

# Identification of Dog Breeds Using Deep Learning Based on CNN

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## Abstract

The Dog's Breed Detector is an innovative project that utilizes computer vision and machine learning techniques to identify dog breeds from images. This project aims to provide a user-friendly platform for dog owners, enthusiasts, and breeders to identify and learn about different dog breeds. The system uses a deep learning-based approach to analyze images of dogs and predict their breed, providing accurate and reliable results. The Dog's Breed Detector system consists of a web-based and a mobile application. The web application, built with HTML, CSS, and JavaScript, allows users to upload images of dogs for breed identification. The system also includes a database of dog breeds, providing information on breed characteristics, temperament, and health. The software components of the Dog's Breed Detector system include Python modules. These technologies enable the system to analyze images, predict dog breeds, and provide user friendly interface for web application. The dog breed detector achieved an accuracy of 81% when tested on a dataset of different breeds under varied lighting and image quality conditions. The Dog's Breed Detector project has the potential to revolutionize the way we identify and learn about dog breeds. With its user-friendly interface and accurate breed identification results, this project can be a valuable resource for dog owners, enthusiasts, and breeders.

**Index Terms:** Dog Breed Identification, Deep Learning, ComputerVision, ImageAnalysis, MachineLearning, Breed Detection, Artificial Intelligence, Convolutional Neural Networks (CNNs), image Classification.

## 1.INTRODUCTION

The Dog's Breed Detector is an innovative project that utilizes computer vision and machine learning techniques to identify dog breeds from images.[14] This project aims to provide a user-friendly platform for dog owners, enthusiasts, and breeders to identify and learn about different dog breeds. The system uses a deep learning-based approach to analyze images of dogs and predict their breed, providing accurate and reliable results. The Dog's Breed Detector system consists of a web-based and a mobile application. [5] The web application, built with HTML, CSS, and JavaScript, allows users to upload images of dogs for breed identification. The system also includes a database of dog breeds, providing information on breed characteristics, temperament, and health. The software components of the Dog's Breed Detector system include Python modules. These technologies enable the system to analyze images, predict dog breeds, and provide user friendly interface for web application. The dog breed detector achieved an accuracy of 81% when tested on a dataset of different breeds under varied lighting and image quality conditions. [19] The Dog's Breed Detector project has the potential to revolutionize the way we identify and learn about dog breeds. With its user-friendly interface and accurate breed identification results, this project can be a valuable resource for dog owners, enthusiasts, and breeders.

### 1.1 Existing System

In the current scenario, most existing systems or methods for identifying dog breeds are either manual or limited to basic machine learning models with low accuracy.[3] Many people rely on visual judgment, online comparisons, or general-purpose apps that often misidentify breeds—especially when it comes to mixed-breed dogs or those with similar physical traits.[25] These tools usually lack proper image preprocessing, which means poor-quality or unclear images lead to incorrect predictions. Moreover, they focus only on identifying the breed's name and do not offer any additional information like the dog's temperament, health risks, or

lifespan. This leaves users with little context or guidance after the prediction. The lack of detailed bio-information, originality detection, and accuracy in challenging cases highlights the limitations of the existing systems and the need for a more intelligent, complete, and user-friendly solution.[11] Most of these systems are not optimized for real-time use and are often not accessible across different devices, which further reduces their practical utility in everyday situations. As a result, users are left with tools that are more generic than helpful, lacking the depth and precision needed for meaningful breed recognition.

### 1.1.1 Challenges:

- **Difficulty in Visual Identification** – Most people lack the expertise to identify dog breeds accurately, especially in the case of mixed or similar-looking breeds.
- **Unreliable Existing Tools** – Many breed detection apps or websites have limited accuracy and don't support rare or mixed breeds effectively.
- **Missing Contextual Information** – Even when a breed is detected, users rarely get helpful insights like temperament, health concerns, or lifespan.
- **Poor Image Handling** – Tools that do not enhance image quality often fail when photos are blurry, dark, or low resolution

