RAJALAKSHMI ENGINEERING COLLEGE
An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY, Chennai

25 years OF ACADEMIC EXCELLENCE

Department of Computer Science and Engineering

DOG BREED PREDICTION

Mrs M. Divya M.E
Mentor

220701186 | NIKILASHREE M

Problem Statement and Motivation

- **Problem statement:** Identifying dog breeds accurately from images is challenging due to the vast number of breeds, visual similarities among them, and variations in pose, lighting, and background. Manual identification is time-consuming, subjective, and often inaccurate, especially for mixed or rare breeds. There is a need for a reliable and efficient method to classify dog breeds using visual data.

- **Motivation:**
  - Manual dog breed identification is prone to human error and lacks consistency, especially with similar-looking or mixed breeds.
  - Accurate breed recognition is essential for providing appropriate care, nutrition, and medical treatment tailored to breed-specific needs.

Existing System

- **Manual Identification by Experts**
  Dog breed classification is traditionally done by veterinarians or breeders using visual inspection, which can be subjective and inconsistent.

- **Limited Mobile Applications**
  Some mobile apps attempt breed detection using basic pattern matching or simple classifiers but struggle with accuracy and generalization to real-world conditions.

- **Inability to Handle Mixed Breeds**
  Most existing systems fail to accurately classify crossbreeds or rare breeds due to limited training data and rigid classification logic.

Objectives

- To design and implement a **deep learning-based model** capable of accurately predicting dog breeds from input images using transfer learning techniques.
- To build a **user-friendly web application** that allows real-time or near-real-time dog breed identification without requiring manual or expert intervention.
- To ensure **model reliability and scalability** by evaluating performance across multiple breeds, including common and less frequent categories.

Abstract

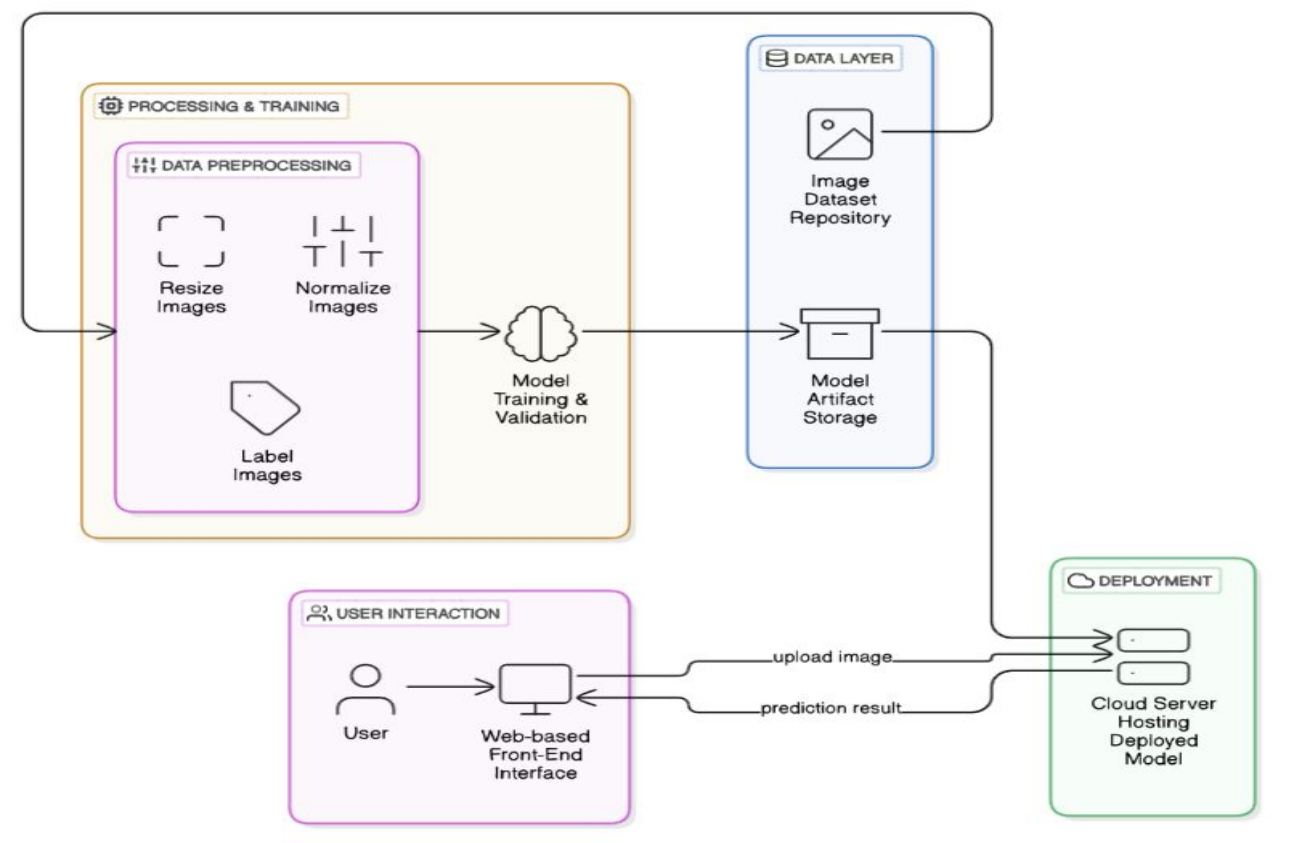
The project develops a machine learning model for dog breed classification using **deep learning techniques**. Leveraging **MobileNetV2** with **transfer learning**, the model predicts breeds from images with high accuracy. The system processes images through **normalization and resizing**, and achieves over **90% validation** accuracy. Integrated into a **web application**, users can upload images for real-time breed identification, offering a practical solution for pet owners, breeders, and shelters.

