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

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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

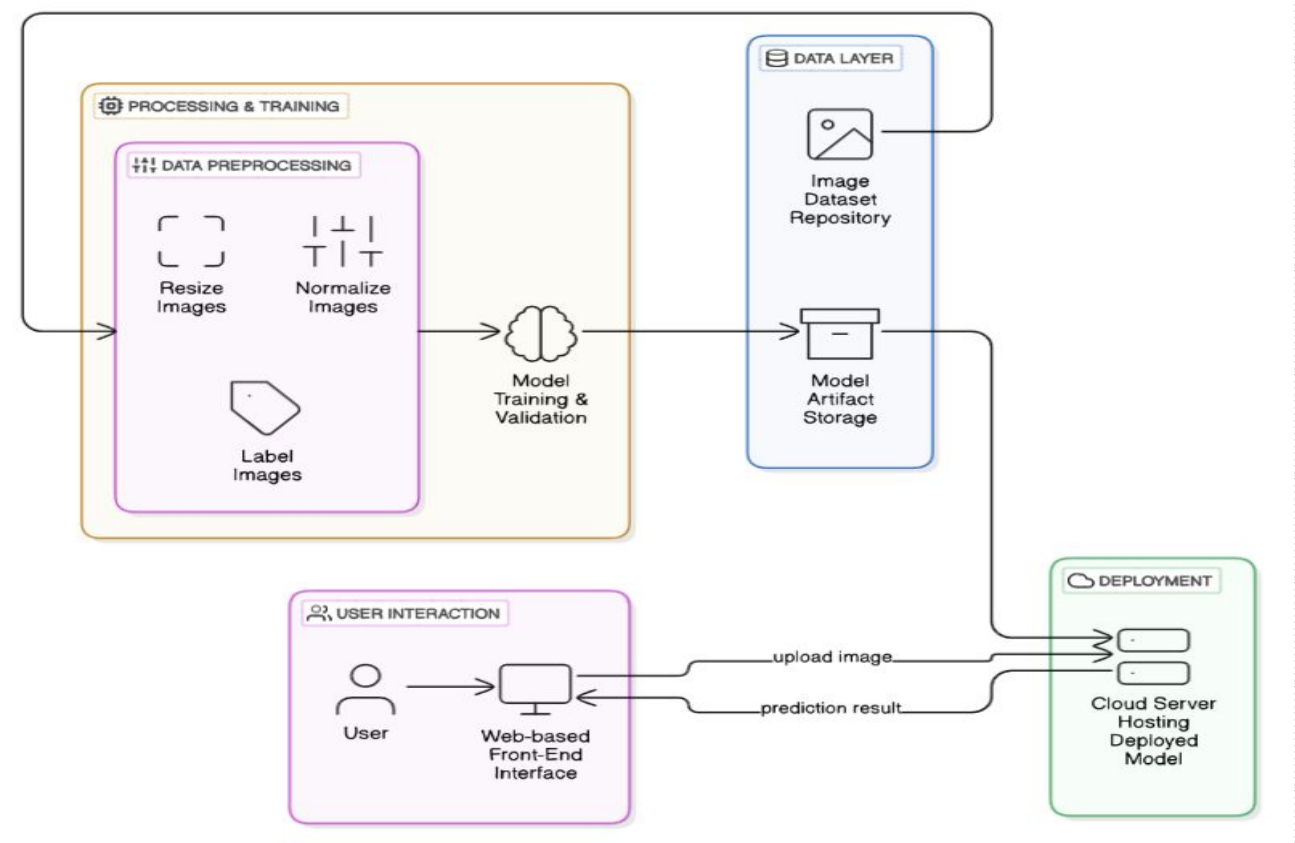
The project develops a machine learning model for dog breed classification using **deep learning techniques**. Leveraging **MobileNetV2** with **transfer learning**, the model predicts breeds from images with high accuracy. The system processes images through **normalization and resizing**, and achieves 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.

