It estimates this gradient in each iteration using a single randomly chosen example a_u

$$x_{u+1} = x_u - z_u \nabla_x R_{(a_u, x_u)} \tag{4}$$

During each iteration, a random example determines the stochastic process. When we compare it to traditional gradient descent SGD can converge with high probability under technical assumptions hence saving time on computation.

We used SGD with minimum batch size, learning rate schedule, momentum, and weight decay in our task. We then repeat these steps until we get the best results.

4.1.5 Face Parts Localization

We use the consensus of model's method to be localised portions the face of the dog. The procedure accurately locates the nose and eyes; we work with much more complex dogs section at the time of breed recognition procedure. To model component locations, low-level detectors are paired with labelled photographs. For each dog section, we start by training a sliding window SVM detector. J is a query image, pJ is the position of the image's components, and D is the Our objective is to compute detector responses for the sections in J

$$\hat{p}^J = arg \max_{pI} P(p^I \,|D) \tag{5}$$

In exemplars that have been manually labelled dictate possible sites for these components.

These examples assist in the establishment of different types of conditional independence components. pl represent Eq. 5 and the positions of the sections in the l'th exemplar picture becomes

$$\hat{p}^J = arg \max_{p^I} \sum_{l=1}^{n} \int_{u \in U} \prod_{j=1}^{o} \quad P(\Delta p_{l,u}^{(j)} P(p^{(j)J} | D^{(j)}) dt \tag{6}$$

$$\hat{p}^J = arg \max_{p^I} \sum_{l=1}^{n} \int_{u \in U} \prod_{j=1}^{o} \quad P(\Delta p_{l,u}^{(j)} P(p^{(j)J} | D^{(j)}) dt \tag{7}$$

The summation of our case is of all m exemplars, or all labelled examples of dog face components in our context. The integral is over the exemplars' transformations of resemblance t. In the query

picture, there is a difference in the location of part I and the exemplar transformed by t in the kth model, is denoted by p(j) l,u, and the part J in the question image and the transformed exemplar are not in the same place is denoted by p(j) l,u. This requires incorporating a part generative model positions, which transforms and places a randomly chosen example in the image, Noise is also there. Following part freedom in variance We exclude the model from the equation.

The optimization is then solved using a RANSAC-style method, in which a large number of exemplars are randomly chosen and u equals the detector output modes. The model part locations are compared with the detector performance for each hypothesis in which a model is converted into an image, and the best fitting fits pool information to form a consensus about the part locations. On the first attempt,

$$\hat{p}^{(j)J} = arg \max_{p^{(i)I}} \sum_{l,u \in N} \quad P(\Delta p_{l,u}^{(j)} P(p^{(j)J} | D^{(j)}) \tag{8}$$

Where $\Delta p_{l,u}^{(j)}$ is modelled, We sun over the best N between the exemplars and detectors provided by RANSAC as a Gaussian distribution.

4.1.6 Breed Identification

The face of the dog is the sole focus of our classification algorithm. This is partially because the face is mostly a rigid entity, making it easy to compare photographs of different dogs. We are, however, motivated by the idea that dog breeds should be classified primarily by their looks. The body outline of a dog is not only difficult to recognise and barely visible in pictures, but it also provides little additional information. detail, unless the in the most serious circumstances (e.g., dachshunds).

4.1.7 Classification of Dog Breeds Using Part Localization

Our goal is to compute the dog's breed, denoted by C.

$$\ddot{C} = arg \max_{C} P(C|J) \tag{9}$$

Allow the positions of the parts in the query image to be determined by Allow **p***J* to specify the component positions in the query image *J*.
Then

$$\ddot{C} = arg \max_{C} \int P(C|J, p^J)P(p^J|J)dp^J \tag{10}$$

Here, we combine all possible positions of the pJ sections in the picture. If the true positions of the components can be accurately localised, P(pJ |J) is a delta function about them.
Then if we write

$$\hat{p}^J = arg \max_{p^J} P(p^J|J) \tag{11}$$

we have: -

$$\hat{C} = arg \max_{C} P(C|\hat{p}^J)P(\hat{p}^J|J) \tag{12}$$

Note that $P(\mathbf{p}J|J)$ is not dependent upon C, so that

$$C = arg \max_{C} P(C|J, \hat{p}^J) \tag{13}$$

As a result, we can divide our issue into 2 segments.
First, as described in the previous section, we must compute $agr\ max_{p^J} P(p^J|J)$
After that, we must compute arg $max_C\ P(C|J, \hat{p}^J)$.

Note that: -

$$P(C|J\hat{p}^J) = \frac{P(J|C, \hat{p}^J)P(C|\hat{p}^J)}{P(J|\hat{p}^J)} \tag{14}$$

Here is the denominator is $P(J|\hat{p}^J)$ constant that has no bearing on which breed has the best chance of succeeding.

So,

$$\hat{C} = arg \max_{C} P\ (J|C, \hat{p}^{J})P(C|\hat{p}^{J}) \tag{15}$$

Our understanding of what makes up a breed, on the other hand, is based entirely on our collection of labelled exemplar images. The information in these images is divided into two sections. To begin, we'll use the abbreviation pC to denote the known positions of all parts in all breed C exemplars. Then we use DC to denote descriptors that describe the appearance of the breed C exemplars. These descriptors are extracted at the pC-specified component locations.

So Eq: -

$$\hat{C} = arg \max_{C} P(J|D^{C}, p^{C}, \hat{p}^{J})P(D^{C}, p^{C}|\hat{p}^{J}) \tag{16}$$

To approximate, We presume that the breed appearance descriptors DC have a standardised distribution across breeds and are unrelated to their roles.
Hence Eq: -

$$\hat{C} = arg \max_{C} P(J|D^{C}, p^{C}, \hat{p}^{J})P(p^{C}|\hat{p}^{J}) \tag{17}$$

Hence, we compute

$$P(J|D^{C}, p^{C}, \hat{p}^{J}) \tag{20}$$

by comparing the appearance of the picture at and around the p^{J}agreed component locations to the a ppearance of our exemplars in their corresponding position p^{C}.