Proposed System

The proposed solution leverages deep learning techniques for accurate dog breed classification, employing the following steps:

- **Data Collection & Preprocessing**: Images resized to 224x224x3, normalized, and labeled by breed.
- **Model Architecture**: MobileNetV2 with transfer learning for efficient, accurate breed prediction.
- **Training**: Model trained with categorical cross-entropy loss and Adam optimizer, achieving over 90% accuracy.
- **Web Application**: Cloud-deployed model integrated with a user-friendly interface for real-time breed prediction.
- **Scalability**: Easy updates to model and dataset for future improvements.

System Architecture



List of Modules

Data Collection & Loading: Importing and preparing the dataset of dog images and metadata.

Data Preprocessing: Resizing, normalizing, and augmenting images.

Model Selection: Defining and configuring the MobileNetV2 model architecture for dog breed classification.

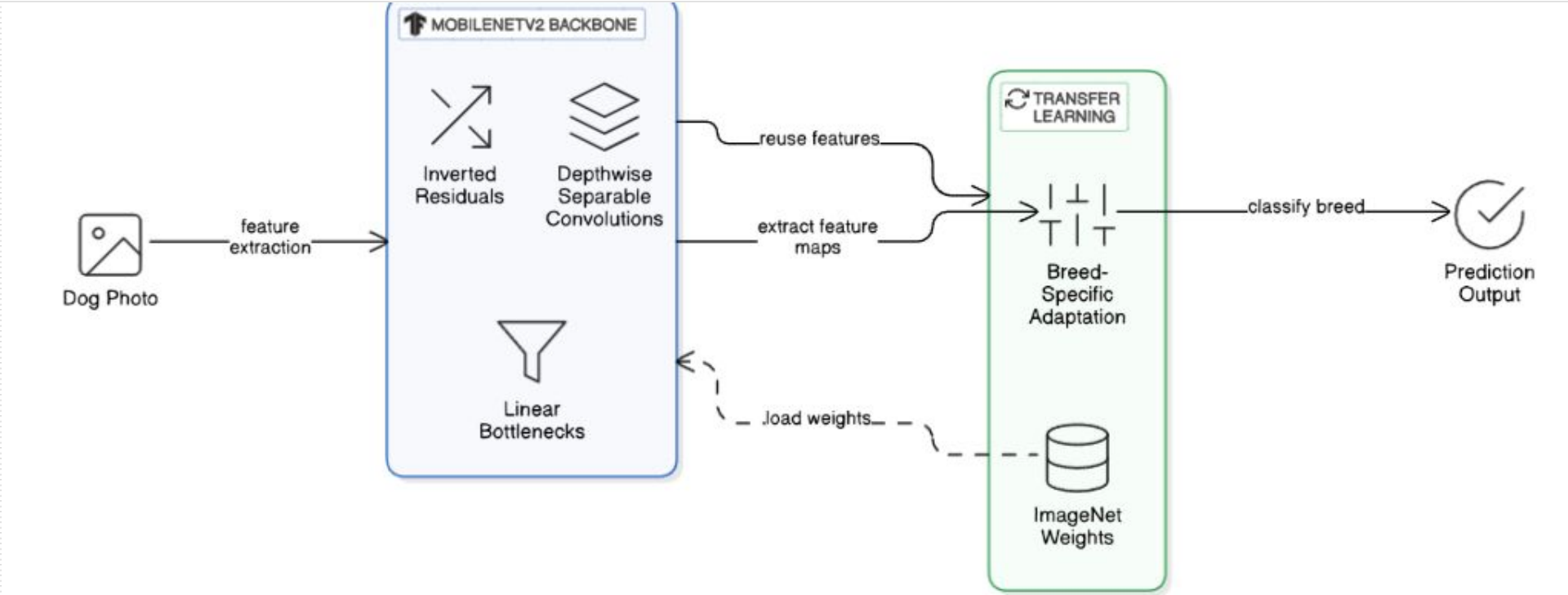
Training & Evaluation: Training the model on the preprocessed dataset.