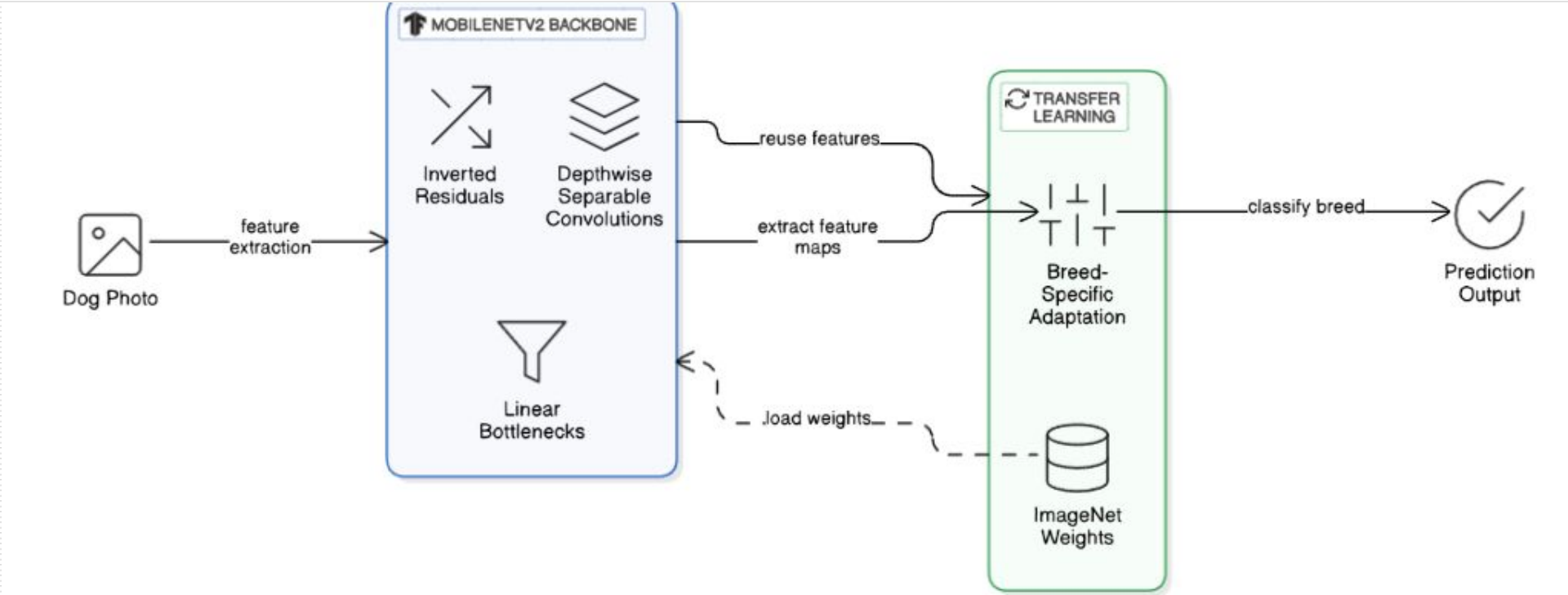
Training & Evaluation: Training the model on the preprocessed dataset.

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.

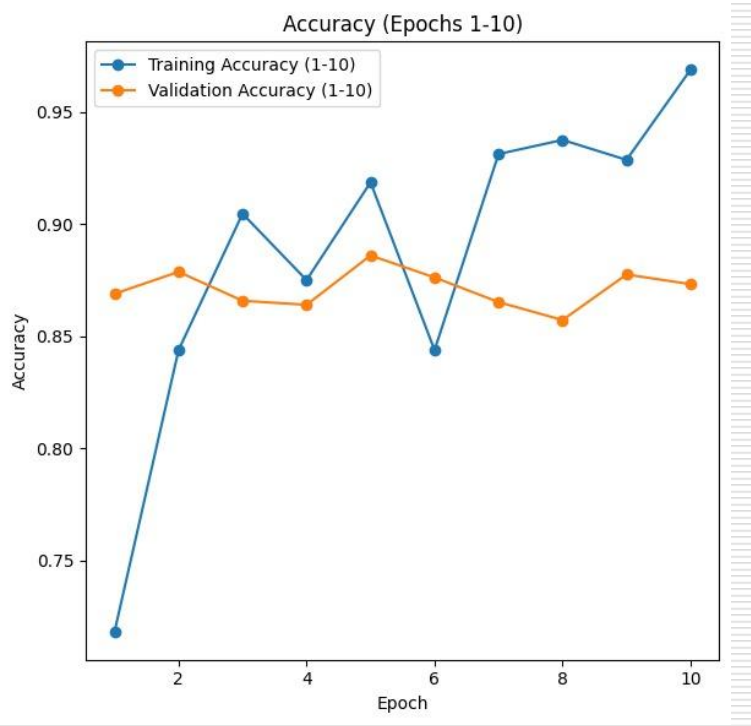
- Applied **transfer learning** with pre-trained ImageNet weights.
- **Preprocessing** included:
  - Image resizing to 224×224×3
  - Pixel normalization [0, 1]
  - Data split: 80% train, 10% val, 10% test
- Added custom classifier with GAP, Dense layers, and Softmax output.
- Trained for **50 epochs**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