4.1.8 Features: -

Dogs are now becoming important part of one’s daily life, they are now considered as the family member in a house. It is said that dogs are men’s best friend. From morning walk to evening walk, shopping to shows, dogs are with human beings like their best friend. But sometimes it is difficult to recognize the breed of the dog as many dogs of different breeds looks somewhat similar to each other. And it is more difficult for us to make computers understand the same. It can be a great help for humans when computer and easily and accurately identify the breed of the dogs. It can help the doctors to identify the breed with help of technology and start the treatment as soon as possible if any dogs meet any accident. Keeping the same application in mind we have used the Stanford dogs’ dataset, normalized the images, and fed the data into deep learning using Convolutional Neural Networks. We have divided the whole process into three processes, data preparation, training and testing. We have used frameworks like ResNet18, AlexNet, Stochastic Gradient Descent (SGD), etc. ResNet18 makes it easy to train the network which are deeper than the networks used before. AlexNet helps to overcome the problem of overfitting in the layers that are fully connected. SGD helps in reducing the complexity. Our framework can easily locate the parts like eyes, nose, etc. through face part localization method and based on that edges, the framework identifies the breed of the dog, but in some cases, it may happen that shape or size of the dog is not clearly visible in the

image, for that we have used SoftMax and cross entropy to evaluate the training and testing failure. The result which we got was average for the images which are not very clear and quite good in case of clear image of the dog. For a very clear image, accuracy of 97.15% was predicted by the model and accuracy of 85.87% was predicted in case of the image which are not quite clear. Thus we can say that the model gives a good accuracy of 97.15% percentage and cad be used as an application to identify the dog breeds if more training data are fed into the system and more images of same breed can be fed into the system, this will help the model to identify the breed more accurately.

4.2 Feasibility Analysis: -

The method of deciding whether a proposal is worthwhile is referred to as "feasibility". A feasibility analysis is the method used to make this decision. To put it another way, a feasibility analysis is conducted to determine the best system for meeting the performance specifications of your project.
Once a project's feasibility has been established, the project specification, which details the project's specifications, can be prepared. The contents and recommendation of such study will be used as a sound basis to decide whether to go ahead with the project, delay it, or cancel it. Although the Since a feasibility study would necessitate the dedication of significant resources, it is critical that it be carried out competently and without fundamental errors. The analyst would normally consider seven distinct but interrelated forms of feasibility during the feasibility analysis. The following are three of the most commonly used ones:

- Technical Feasibility
- Operational Feasibility
- Economic Feasibility

4.2.1 TECHNICAL FEASIBILITY

At the feasibility point, two or three different configurations that fulfil the main technical requirements but reflect different levels of ambition and cost should be sought. Approaching a variety of suppliers for preliminary consultations may help with the investigation of these technological alternatives. Technical feasibility is the most difficult to assess of all the forms of feasibility.

4.2.2 ECONOMICAL FEASIBILITY

The most common methodology for determining the efficacy of a proposed scheme is economic viability analysis. The method for determining the advantages and savings that are anticipated from a proposed scheme and comparing them to costs is known as cost-benefit analysis.

If the advantages outweigh the costs, the system is designed and implemented. Otherwise, further rationale or alternatives in the proposed scheme would be required if it is to be accepted. This is a continuous endeavour to increase accuracy at any stage of the system's life cycle.

4.2.3 OPERATIONAL FEASIBILITY

It is primarily concerned with human organisation. The following points should be considered:

- What improvements will this device bring?
- What are the organisational systems that will be disrupted?
- What new abilities would be needed? Do any of the current employees have these abilities? If not, will they be able to train in a reasonable amount of time?
- While the project would not be refused solely due to organizational infeasibility, certain factors are likely to have a significant impact on the design and extent of the final recommendations. This feasibility study is carried out by a small group of people who are familiar with information system techniques, who are knowledgeable about the parts of the market that are important to the project, and who are experienced in the systems analysis and design process.

4.3 Project Plan

The systematic analysis of the different operations to be undertaken by a system and their relationship inside and outside of the system is known as planning and scheduling. Data is collected on the available databases, decision points, and transactions managed by the current system during Planning and Scheduling. Planning and decision-making are important conditions for the project's progress. Planning include which dataset should we consider, in what platform we should work, how much accuracy we are expecting, what are the available resources and what we need to arrange.

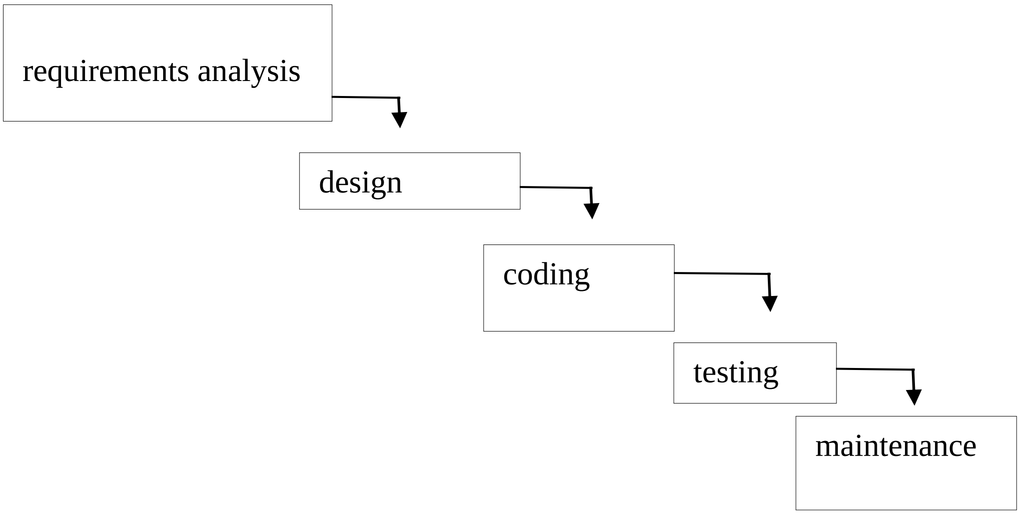


Fig 3: Project Plan

System analysis actually involves the creation of various types of models and system testing, which is why the project is completed.

5-Software Requirement Analysis

5.1 Introduction

SRS' stands for software requirement specification. This document is prepared to determine the software requirement specification for " An Intelligent System for Dog Breed Identification ". An Intelligent System for Dog Breed Identification is an interface. Using this interface one can check or Identify that the dog is of which Breed. Anyone in this world can test and identify the accuracy of the dog of a particular breed via this system. For all this, at first, one have to upload a picture or choose a pic from uploaded database on ' An Intelligent System for Dog Breed Identification ' by providing the required data needed for it.

5.2 General Description

Overall Description in this section the background description of the system should have will provide. ‘An Intelligent System for Dog Breed Identification’ is an independent network system. Every person can use it without any cost. People from a different region of the world can test accuracy via this system. After creating an account people can search and identify dogs of different breeds, they can also check the dog is mix breed if the accuracy is not satisfactory. With the help of this interface anyone can check and identify DOG’s BREED.

User Characteristics: -

‘An Intelligent System for Dog Breed Identification’ does not require any computer knowledge to use it. Anyone can use it very easily.

Design and implementation: -

Being a social Interface system, its Being a social Interface system, its design should be perfect and attractive. It should be secure enough so that user’s data and their personnel information should not be leaked and those should securely be preserved in the system.

We propose an Interface (later can be converted into software) where users can select a dog breed by tapping or downloading a snapshot into the application. The application makes an assessment using traditional neural networks and pre-trained feature extraction models.