Evaluating model performance using accuracy, confusion matrix, and other metrics.

Deployment & Inference: Deploying the trained model on the cloud for real-time predictions.

Integrating the model into a web application for user interaction.

Functional Description for each modules with DFD and Activity Diagram



Implementation & Results of Module

Implementation:

Built using **Python** and **TensorFlow/Keras** with **MobileNetV2** as the base model.

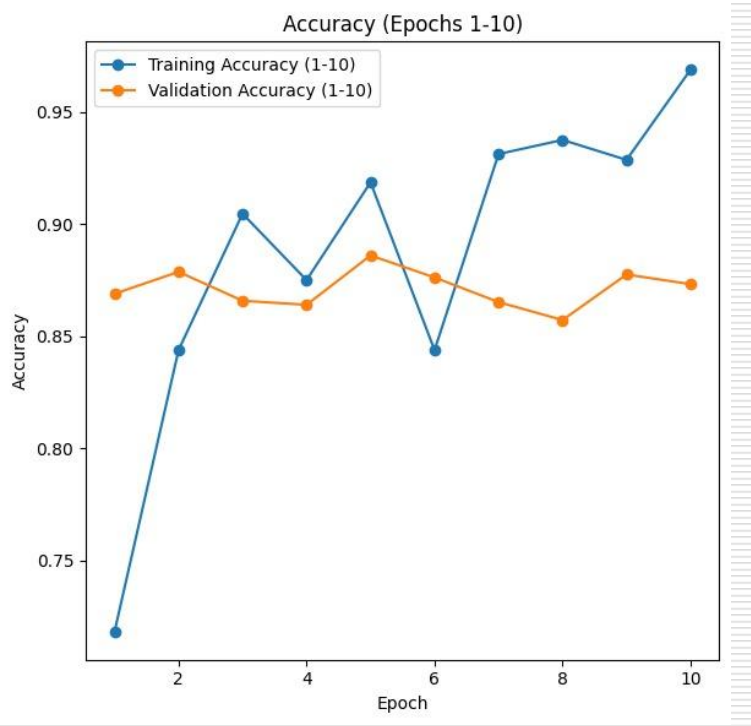
- Applied **transfer learning** with pre-trained ImageNet weights.
- **Preprocessing** included:
  - Image resizing to 224×224×3
  - Pixel normalization [0, 1]
  - Data split: 80% train, 10% val, 10% test
- Added custom classifier with GAP, Dense layers, and Softmax output.
- Trained for **50 epochs** using **Adam optimizer**, with **early stopping** and **learning rate scheduling**.

