BATCH NO:MI1034

IDENTIFICATION OF MEDICAL PLANT USING DEEP LEARNING

Minor project-I report submitted
in partial fulfillment of the requirement for award of the degree of

Bachelor of Technology
in
Computer Science & Engineering

By

PRAVEENKUMAR M	(23UECS0458)	**(VTU25226)**
M.LEELAVARDHINI	(23UECS0370)	**(VTU25234)**
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VEL TECH RANGARAJAN DR. SAGUNTHALA R&D INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University Estd u/s 3 of UGC Act, 1956)
Accredited by NAAC with A++ Grade
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CERTIFICATE

It is certified that the work contained in the project report titled "IDENTIFICATION OF MEDICAL PLANT USING DEEP LEARNING" by "PRAVEENKUMAR M (23UECS0458), M.LEELAVARDHINI (23UECS0370), T.KEERTHANA (23UECS0570)" has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

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Department of CSE

DECLARATION

We declare that this written submission represents my ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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APPROVAL SHEET

This project report entitled IDENTIFICATION OF MEDICAL PLANT USING DEEP LEARNING by PRAVEENKUMAR M (23UECS0458), M.LEELAVARDHINI (23UECS0370), T.KEERTHANA (23UECS0670) is approved for the degree of B.Tech in Computer Science & Engineering.

Examiners

Supervisor

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Date: 02 / 11 / 2025

Place: chennai, avadi

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ABSTRACT

The identification of medicinal plants plays a vital role in the pharmaceutical and healthcare industries, as many plants possess unique therapeutic properties. Traditional methods of plant identification are time-consuming, labor-intensive, and require expert botanical knowledge. To overcome these challenges, this project proposes an automated system for identification of medicinal plants using Deep Learning, specifically employing the MobileNet and NRR (Noise Reduction and Refinement) algorithms. MobileNet, a lightweight convolutional neural network, enables efficient feature extraction and classification, making it ideal for deployment on mobile and embedded devices. The NRR algorithm enhances image quality by removing noise and improving feature clarity, leading to more accurate predictions. The proposed model is trained on a dataset of medicinal plant images and tested for accuracy, precision, and recall. Experimental results demonstrate that the integration of NRR preprocessing with MobileNet significantly improves the model's performance while maintaining computational efficiency. This system can assist researchers, students, and healthcare professionals in real-time identification of medicinal plants through mobile applications, promoting awareness and conservation of natural medicinal resources.

Keywords: Feature Extraction, Image Classification, Medicinal Plants, MobileNet, Noise Reduction and Refinement (NRR), Plant Identification, Preprocessing, Smart Healthcare

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ANN	Application Programming Interface
CPU	Central Processing unit
DL	Deep Learning
DNN	Deep Neural Network
GPU	Graphics Processing Unit
IP	Internet Protocol
ISO	International Organisation for Standardisation
JS	Javascript
MN	Mobile Net
NRR	Noise Reduction and Refinement
OS	Operating System
RGB	Red Blue Green
RAM	Random Access Memory
ROI	region Of Intrest
TP	True Positive
TN	True Negative
UI	user interface
UX	User Experience
VS	Visual Code

TABLE OF CONTENTS

Chapter 1

INTRODUCTION

1.1 Introduction

Medicinal plants have been an integral part of traditional medicine and modern pharmacology due to their therapeutic properties and biological significance. Accurate identification of these plants is crucial for ensuring the correct usage in pharmaceutical and healthcare applications. However, conventional identification methods rely heavily on manual observation and expert knowledge, which can be time-consuming, error-prone, and inefficient when dealing with large varieties of plant species.This approach enables the system to classify and identify medicinal plants in real time, making it suitable for mobile-based applications that assist researchers, students, and farmers. The project contributes to the promotion of biodiversity awareness, preservation of medicinal plants, and supports sustainable herbal medicine development through technology-driven innovation.

The combination of NRR and MobileNet provides a robust solution that balances high accuracy with computational efficiency. This approach enables the system to classify and identify medicinal plants in real time, making it suitable for mobile-based applications that assist researchers, students, and farmers. The project contributes to the promotion of biodiversity awareness, preservation of medicinal plants, and supports sustainable herbal medicine development through technology-driven innovation.The combination of NRR and MobileNet provides a robust solution that balances high accuracy with computational efficiency.