The following is a step-by-step procedure for implementing the model on Android application or web application:

1) Resize the image.
2) Summarize the features of the original image, which will be sent to the fully connected network.
3) Fully linked layer structure
4) Model the model using the original sketches and save it as a Model-1.
5) Model-2 is generated by training the model with flipped versions of the original pictures and storing it.
6) Estimate average dog breed for Model-1 and Model-2 results.
7) Set it up on Interface.

Non-functional requirements: -

1) **Performance**: -

   The speed at which results are transmitted to users, as well as the accuracy of the interface, is referred to as performance.

   i. Processing time
   ii. Response time
   iii. Querying time

2) **Scalability & Capacity**: -

   The power of a system refers to the amount of resources made available to it, while scalability refers to the system's ability to use these resources.

   i. Storage
   ii. Growth requirement
   iii. Throughput

3) **Availability**: -

   The percentage of time that the resource is available to interface and is useable is known as availability.

   i. Hours of operation
   ii. Operation of Location

4) **Maintainance**: -

   It explains how well the interface can be maintained and modified.

   I. Architectural standards
   II. Coding standards

5) **5. Backup**: -

   It refers to a system's or interface's ability to plan for and react to a catastrophe.

   i. Backups
   ii. Backup's frequency
   iii. Backup timed
   iv. Recovery time

6) **6. Privacy and Security**: -

Since the database contains potentially confidential material, the system can promote protection and privacy.

7) **7. Mobility**: -

It specifies the system's platform compatibility

6. Design: -

6.1 System Design

The whole system is designed keeping in mind that the pictures should should show accuracy of breed identify and load as quickly as possible. And there isn't any latency to other users. The site should be 100% reliable in terms of data security (data can't be lost or misused). Although, we aren't using any paid data storage, so for now, data will be deleted either by user or automatically after some time. But it's nothing to do with the efficiency of the site. So in our site, if we take an example of photos uploaded by users, we need 2 scenarios, one must be a storage server to store the assets and another would-be database server to store the metadata of the asset (like their unique name, so that it can be easily filtered out while fetching).

Machine Learning is an approach to classify images and extract key feature from an image and then machine learning model use them as input. Image classification and machine learning approach is similar to the way the human brain works. In this method, our system is guided to extract the visual things which is available in the image by computer. When our system gets some idea by observing the running process and by Due to communication with large amount of database, our system is able to understand visual things in image and then it will create some tag and categories accordingly.

On behalf of using fully connected network, our CNN uses that same parameter again and again many times. Having very less amount of parameter decreases the time which is required to learn and to train the amount of data which is required. On behalf of the network which is totally connected with each pixel, CNN has enough ability to detect tinny patch available in the image. As like if we say, read a book using magnifying glass, even we will read all the pages of that book but we will only see a tinny patch of that page at some time.

Let’s suppose we have a 256 x 256 image. On behalf of process all area of image at a same time, CNN can process it by dividing the images in few parts and then process in such a manner like process from left to right and from top to the bottom area of image.

The Stanford Dog Dataset was used to train the model. This dataset includes pictures of 120 distinct dog breeds. There are at least 60 pictures of the dog breed. We have a dataset that we can use to practise, test, and stratify results, validation data 9199 images in train data, shuffle partition with validation

The data contained 2000 images and the test data contained 9381 images.

6.2 Design Notations

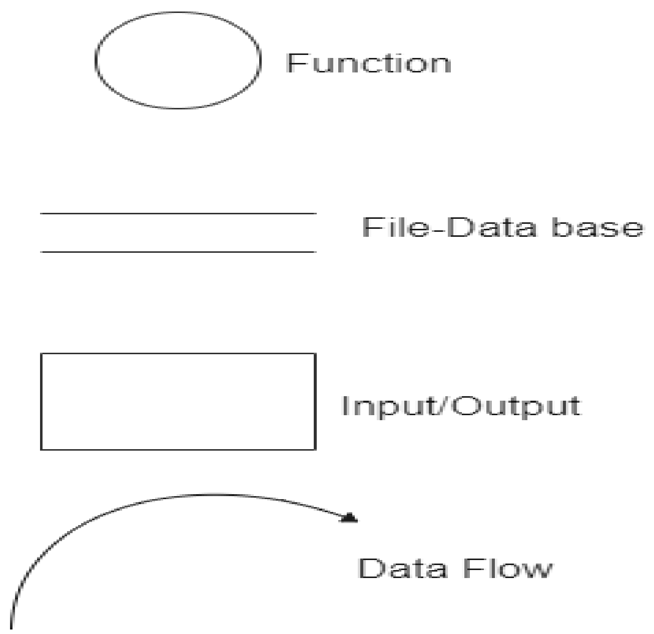


Fig 4: Design Notations

6.3 Detailed Design

In data flow diagrame some symbol are used. A flow diagram is generally used to design by using simple symbols such as an oval, circle, rectangle, data stored and arrows which are often used to depict the knowledge transition from one step to the next.

A DFD is made up of four elements that are identified by four symbols. Symbols are as follows: External entities, Processes, Data flow, Data Store.

External Entity

Squares are used to describe external entities. It is a source or endpoint of data flows that are not within the scope of the research. Only certain organisations that produce or receive data are depicted in a business process diagram.

Data Processes:

Data Processes is represented by a rectangle with a rounded corner. This is a method for transforming or manipulating data as it moves through the machine.

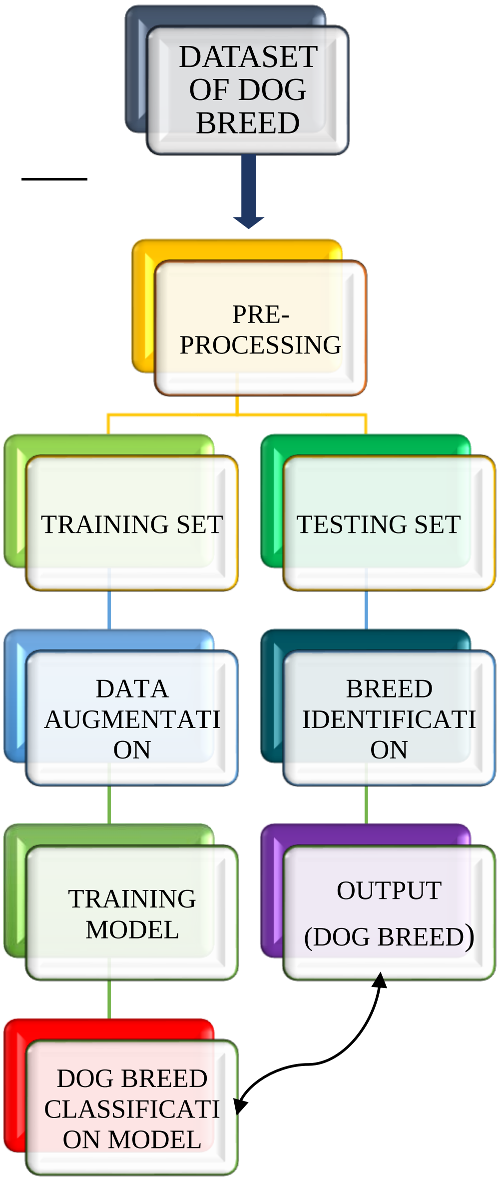
Data Flow

Data flow are represented by arrows sign. It shows the information of the transmission of data from one point to another Information, whether written, verbal, or electronic, often flows through a mechanism..