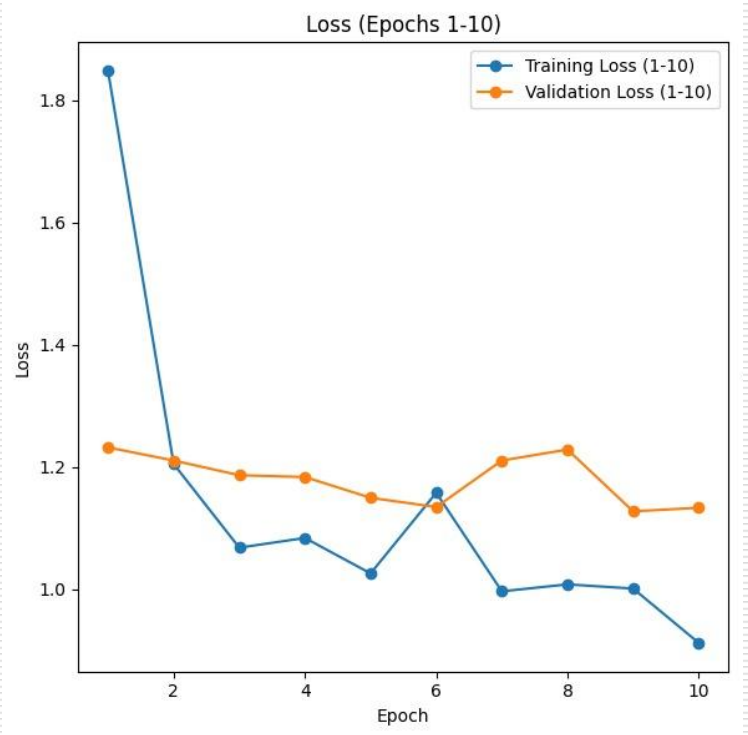
Implementation & Results of Module

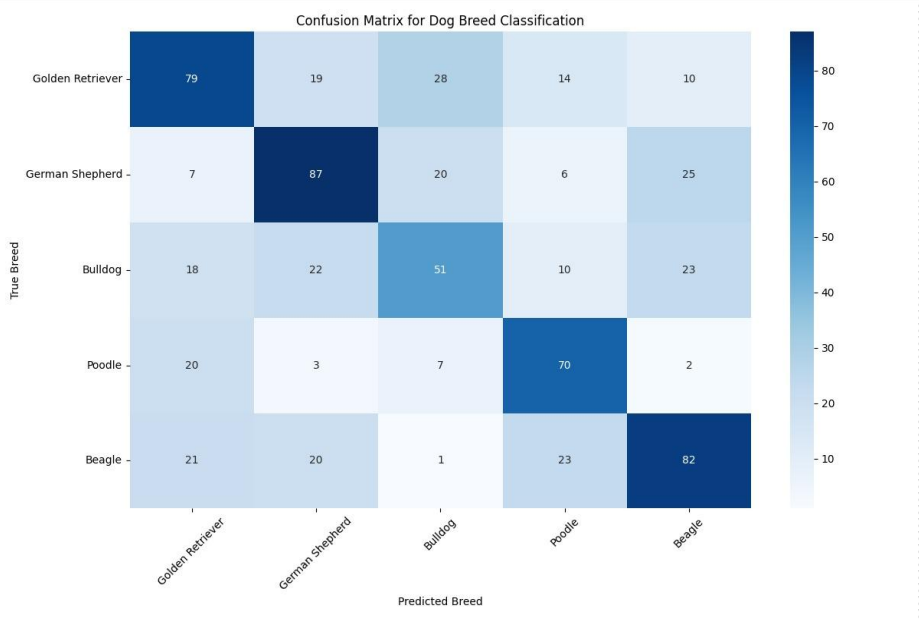
Result:

- 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