1.2 Aim of the project

The main aim of this project is to develop an intelligent and efficient system for the automatic identification of medicinal plants using Deep Learning techniques, specifically the Noise Reduction and Refinement (NRR) algorithm for image preprocessing and the MobileNet architecture for classification. The project seeks to enhance the accuracy, speed, and reliability of plant recognition by minimizing image noise, extracting key visual features, and enabling real-time identification through mobile and embedded platforms. This system is intended to assist researchers, students, and healthcare professionals in accurately identifying medicinal plants, promoting their proper utilization, and contributing to the advancement of digital herbal research.

1.3 Project Domain

The project falls under the domain of Artificial Intelligence (AI) and Deep Learning (DL), with applications in Computer Vision and Smart Healthcare. It focuses on automating the identification of medicinal plants using advanced image processing and neural network techniques. The domain integrates image preprocessing, feature extraction, and classification to accurately recognize plant species based on their visual characteristics such as leaf shape, texture, and color. The use of the Noise Reduction and Refinement (NRR) algorithm enhances image clarity, while MobileNet, a lightweight Convolutional Neural Network (CNN) model, enables efficient and accurate classification even on mobile or low-power devices. This domain bridges technology and biology, providing a modern approach to botanical research, herbal medicine identification, and biodiversity conservation. By leveraging AI, the project contributes to the development of intelligent systems that can support healthcare, agriculture, and environmental sustainability.

Traditional botanical identification methods are often slow, subjective, and require expert knowledge, making them unsuitable for large-scale or field-based applications. By leveraging Deep Learning techniques, particularly Convolutional Neural Networks (CNNs) such as MobileNet, the system can automatically learn distinguishing features of medicinal plants from image datasets. The integration of the Noise Reduction and Refinement (NRR) algorithm further enhances image quality, improving classification accuracy. This technological approach not only saves time and resources but also ensures reliability and scalability. Hence, choosing this domain allows the project to merge modern computational intelligence with biological science, providing practical applications in healthcare, agriculture, and environmental preservation.

1.4 Scope of the Project

The scope of this project encompasses the design and development of an automated system capable of identifying medicinal plants accurately using advanced Deep Learning and image processing techniques. The project focuses on implementing the Noise Reduction and Refinement (NRR) algorithm to enhance image quality and applying the MobileNet architecture for efficient and lightweight classification. It is designed to function across multiple platforms, including mobile devices, enabling users to capture plant images and obtain instant identification results. The system can be extended with large datasets to include a wide range of medicinal plants, improving accuracy and reliability over time. Furthermore, the project opens opportunities for applications in smart healthcare, botanical research, agriculture, and environmental conservation. By integrating artificial intelligence with plant science, the project promotes sustainable use of natural resources and supports educational and research activities related to herbal medicine.

The project's scope also includes building a scalable database of medicinal plant species, improving recognition accuracy through continuous training, and integrating the model into a mobile or web application. It can be applied in pharmaceutical research, agriculture, forestry, and education to assist botanists, students, and healthcare professionals. In the future, the system can be expanded to identify plant diseases, analyze leaf health, or suggest medicinal properties, thus promoting digital herbal research, biodiversity conservation, and sustainable development.The MobileNet architecture, a lightweight and efficient Convolutional Neural Network (CNN) model designed for high performance even on mobile and embedded devices. This makes the system suitable for real-time applications, where users can simply capture an image of a plant and instantly receive identification results.The project's scope extends to developing a scalable framework that can be implemented on mobile and web platforms, allowing users to capture or upload images for real-time identification. The system can serve as a valuable tool for botanists, researchers, farmers, students, and healthcare professionals who rely on precise plant identification for medicinal, agricultural, or educational purposes.

Chapter 2

LITERATURE REVIEW

2.1 Literature Review

The rise of deep learning, especially Convolutional Neural Networks (CNNs), transformed plant recognition by enabling end-to-end learning of hierarchical visual features directly from images. State-of-the-art CNN architectures consistently outperformed handcrafted-feature pipelines because they learn robust, discriminative representations for complex visual cues like venation, serration, and subtle color variations. Transfer learning fine-tuning pre-trained networks on plant datasets became a standard practice, significantly improving performance when labeled botanical data were limited.

Image preprocessing and noise handling remain central to improving classification robustness. Preprocessing techniques include background removal, color normalization, contrast enhancement, and denoising filters.Domain-specific approaches that segment the leaf (ROI extraction) or enhance venation patterns often boost classifier performance by emphasizing biologically relevant features and reducing distractors.The concept of “Noise Reduction and Refinement” (NRR) — combining denoising, morphological refinement, and adaptive contrast enhancement has been shown to help when datasets include images taken in uncontrolled environments with varying illumination and occlusion.