Data Store

Datastore is represented by an open-ended rectangle symbol. It acts as a data base for the applications. Each datastore is given a reference which is followed by an arbitrary number.

6.4 Flowcharts



6.2: Flow Chart

6.5 Pseudocode: -

1. If a user is new, sign up and enter after confirmation via the link forwarded to the registered email id.
2. If the user exists, direct login and enter.
3. Upload Dog Picture.
4. Get the Information of the Dog Breed Identified.
5. Change password from a User Profile page.

7. Testing

7.1 FUNCTIONAL TESTING

Form of black-box testing in which the test cases are built around the requirements of the device components being tested. Functions are checked by feeding them data and analysing the results, and the internal configuration of the software is almost never organised.

The selection of test cases relies on a range of innovations that fulfil the overall research objectives. The engineer produces a sequence of test cases in the test cases design process to demolish the programme that has been designed.

There are two approaches to analyse software goods.:

1) Knowing the exact role that a product is supposed to do, a test may be run to ensure that all of the functions are completely functional and still looking for flaws in each one. Black-box research is the term for this technique.
2) Once you know how the product works within, you will run a test to ensure that all internal processes were completed according to expectations and that all internal modules were properly exercised. White-box testing is the term for this process.
3) Error detection is the aim of black box research. It's used to show that software functions are operations; that input is correctly acknowledged and output is correctly generated in a specified amount of time; and that the confidentiality of external data is preserved (e.g. data files.). A black-box analysis looks at some of the more basic features of a machine without taking into account the software's internal conceptual framework.
4) White-box programme testing is based on a thorough review of procedural data. Providing test cases that exercise a complex series of criteria and loops that test the software's logical routes. At different stages in the program's life cycle, the state of the programme will be checked to see whether the intended or asserted status matches the real status.

7.2 STRUCTURAL TESTING

Its aim is to test the functionality of the built framework, configuration, and programmes. The key goal is to ensure that the engineered product is structurally stable and can work properly. It tries to figure out how the hardware was applied correctly and how any of the pieces work together as a team when they're all put together.

The following experiments should be planned and conducted at different times to ensure that the substance passes the requirements.

- Specific standalone systems was subjected to unit tests performed by the production team.
- Integration Tests after two or more products units is integrated conducted by the development team to test the interface between the integrated units.
- Functional Test before the release to validation manager, which is developed and carried out by a group of individual designers and coders to ensure that the software offered is in accordance with the customer's requirements.
- Acceptance Tests are performed by the production team prior to the release to the certification manager, if any are supplied by the user.
- Validation Tests before Validation of the commodity to the customer's specifications, done by the validation team requirements specifications, as well as the documents provided by the customer.
- Regression Testing is the re-execution of some subset of test which already is conducted to Ensure all the modifications don't have any negative consequences.

7.3 LEVEL OF TESTING: -

We have the idea of stages of checking to expose the defect that appears in various phases. The fundamental stages of research are as follows: Unit Testing, Integration Testing, System Testing and Acceptance Testing.

All these testing performs very important role in any Interface. They all are extremely important in their individual role as well as collective role.

The Diagram representation of their role are: -

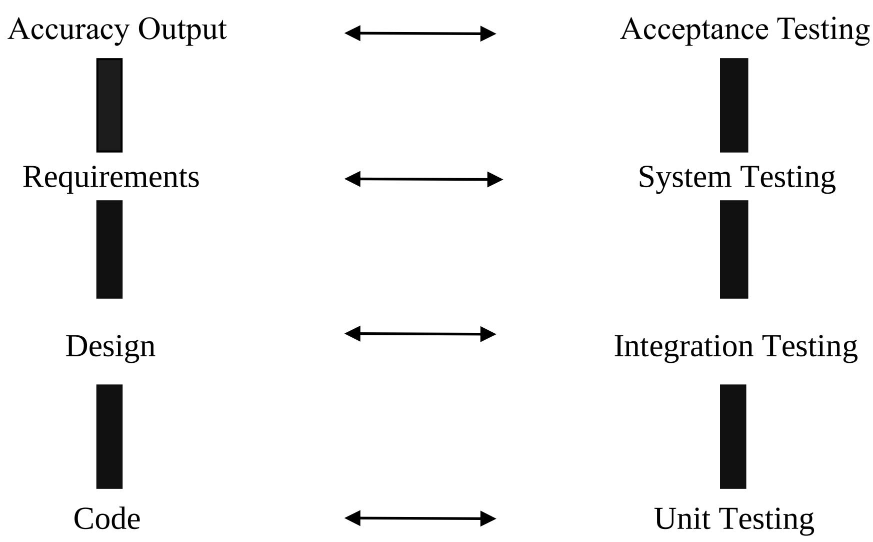


Fig 5: Level of Testing

Integration Testing: -

In this research process, it is the gradual path to the construction of programme structure. Starting with the main control module, modules are connected in a downward order.This form of testing has been performed in 5 steps: -

1. The test drivers are controlled by the main control modules, and stubs are used to replace all main control components.
2. The chosen subordinate stubs are updated one at a time, depending on the integration.
3. When each part is combined, tests are carried out.
4. After completing each set of the A new stub is added to the exam.
5. It is also tested to ensure that the new errors have not been introduced.

Decisions are made at the top layers of the hierarchy of a well-factored programme layout, so they are met first. If there is a big control challenge, it is critical to recognise it as soon as possible. This method is referred to as top-down integration checking.

Bottom-up integration testing would continue with the development and testing of atomic modules as the components to be assembled from the bottom-up. Processing is often required for components that are subordinate to a defined standard, and stubs are no longer required..

Clusters of low-level modules execute basic programme tasks. The programme updates every time a new module is introduced as part of the integration testing. New data flow paths can be created, new I/O can be performed, and new control logic can be enabled.

This modifications have caused issues with a previously flawless feature. In the form of a research plan for integration. Successful experiments lead to the detection of defects, which must be fixed. Any aspects of device configuration have improved as a result of software correction.

Smoke testing

One of Integrity testing type, also known as smoke testing, is widely used when shrink-wrapped software devices are being made. It was created as a project pacing tool for time-sensitive tasks, enabling us to evaluate the project on a regular basis. This consists of the following steps: -

a) A "build" is made up of software components that are converted into code. Data files, libraries, reusable modules, and built components all make up a build.
b) The build is combined with other forms of builds, and the whole thing is smoke checked on a regular basis.