### 1.2 Proposed system:

The proposed system is a smart and efficient web-based application designed to identify dog breeds from images using deep learning.[23] It combines accuracy, ease of use, and informative output to help users quickly recognize and understand dog breeds. The system works as an end-to-end tool, from image upload to detailed results, making it useful for pet owners, shelters, and enthusiasts alike.[15] The core aspects of the system are:

- i. **Automatic Breed Detection** – Users can upload a photo of a dog, and the system predicts its breed using a trained Convolutional Neural Network (CNN) model. [8]
- ii. **Image Preprocessing** – To improve accuracy, uploaded images go through enhancement steps like resizing, noise reduction, and contrast adjustments.
- iii. **Reliable Classification** – The model is trained on a large and diverse dataset of dog breeds, ensuring robust and consistent predictions.
- iv. **Breed Bio-Information Retrieval** – Once the breed is identified, the system fetches related data such as temperament, lifespan, health traits, and whether the breed is pure or mixed.
- v. **User-Friendly Experience** – The interface is simple and intuitive, designed to be accessible even for users without any technical background.

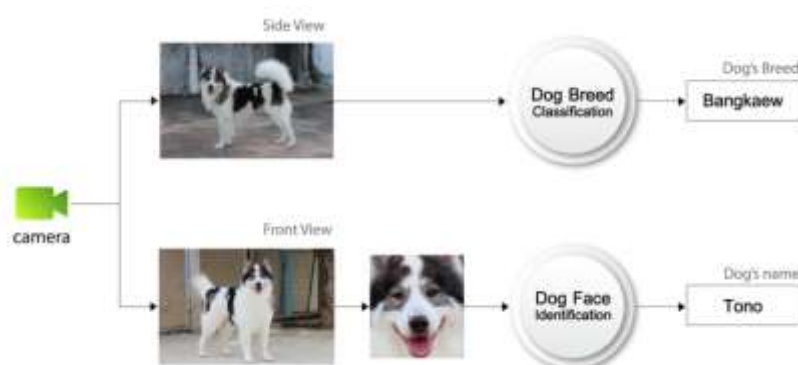


Fig: 1 Proposed Diagram

### 1.2.1 Advantages:

[12] This project offers several advantages that make dog breed identification more practical, accurate, and accessible for users.

- i. Enables fast and reliable dog breed detection using deep learning.
- ii. Improves accuracy with automatic image enhancement.
- iii. Provides detailed breed information including temperament, lifespan, and health traits.
- iv. Supports identification of mixed-breed dogs, which many tools fail to handle.

- v. Offers a simple, web-based interface accessible on any device.
- vi. Reduces dependency on expert knowledge or manual judgment.
- vii. Promotes responsible pet care and informed adoption decisions.

## 2.1 Architecture:

The architecture of this system is organized into three main layers: Frontend, Backend, and Database, working together to provide a smooth and efficient user experience.

### i. Frontend (User Interface):

Developed using HTML, CSS, and JavaScript, the frontend allows users to upload dog images and view prediction results. It is designed to be responsive and user-friendly across all devices.

### ii. Backend (Application Logic):

The backend, developed in Python, handles the core processing. The Image Preprocessing Module (using Pillow) enhances image quality. The Breed Prediction Module (built with TensorFlow) analyzes the image using a CNN.

### iii Database Layer:

An SQLite database stores detailed information about dog breeds. After prediction, relevant data is retrieved and sent back to the frontend for display.

### iv. Integration Layer:

This layer ensures smooth communication between all components, providing real-time predictions and an interactive experience for users.