2.2 Gap Identification

[1] Although extensive research has been carried out in the field of plant identification using image processing and deep learning techniques, several research and practical gaps still remain unaddressed. Most existing systems focus on general plant species recognition rather than medicinal plant identification, which requires higher precision due to the similarity between leaves of different species. Traditional

Chapter 3

PROJECT DESCRIPTION

3.1 Existing System

In the existing systems for medicinal plant identification, most approaches rely on traditional image processing or standard deep learning models that lack effective preprocessing and optimization for mobile environments. Earlier systems primarily focused on extracting handcrafted features such as leaf shape, edge structure, and color histograms. These features were then classified using algorithms like Support Vector Machines (SVM), K-Nearest Neighbors (KNN), or Random Forests. While these methods achieved moderate success under controlled conditions, they performed poorly in real-world scenarios due to variations in lighting, background noise, and leaf positioning.

Hence, the existing systems suffer from challenges such as low robustness to noise, high computational cost, and poor mobile compatibility. These limitations highlight the need for an improved approach that integrates Noise Reduction and Refinement (NRR) for enhanced image quality and employs a MobileNet-based lightweight deep learning model for fast and accurate medicinal plant identification suitable for mobile platforms.

3.2 Problem statement

Medicinal plants play a vital role in healthcare, pharmacology, and traditional medicine, but their accurate identification remains a major challenge due to high visual similarity among species, variations in environmental conditions, and dependence on expert knowledge. Conventional plant identification methods rely on manual observation or basic image processing techniques that are time-consuming, prone to human error, and inefficient for large-scale applications.

Existing deep learning models such as VGG16, ResNet, and Inception have improved accuracy but are computationally heavy and unsuitable for mobile or real-time applications. Moreover, most existing systems overlook the importance of image preprocessing, leading to reduced performance when dealing with images captured in natural environments that contain noise, uneven lighting, or complex backgrounds. These limitations restrict the accessibility and usability of automated plant identification tools, particularly for field researchers, farmers, and healthcare practitioners.

3.3 System Specification

3.3.1 Hardware Specification

Processor:Intel Core i5

Ram:Minimum 8 GB

Storage:Minimum 500 GB Hardisk

Display:monitor with a minimum 1080p resolution

3.3.2 Software Specification

Programming language:Python 3.14

Operating System:Windows 10 or Above

Dataset Source:Kaggle,Medical Plant Image

Development source:Tenser Flow and Keras

3.3.3 Standards and Policies

Python Environment The data preprocessing and training process comply with fair data usage policies by utilizing open-source or publicly available plant image datasets such as those from Kaggle or PlantVillage, ensuring that no copyrighted or proprietary data is misused. Additionally, the system upholds data privacy and integrity by ensuring that user-uploaded images are processed securely and not stored without consent.

Standard Used: ISO/IEC 9126-FAIR (Findable, Accessible, Interoperable, Reusable)

Chapter 4

METHODOLOGY

4.1 Proposed System

The proposed system aims to develop an intelligent and efficient medicinal plant identification model that combines advanced image preprocessing and deep learning techniques to achieve accurate, fast, and mobile-compatible performance. The system integrates two main components: the Noise Reduction and Refinement (NRR) algorithm for image enhancement and the MobileNet deep learning architecture for classification.

In this system, input images of medicinal plants are first processed using the NRR algorithm, which removes background noise, improves image clarity, and refines key features such as leaf edges, texture, and color variations. This preprocessing stage ensures that the system extracts only relevant visual features, reducing misclassification caused by noisy or low-quality images.

4.2 General Architecture

The general architecture of the proposed system for medicinal plant identification is designed to process plant images efficiently through several interconnected stages. The process begins with image acquisition, where plant leaf images are captured using a camera or obtained from a dataset. Since these images may contain noise, uneven lighting, and complex backgrounds, they are first passed through the Noise Reduction and Refinement (NRR) module, which enhances image clarity by removing unwanted noise and improving the contrast and texture of essential features such as leaf shape, veins, and edges.