7.4 Testing the Project:

Fig 6: Testing of Project

S .no	Test cases	Expected value	Actual value
1	If picture of any other animal/used.	Accuracy value would be very less	Displayed
2	If picture of Dog used.	Accuracy value would be High	Displayed
3	If picture of Dog with background or with another animal used.	Accuracy value would be Satisfactory	Displayed

8.Implementation

8.1 SOFTWARE MAINTENANCE AND AFTER-IMPLEMENTATION

The outcome revealed significant time savings and came to light with the rapid and efficient development of the project. Examining system staff and implementing new technologies is a time-consuming operation, trained users, installing new applications and developing any strategy.

The implementation phase is less creative than the design of the systems. Implementation is used to turn the design of a new or modified system into a functionality. It mainly deals User testing, site planning, and file transfer are all things that we can help with.

Words that have been modified

Changes in Structure

a lexicon

In computer science, implementation is defined as a programme, software component, or other computer system that has a technical explanation or algorithm. Under the framework of a certain specification or standard, there might be many implementations. Like, web browsers have the implementation specifications and software creation tools recommended by the World Wide Web Consortium include implantations of Languages for computer programming

IT industry, refers to the implementation of the customer-made follow-up sales process using software or hardware purchases. This covers scope and criteria study, optimization, system integrationPolicies, instruction, and distribution for users. Users' policies, instructions, and dissemination management practices through project management practices, which are dictated in the project management body knowledge. Software implementation has many benefits business analyst, technical analyst, solution architect, and project manager are examples of roles that are comparatively new to the knowledge-based economy.

Political science, refers, enforcement is concerned with maintaining the public policy. Legislatures pass laws made by government employees working as government bureaucracies. This process includes establishing, enforcing, and maintaining rules. Factors influencing Legislative intent is part of the process, the capability of the administration enforcement bureaucracy, interest group activities opposition and assistance from the president or the executive branch

The Stanford Dogs dataset is a picture dataset of dog breeds that is available to the public. There are 120 dog groups in total, with a total of 20580 in which 8580 photographs were used for assessment, while 12000 were used for training. The bounding boxes that ideally contain the dogs in the image are indicated by annotations on the image dataset. Within one unified class, the bounding boxes and original pictures are all different sizes, and the scenes are all different types, with occlusion, different poses, different backdrop subjects, and different fur colours.
The first step in the learning process is to convert the raw image files into a functional collection of images for training and testing. The first thing we did was crop all the pictures using the bounding boxes that were annotated. For training and testing purposes, resize all the resulting images to 256x256. We decided against just resizing it by hand because we doubted that filters could measure a squished or strained image in the same way. As a result, we chose to discard all cropped images of one of the two dimensions less than 256 pixels, resize all dimensions until the smaller dimension

was 256, and then remove rows and columns [1:256] from the file. We realise that taking repetitive random samples of rows and columns from the image will generate an augmented dataset that can help with training, but we didn't do so for this project. There were 5678 training photos and 4007 research images at the end after this pre-processing, which we converted to LMDB format for use with Caffe.

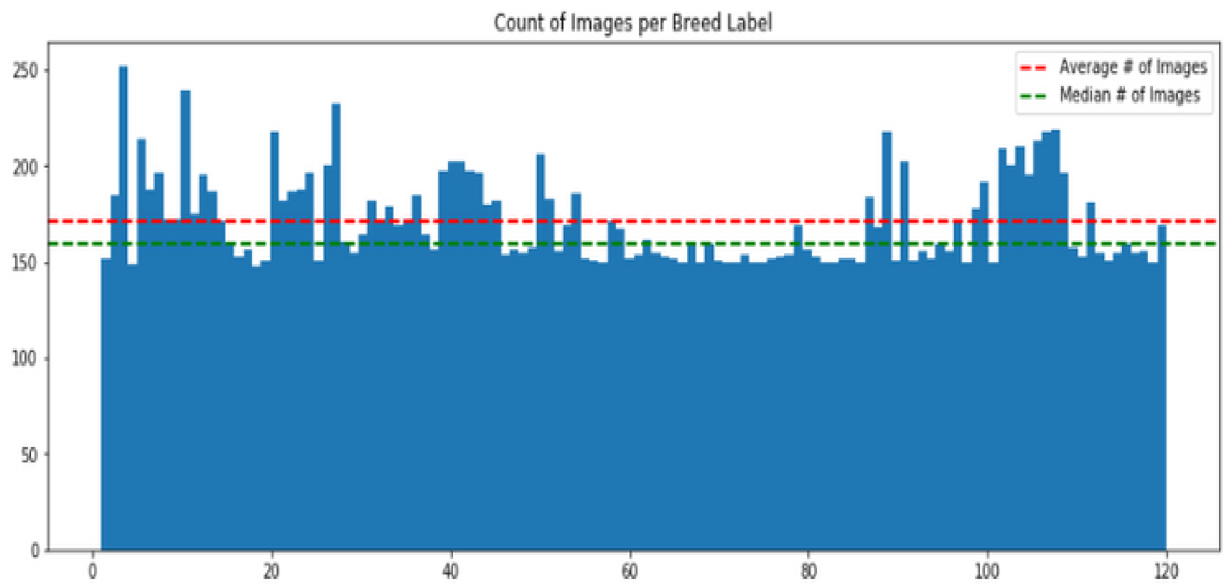


Fig. 7. Image Per Breed

8.2 Loss Analysıs And Accuracy

In our project, we compare 4 different pretrained models: ResNet18, AlexNet, DenseNet161, and VGG16.

We use SoftMax and cross entropy to evaluate their output in terms of training and testingfailure.The softmax function is a generalisation of the logistic function that "squashes" a L di mensional vector Y of arbitrary real values into a L dimensional vector (Y) of real values, each entr y in the range (1,0) and all entries adding up to 1.

The role is depicted in Fig: -

$$\sigma : S^L \rightarrow \left\{\sigma \epsilon S^L \middle| \sigma_j > 0, \ \ \sum_{j=1}^{L} \sigma_J = 1\right\} \tag{21}$$

(22)

$$\sigma(Y)_k = \frac{f^{yk}}{\sum_{l=1}^{L} f^{yk}}$$

The cross-entropy loss is a metric for evaluating the effectiveness of a classification model that produces a probability value between 0 and 1. As the predicted probability varies from the actual label, cross-entropy loss increases. Cross-entropy can be calculated in multiclass classification as follows:

$$-\sum_{d}^{N} z_o, d^{\log(q_o, d)}\mathrm{b} \tag{23}$$

C= accuracy %

C= (CP/TP) *100

CP= No. of Images (correctly predicted)