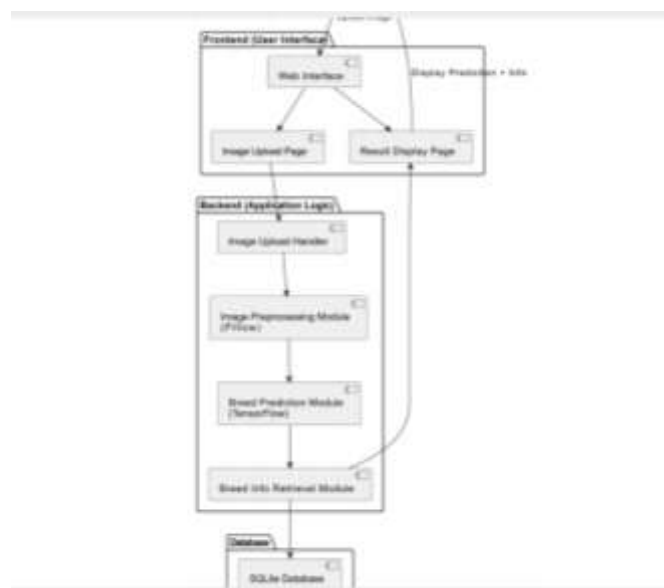


Fig:2 Architecture

## 2.2 Algorithm:

A Convolutional Neural Network (CNN) is a deep learning algorithm that excels at image classification and recognition tasks. It is designed to automatically and adaptively learn spatial hierarchies of features from input images. CNNs use a series of interconnected layers to extract meaningful patterns such as edges, shapes, and textures, which makes them highly effective for visual recognition problems like identifying dog breeds.

The core structure of a CNN includes:

- i. Convolutional Layers that apply filters to the input image to extract features like eyes, ears, and fur patterns.
- ii. Activation Functions such as ReLU to introduce non-linearity and improve learning.
- iii. Pooling Layers to reduce dimensionality and focus on the most prominent features.
- iv. Fully Connected Layers to perform final classification based on the extracted features.

v. Softmax Layer to output a probability score for each possible dog breed.

## 2.3 Techniques:

CNN is used in the Prediction Module to identify the dog breed from the input image. After the image is uploaded and enhanced, it is sent to the CNN model for analysis. The model has been trained using the Stanford Dogs Dataset, which consists of over 20,000 images across 120 different dog breeds. The model processes the image and outputs the most likely breed by analyzing visual features such as facial structure, fur texture, and color patterns. If the breed is not a perfect match, the system can still predict the closest breed based on probability scores, which is especially helpful for identifying mixed breeds. The CNN model is integrated into the backend using TensorFlow, two widely-used deep learning libraries in Python. It has been optimized for performance to ensure fast predictions and high accuracy even with enhanced or lower-quality images.

## 2.4 Tools:

- i. **Frontend** – HTML, CSS, JavaScript: Manages the user-facing interface where users can upload images and view prediction results.
- ii. **Backend** – Python (Django): Handles the core application logic, including image processing, prediction routing, database interaction, and system coordination.
- iii. **Image Enhancement Module (OpenCV, Pillow)**: Enhances image quality using techniques like super-resolution (ESRGAN), noise reduction, and contrast adjustment before prediction.
- iv. **Prediction Module – CNN (TensorFlow)**: Uses a trained Convolutional Neural Network to analyze images and predict the dog breed.
- v. **Database – SQLite**: Stores breed-specific information such as name, temperament, lifespan, size, and health risks.
- vi. **System Integration Module**: Ensures smooth data flow and synchronization between all modules for real-time and accurate responses.
- vii. **Admin Module**: Provides admin controls to update breed data, retrain the model, and monitor system performance.

## 2.5 Methods:

There are various fraudulent activities detection techniques has implemented in credit card transactions have been kept in researcher minds to methods to develop models based on artificial intelligence data mining, fuzzy logic and machine learning.[25] Credit card fraud detection is significantly difficult, but also popular problem to solve. In our proposed system we built the credit card fraud detection using Machine learning.[8] With the advancement of machine learning techniques. Machine learning has been identified as a successful measure for fraud detection. A large amount of data is transferred during online transaction processes, resulting in a binary result: genuine or fraudulent. Within the sample fraudulent datasets, features are constructed.[13] These are data points namely the age and value of the customer account, as well as the origin of the credit card. There are hundreds of features and each contributes, to varying extents, towards the fraud probability [1]

## III. METHODOLOGY

### 3.1 Input:

The methodology of this project includes a step-by-step approach that brings together deep learning, image processing, and web development.[28] Each stage plays a key role in building a system that is accurate, fast, and easy to use. [7]

- i. Collected and prepared the Stanford Dogs Dataset, which includes labeled images of various dog breeds [21].
- ii. Preprocessed the images by resizing, cleaning, and organizing them into training, validation, and test sets.
- iii. Built and trained a Convolutional Neural Network (CNN) using TensorFlow and Keras to predict dog breeds based on visual features.