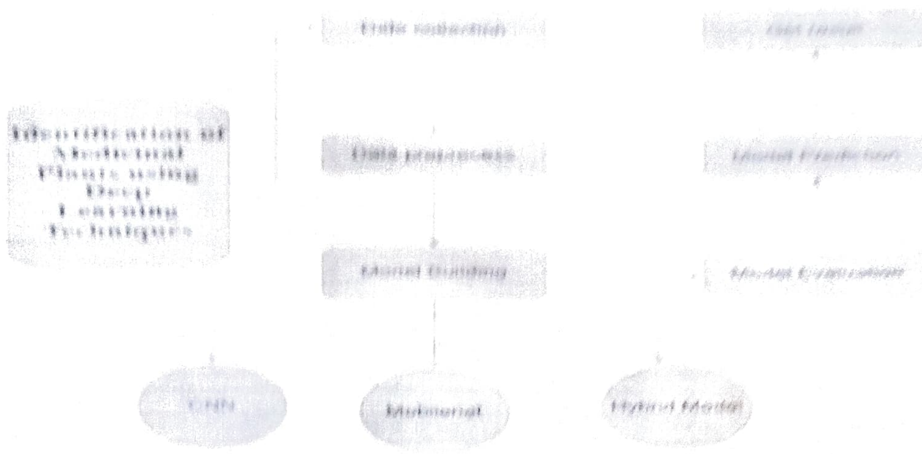

Figure 4.1: **ARCHITECTURE DIAGRAM FOR MEDICAL PLANT USES**

4.3 Design Phase

The design phase of the project plays a crucial role in transforming the proposed concept into a structured and functional system for medicinal plant identification. During this phase, the system's architecture, data flow, and component interactions are carefully planned to ensure optimal performance and usability.The process begins with designing the data acquisition and preprocessing modules, where the Noise Reduction and Refinement (NRR) algorithm is implemented to enhance image quality by eliminating background noise and improving visual clarity.The next design component focuses on the deep learning model, where the MobileNet architecture is configured for efficient feature extraction and classification of medicinal plant species. This involves defining network layers, activation functions, and training parameters to balance accuracy and computational efficiency. The user interface design ensures smooth interaction by allowing users to upload or capture plant images and receive instant identification results along with medicinal information. Database design is also incorporated to store plant images, features, and classification results for future retrieval and model updates