TP= Total predictions

$$ACCURACY = \frac{NO.OF\ CORRECT\ PREDICITIONS}{TOTAL\ NO.OF\ PREDICITIONS}$$

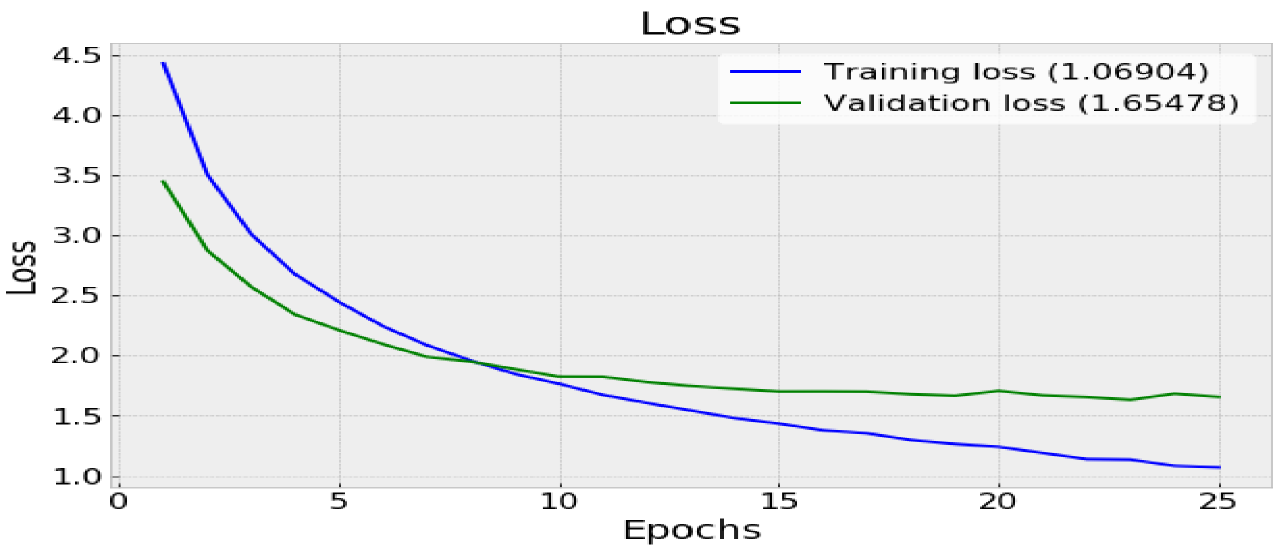


Fig. 8. Graph (Loss)

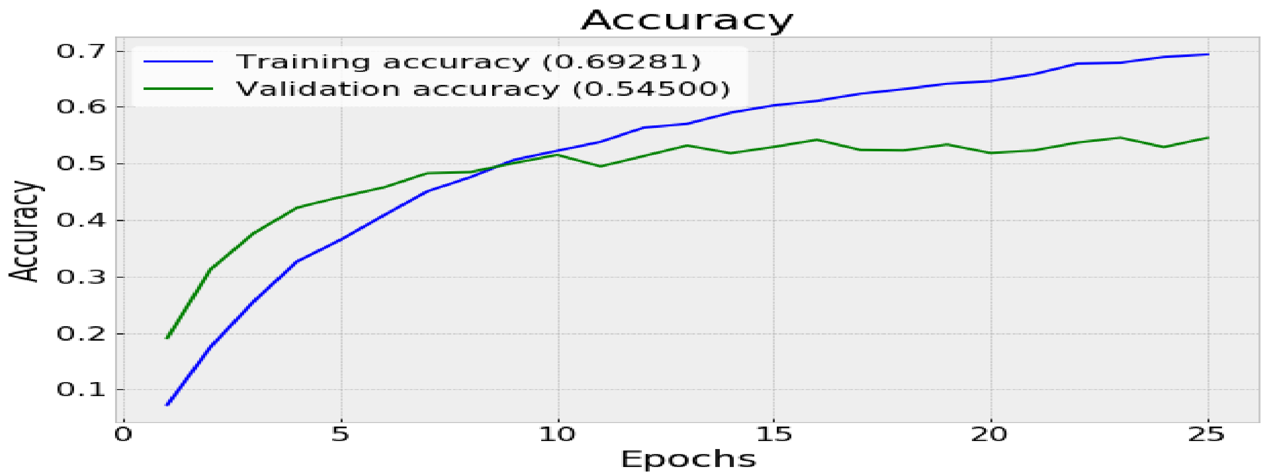


Fig. 9. Graph (Accuracy)

8.2 POST IMPLEMENTATION AND SOFTWARE MAINTENANCE

After the software and application development is complete and the user staff has been adjusted for changes, assessment and upkeep will begin. Any system, for that matter,, there is an ageing method that necessitates hardware and software maintenance on a regular basis. If there is a discrepancy between the old and new records, from specifications for design, changes will need to be made. Periodic maintenance is also required to keep the hardware compliant with the design specifications. The role of management will continue to be stressed as the current structure is brought up to code.

All maintenance equipment should be checked regularly to ensure that it is working properly. If any device on the network does not work, it should be checked and modified promptly.

9.Project Legacy

The project's current standing

Till now, each module till the testing part is working very fine and the result of each page are the standards were met to a high standard.

Remaining Areas of concern

There are some areas of concern related to storage, as the software development is still under process. There are total 180 dog breeds in the world, the data set include 120 dog breeds images, we will surely increase the images of left dog breeds in an order to increase accuracy of the user entered picture.

Lessons learned in terms of technology and management: Throughout the system's growth, we have learned a lot of assets related to tools, system language, database, concept of machine learning and many more.