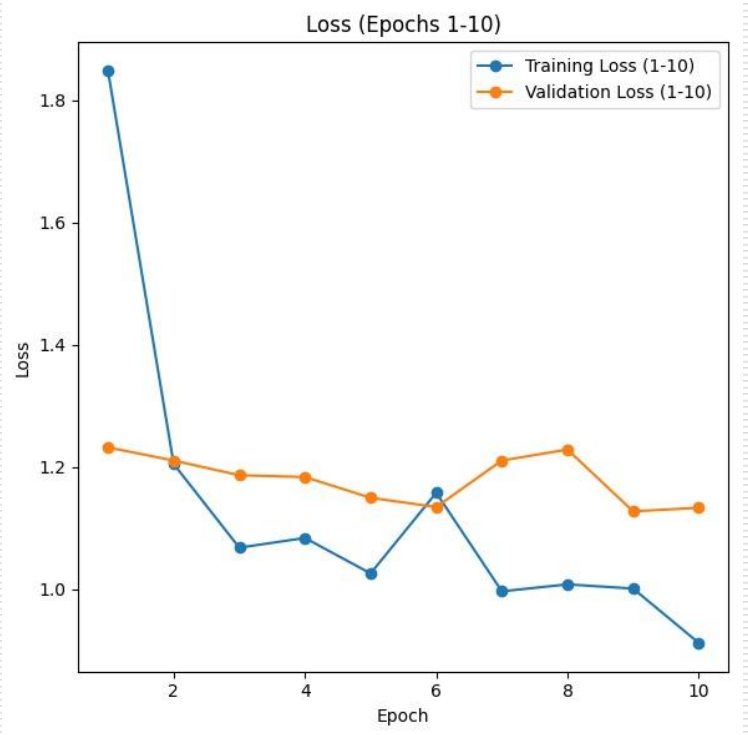
Implementation & Results of Module

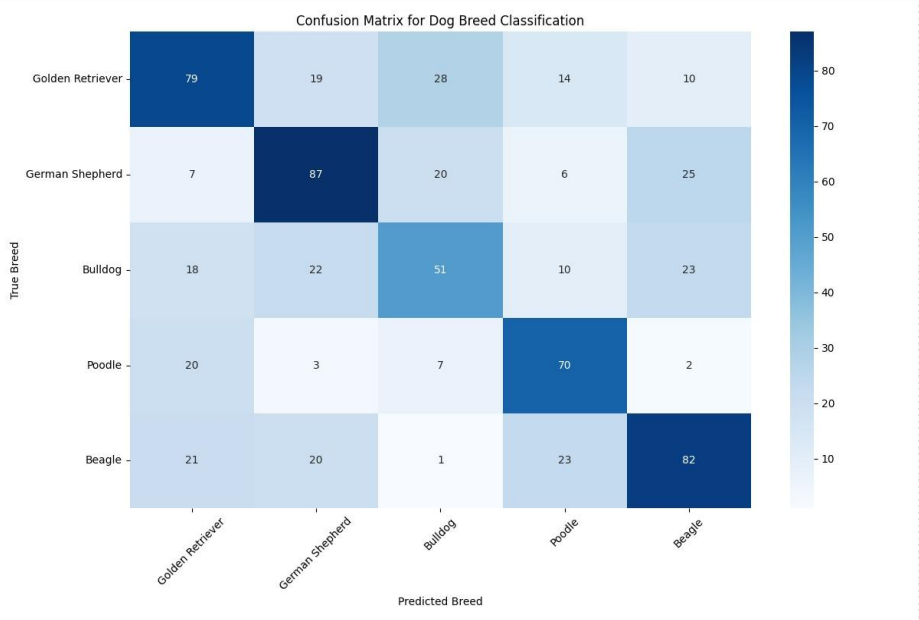
Result:

- The model achieved a validation accuracy of around **85–90%**, indicating strong generalization performance.
- Confusion matrix analysis showed the model performed well on most of the major dog breeds.
- Prediction outputs included the breed name.
- Inference time per image was under 1 second, making it suitable for real-time applications.

Implementation & Results of Module







Conclusion & Future Work

The Dog Breed Prediction System uses transfer learning with MobileNetV2 to accurately classify dog breeds from images. The system achieves high accuracy and provides real-time predictions, making it a reliable tool for pet owners and enthusiasts.

Future Work:

- **Expand Dataset** to include more breeds and image variations.
- **Experiment with Other Architectures** like EfficientNet or ResNet.
- **Fine-tune Model** for improved accuracy.
- **Add Features** such as dog age and size.
- **Enhance User Interface** with breed info and care tips.

References

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- R. Saeed, A. Shaikh, and S. Rasheed, "Multi-CNN with SVM for dog breed classification," *Bioengineering*, vol. 11, no. 11, p. 1157, 2024.

Paper Publication Status

The paper based on this project is done and is planned to be submitted to a reputed journal or conference specializing in machine learning.

Thank You