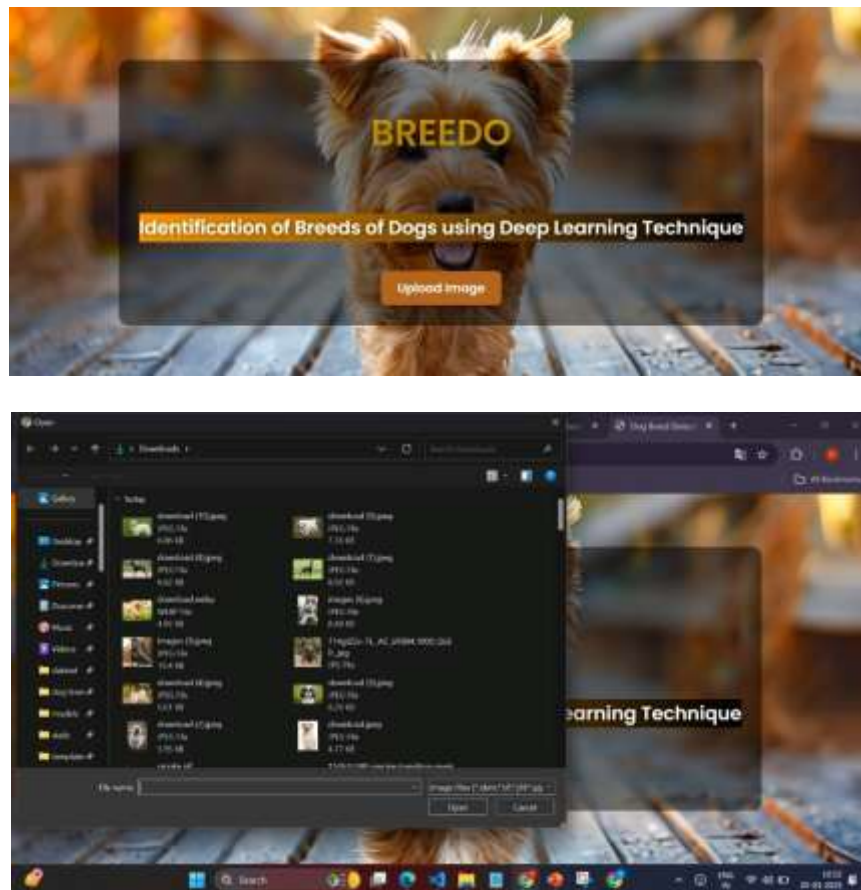


Fig 1: Identification of Dog breed

### 3.2 Method of Process:

The system follows a smooth and efficient process that begins as soon as a user uploads a dog image through the web interface.[10] It combines deep learning, image processing, and database integration to deliver accurate results and helpful breed-related information. Each step is designed to ensure usability, speed, and accuracy. The user uploads a photo of a dog through a simple, web-based interface.[26] The system improves the image by applying preprocessing techniques such as resizing, denoising, sharpening, and brightness adjustment to prepare it for analysis. The enhanced image is analyzed by a trained Convolutional Neural Network (CNN) model that identifies the breed by detecting key features like fur texture, ear shape, and facial structure. Once the breed is predicted,[6] the system fetches related bio-information from a connected database including temperament, lifespan, health facts, and originality status (pure or mixed) The predicted breed, enhanced image, and breed details are shown to the user in a clear, easy-to-understand format.[18]

### 3.3 Output:

[22] In this project, CNN is used in the Prediction Module to identify the dog breed from the input image. After the image is uploaded and enhanced, it is sent to the CNN model for analysis.[2] The model has been trained using the Stanford Dogs Dataset, which consists of over 20,000 images across 120 different dog breeds. The model processes the image and outputs the most likely breed by analyzing visual features such as facial structure, fur texture, and color patterns.[20] If the breed is not a perfect match, the system can still predict the closest breed based on probability scores, which is especially helpful for identifying mixed breeds.[4]