10. System Snapshots

10.1 Accuracy Output

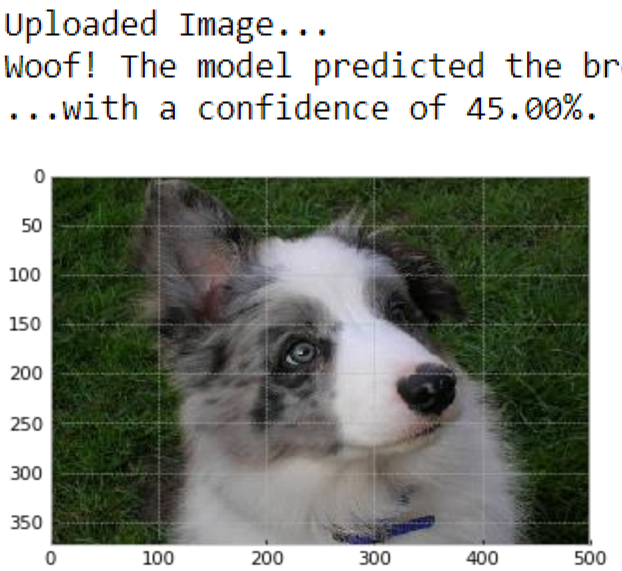


Fig. 11. Forecasting of Border Collie

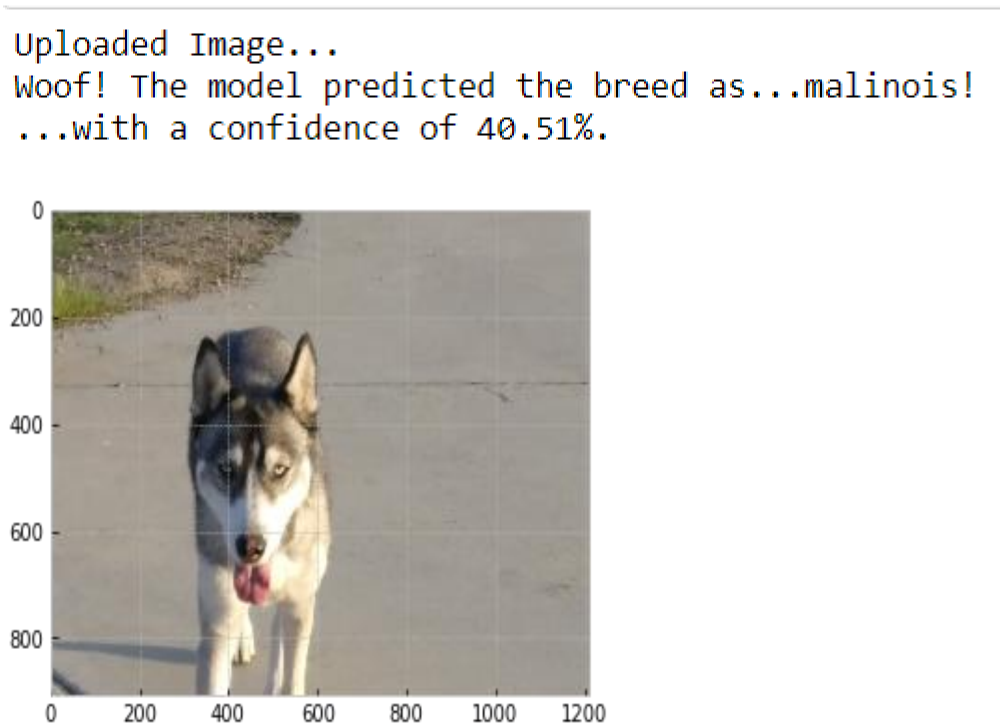


Fig. 12. Forecasting of Malinois

```
Uploaded Image...
Woof! The model predicted the breed as...Tibetan_mastiff!
...with a confidence of 85.87%.
```

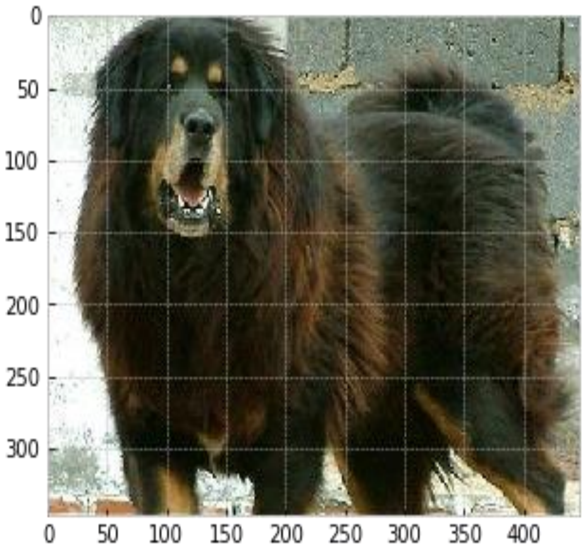


Fig. 13. Forecasting of Tibetan Mastiff

```
Uploaded Image...
Woof! The model predicted the breed as...malamute!
...with a confidence of 51.96%.
```

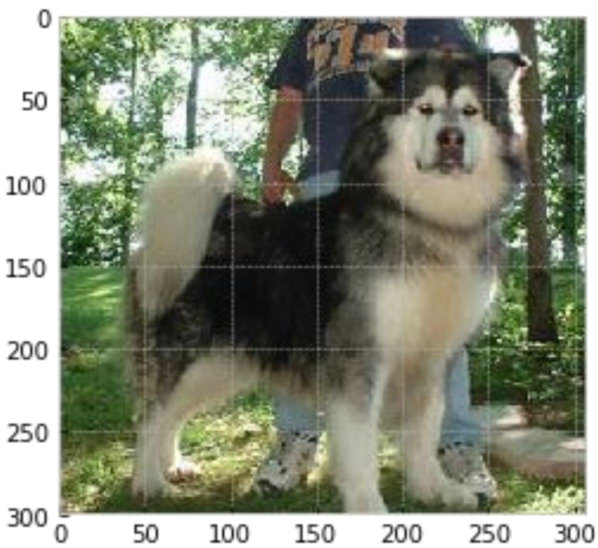


Fig. 14. Forecasting of Malamute

```
Uploaded Image...
Woof! The model predicted the breed as...West_Highland_white_terrier!
...with a confidence of 54.76%.
```

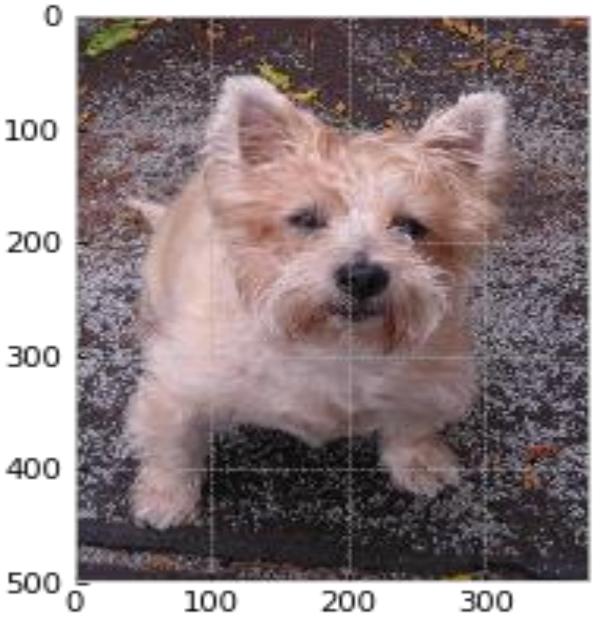


Fig. 15. Forecasting of West Highland White Terrier

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Uploaded Image...
Woof! The model predicted the breed as...EntleBucher!
...with a confidence of 86.99%.
```

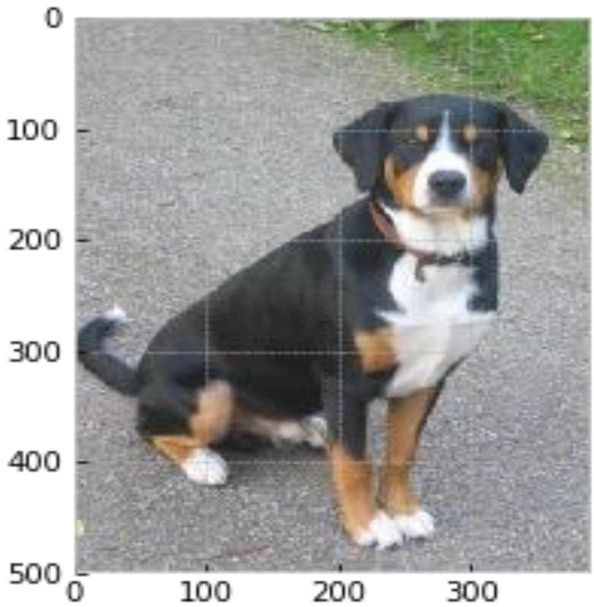

Fig. 16. Forecasting of Entle Bucher