4.3.1 Data Flow Diagram

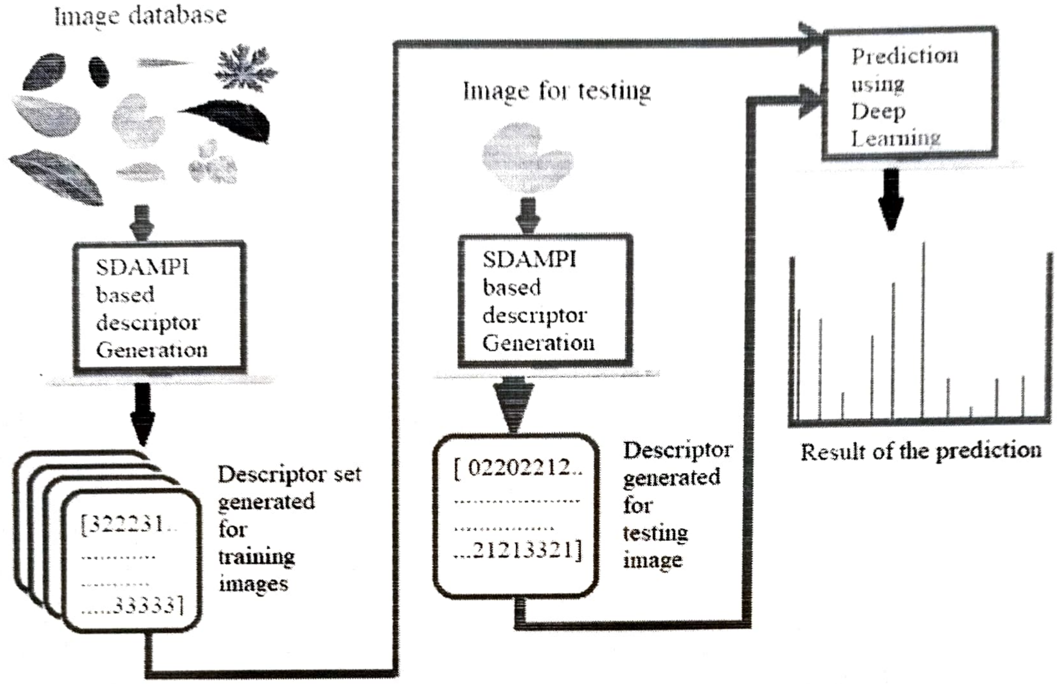

Figure 4.2: **DATA FLOW DIAGRAM FOR MEDICAL PLANT USES**

The Data Flow Diagram (DFD) of the proposed system illustrates the logical movement of data throughout the medicinal plant identification process, from image input to final output. The process begins when the user uploads or captures an image of a medicinal plant leaf using a camera or file upload interface. This input image is first sent to the Preprocessing Module, where the Noise Reduction and Refinement (NRR) algorithm is applied to eliminate unwanted background elements, noise, and lighting inconsistencies. The refined image is then passed to the Feature Extraction Module, where the MobileNet deep learning model extracts essential visual features such as color, texture, and shape patterns. These extracted features are transferred to the Classification Module, where the trained neural network analyzes them and predicts the plant species using a softmax classifier. The classification result is then sent to the Database,Finally, the Output Module displays the identified plant name and relevant medicinal details to the user through a user-friendly interface. The DFD effectively represents how data is processed in a sequential manner, ensuring a smooth flow of information between users, processing components, and databases to achieve accurate and efficient plant identification.

4.3.2 Use Case Diagram

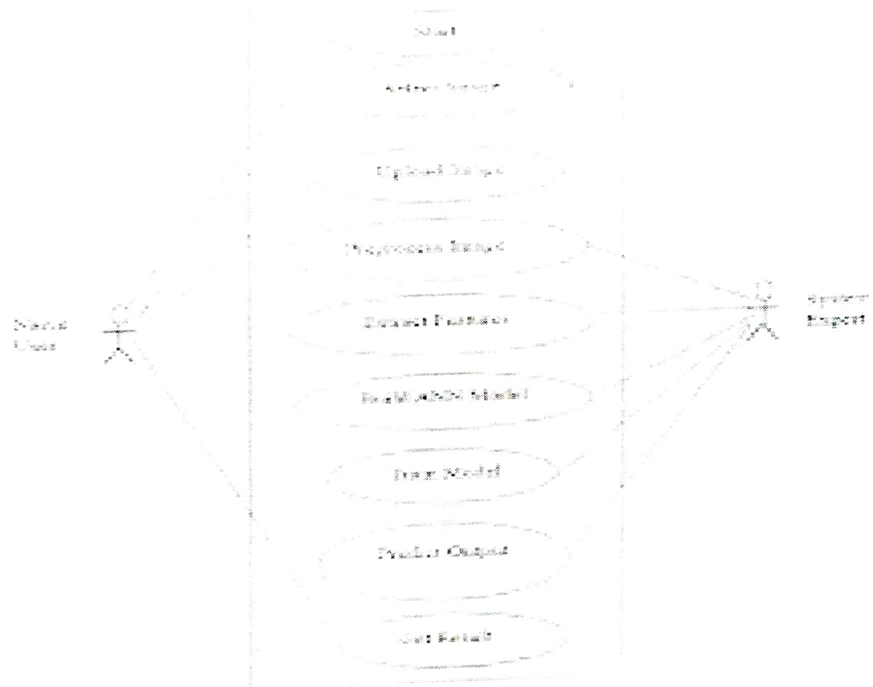

Figure 4.3: **USECASE DIAGRAM MEDICAL PLANT USES**

The Use Case Diagram for the proposed system represents the interaction between the user and the plant identification system, highlighting the major functionalities and processes involved. The primary actor in this system is the user, who can either be a researcher, student, or healthcare professional seeking to identify medicinal plants. The process begins when the user accesses the system through a mobile or web interface and performs the “Upload or Capture Image” use case by providing an image of a plant leaf. The system then performs the “Preprocess Image” use case, where the Noise Reduction and Refinement (NRR) algorithm removes background noise and enhances image quality. After preprocessing, the “Feature Extraction and Classification” use case is executed using the MobileNet deep learning model,The next use case, “Retrieve Plant Information,” connects to the database to fetch medicinal properties and details of the identified plant. Finally, the system performs the “Display Result” use case, showing the identified plant name and related medicinal information to the user. The diagram effectively demonstrates the flow of interactions between the user and system components, ensuring a smooth and logical process from image input to final identification output.