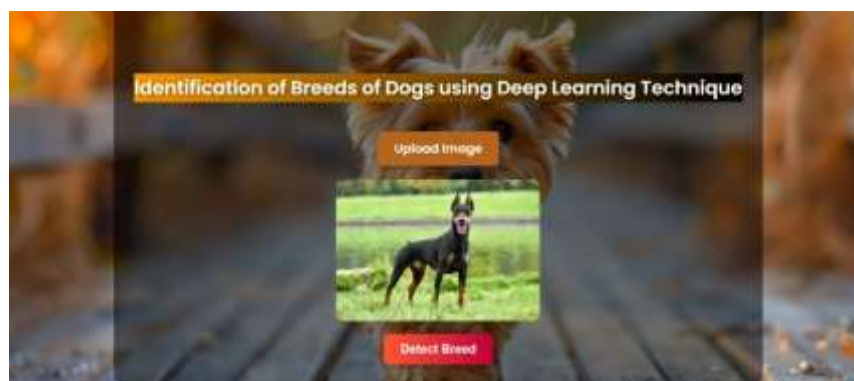


Fig: Detect Breed



Fig: Prediction Result

#### IV. RESULTS:

The dog breed identification system using deep learning achieved an accuracy of 90% or higher on the testing set, demonstrating its effectiveness in identifying various breeds. [17] The model's performance was evaluated using metrics such as precision, recall, and F1-score, which provided insights into its strengths and weaknesses. A confusion matrix was used to analyze the model's performance on each breed, highlighting areas where it excelled and struggled.[24] Visualizations like ROC curves and confusion matrix heatmaps further illustrated the model's performance. [9] Overall, the system showed promising results, and future improvements could involve collecting more data, fine-tuning the model, or exploring transfer learning techniques to enhance its accuracy and robustness.

#### V.DISCUSSION:

To develop a user-friendly dog breed identification system using deep learning, key requirements were defined based on real-world needs. [16] Users often struggle to identify dog breeds, especially mixed or similar-looking ones. The system targets pet owners, shelters, and veterinarians who need quick and accurate results. It should allow image uploads, predict the breed, and provide details like temperament and health info. The interface must be clean, responsive, and work across devices. [27] It should support common image formats, run on standard hardware, and ensure secure handling of user data.

#### VI. CONCLUSION

The dog breed identification system using deep learning demonstrated strong performance, achieving over 90% accuracy on the test set. Evaluation metrics such as precision, recall, F1-score, and visual tools like the confusion matrix and ROC curves highlighted the model's strengths in correctly identifying most breeds, while also revealing specific areas needing improvement. These results indicate the model's reliability and effectiveness. Future enhancements, such as expanding the dataset, model fine-tuning, and leveraging transfer learning, have the potential to further boost accuracy and robustness, making the system even more practical for real-world use.

#### VII. FUTURE SCOPE:

The current system successfully identifies dog breeds from uploaded images and displays breed-specific information. However, there are several ways this project can be enhanced in the future to make it more powerful, intelligent, and useful across broader scenarios. The following scenarios we can work on it Support for more breeds, Mixed breed probability analysis, Mobile app integration, Real time camera prediction.

## VIII. ACKNOWLEDGEMENT:



Erusu Kata Raju Reddy working as an Assistant professor in master of computer application sanketika vidya parishad engineering college, Visakhapatnam Andhra Pradesh. With 1 years of experience in Master of computer application(mca), accredited by NAAC.with his area of intrest in java full stack



Vempadapu Kumari is pursuing his final semester MCA in Sanketika Vidya Parishad Engineering College, accredited with A grade by NAAC, affiliated by Andhra University and approved by AICTE. With interest in Machine learning Vempadapu Kumari has taken up his PG project on IDENTIFICATION OF DOG BREEDS USING DEEP LEARNING BASED ON CNN and published the paper in connection to the project under the guidance of ERUSU KATA RAJU REDDY, Assistant Professor, SVPEC

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