```
Uploaded Image...
Woof! The model predicted the breed as...cairn!
...with a confidence of 35.88%.
```

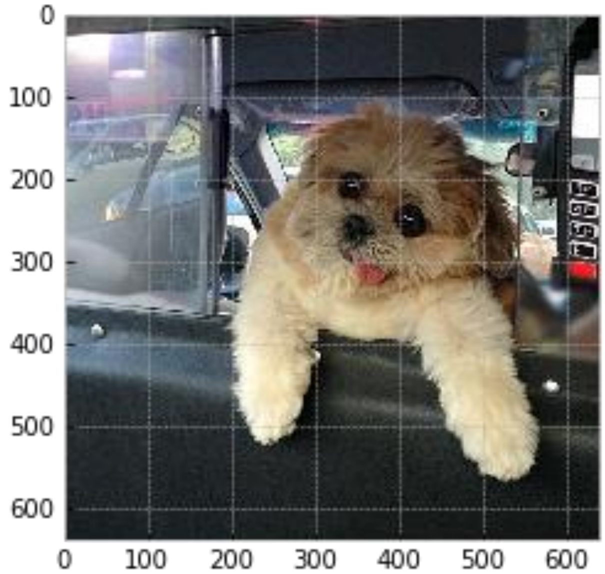

Fig. 17. Forecasting of Cairn

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Uploaded Image...
Woof! The model predicted the breed as...French_bulldog!
...with a confidence of 56.05%.
```

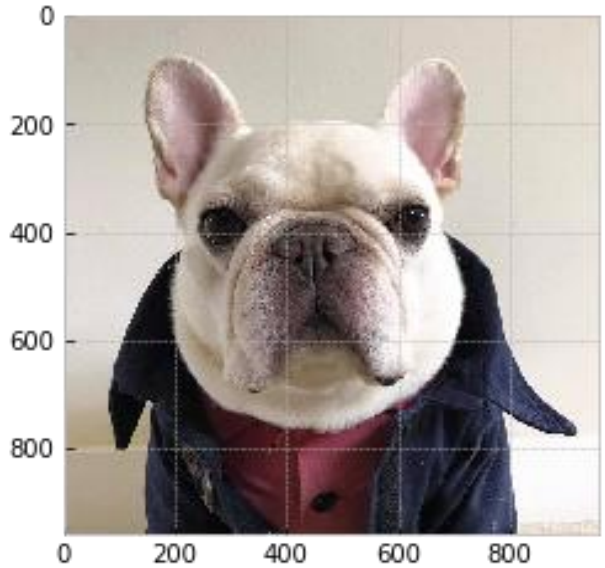

Fig. 18. Forecasting of French Bull Dog

```
Uploaded Image...
Woof! The model predicted the breed as...pug!
...with a confidence of 48.72%.
```

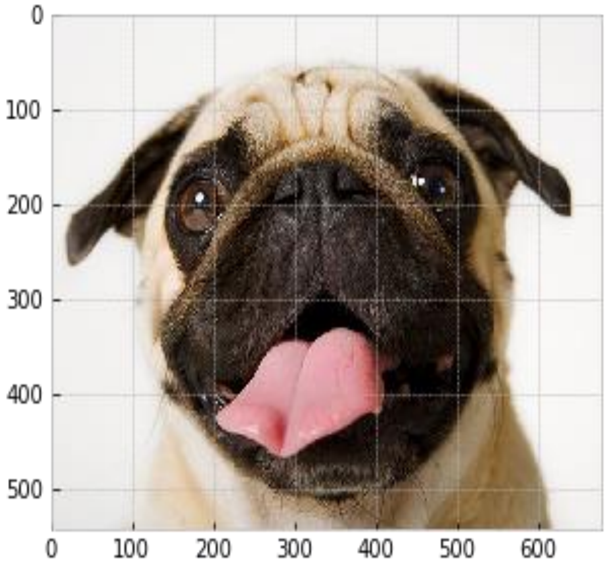

Fig. 19. Forecasting of Pug

```
Uploaded Image...
Woof! The model predicted the breed as...Shih-Tzu!
...with a confidence of 15.16%.
```

Fig. 20. Forecasting of Shih Tzu

```
Uploaded Image...
Woof! The model predicted the breed as...papillon!
...with a confidence of 99.50%.
```

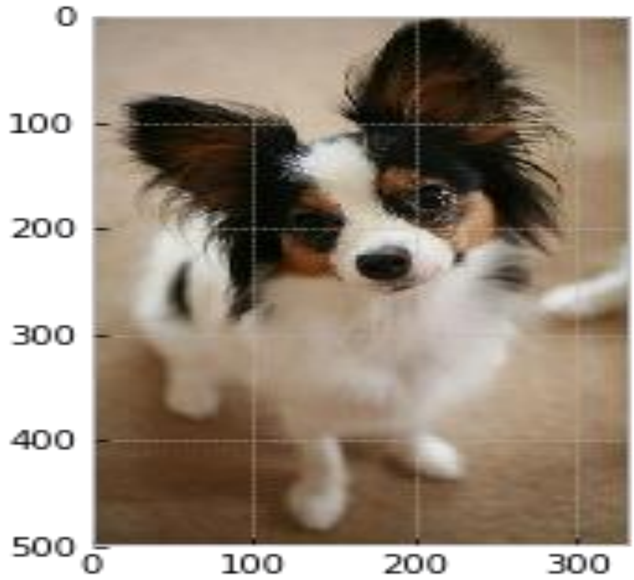

Fig. 21. Forecasting of Papillon

In this project we used only 5678 training images and 4007 testing images. As we can see from above used images as examples, the image of the French bulldog is quite clear and easy to identify, because of which the system gives accuracy of 97.15%. Whereas in case of the image of Saluki, the system gives accuracy of only 18.06% because the image of the dog is not clear. From this we can say that more image data can give better result. Rather than focusing on optimization, one should use various image tools and mark them to add more images for training and testing, or use NASNet, Xcaption, MobileNet, DenseNet, and other templates for higher accuracy.

11.BIBLIOGRAPHY

- **Websites**
- **1.** https://www.kaggle.com/
- **2.** https://teachablemachine.withgoogle.com/
- **3.** https://www.deeplearning.ai/

- **4.** https://www.tensorflow.org/
- **5.** https://www.expert.ai/blog/machine-learning-definition/

- **Books**

- **“Machine Learning in Action”** by Peter Harrington