4.3.3 Class Diagram

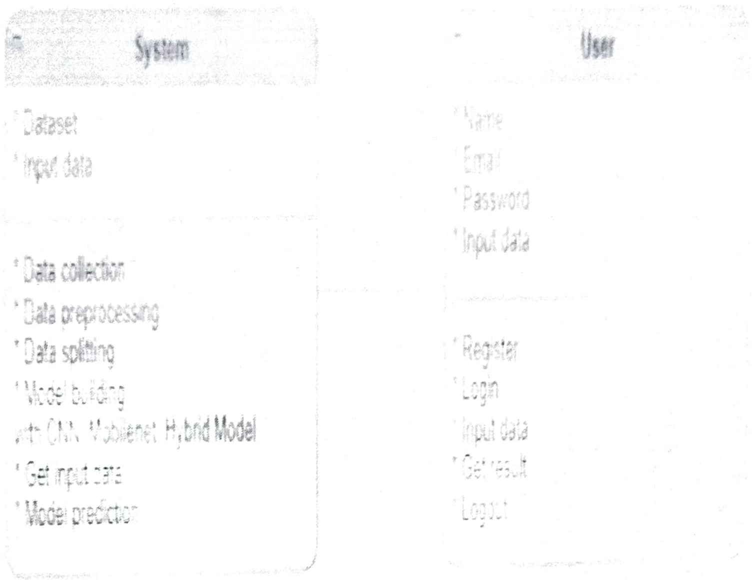

Figure 4.4: **CLASS DIAGRAM FOR MEDICAL PLANT USES**

The Class Diagram of the proposed system illustrates the structural design and relationships among the major components involved in medicinal plant identification. The system is organized into several key classes that represent the main functionalities. The User class allows interaction with the system by uploading or capturing a plant image and receiving identification results. The ImageProcessor class handles all preprocessing operations, including the Noise Reduction and Refinement (NRR) technique, which enhances image quality and removes unwanted noise before analysis. The FeatureExtractor class utilizes the MobileNet deep learning model to extract meaningful visual patterns and features from the refined image. These extracted features are then passed to the Classifier class, which applies a trained neural network model to predict the plant species based on learned data.The ResultDisplay class manages output generation, presenting the identified plant name and its medicinal properties to the user through an intuitive interface. Relationships among classes are primarily associative, with one-to-one and one-to-many connections between components such as User–ImageProcessor and Classifier–Database. Overall, the class diagram defines a well-structured, modular, and scalable architecture that supports easy maintenance and future expansion of the system.

4.4 Algorithm & Pseudo Code

4.4.1 Algorithm

Start The Process

Create labels (species IDs). Split into train / val / test

Load MobileNet (pretrained on ImageNet) without top layers

From MobileNet get final feature map (e.g., shape (H, W, C)).

After training, evaluate on test set

Convert to TensorFlow Lite (quantization optional) for mobile.

4.4.2 Pseudo Code

Model Training

```
import tensorflow as tf
from tensorflow.keras.applications import MobileNet
from tensorflow.keras.layers import Input, Reshape, LSTM, Dense, Dropout, BatchNormalization,
    GlobalAveragePooling2D
from tensorflow.keras.models import Model
from tensorflow.keras.preprocessing.image import ImageDataGenerator
import cv2
import numpy as np

def nrr_preprocess(image_path, target_size=(224, 224)):
    img = cv2.imread(image_path)
    img = cv2.resize(img, target_size)
    img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
    img = cv2.GaussianBlur(img, (3, 3), 0)
    lab = cv2.cvtColor(img, cv2.COLOR_RGB2LAB)
    l, a, b = cv2.split(lab)
    clahe = cv2.createCLAHE(clipLimit=3.0, tileGridSize=(8, 8))
    cl = clahe.apply(l)
    lab = cv2.merge((cl, a, b))
    img = cv2.cvtColor(lab, cv2.COLOR_LAB2RGB)
    img = img.astype('float32') / 255.0
    return img

train_datagen = ImageDataGenerator(
    preprocessing_function=lambda x: x / 255.0,
    rotation_range=25,
    zoom_range=0.2,
    horizontal_flip=True,
```

4.5.1 Module1:Convolutional

Figure 4.8: CNN ALGORITHM

Data is preprocessed and formatted for CNN input. For structured data, this might involve reshaping or normalization,The CNN applies convolutional filters to the input data, detecting local patterns and features through learned kernels.Max or average pooling layers reduce the spatial dimensions of the data, retaining important features and reducing computational complexity.

4.5.2 Module2:Mobile Net

Figure 4.9: MOBILE NET

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