FLOWER SPECIES RECOGNITION

Project Report submitted in the partial fulfilment of the

requirements for the award of the degree

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING

Submitted by

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

NARASARAOPETA ENGINEERING COLLEGE: NARASARAOPET

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Approved by AICTE, New Delhi, Permanently Affiliated to JNTUK, Kakinada

KOTAPPAKONDA ROAD, YALAMANDA VILLAGE, NARASARAOPET-522601

2022-2023

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CERTIFICATE

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ACKNOWLEDGEMENT

We wish to express my thanks to carious personalities who are responsible for the completion of the project. We are extremely thankful to our beloved chairman sri **M.V.Koteswara Rao, B.Sc** who took keen interest in us in every effort throughout this course. We owe out sincere gratitude to our beloved principal **Dr.M.Sreenivasa Kumar, M.Tech, Ph.D.(UK), MISTE., FIE(I)** for showing his kind attention and valuable guidance throughout the course.

We express our deep felt gratitude towards **Dr.S.N.Tirumala Rao,M.Tech.,Ph.D** HOD of CSE department and also to our guide **D.Venakata Reddy, M.Tech.,(Ph.D)** Assistant Professor of CSE department whose valuable guidance and unstinting encouragement enable us to accomplish our project successfully in time.

We extend our sincere thanks towards **M. Sireesha, M.Tech.,Ph.D** Associate professor & Project coordinator of the project for extending her encouragement. Their profound knowledge and willingness have been a constant source of inspiration for us throughout this project work.

We extend our sincere thanks to all other teaching and non-teaching staff of department for their cooperation and encouragement during our B.Tech degree.

We have no words to acknowledge the warm affection, constant inspiration and encouragement that we received from our parents.

We affectionately acknowledge the encouragement received from our friends and those who involved in giving valuable suggestions had clarifying out doubts which had really helped us in successfully completing our project.

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ABSTRACT

Flowers are one of the beautiful creations of god and they exist in millions of different species and colours. Identifying each of them requires a botanist with immense knowledge and skills. Identifying the scientific names and family of the flower species is complicated too. In this rising era of technologies most of the impossible are made possible by incorporating artificial intelligence into real world problems. By introducing machine learning algorithms such as convolutional neural networks for identifying flower species with just an image would be a great help for industries like pharmaceuticals and cosmetics. Ancient Ayurveda recognizes several medicinal benefits in most of the flowers. This paper tries to introduce convolutional neural networks to efficiently identify a flower by just feeding an image of the flower to be recognized. Flowers have been used for centuries to convey emotions and communicate messages, from expressing affection to offering condolences and sympathies. However, identifying the different flowers and their information is not an easy task.

With the help of machine learning algorithms, it is possible to create a system that can accurately identify flowers and provide information about their meanings and uses. By analysing images of different flowers and their associated metadata, machine learning algorithms can learn to recognize the unique characteristics of each species and match them to their corresponding meanings.

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M2: Build a passionate and a determined team of faculty with student centric teaching, imbibing experiential, innovative skills

M3: Imbibe lifelong learning skills, entrepreneurial skills and ethical values in students for addressing societal problems

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M2: Impart high quality professional training to get expertize in modern software tools and technologies to cater to the real time requirements of the Industry.

M3: Inculcate team work and lifelong learning among students with a sense of societal and ethical responsibilities.

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PSO2: Acquaint module knowledge on emerging trends of the modern era in Computer Science and Engineering

PSO3: Promote novel applications that meet the needs of entrepreneur, environmental and social issues.

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PEO2: Use various software tools and technologies to solve problems related to academia, industry and society.

PEO3: Work with ethical and moral values in the multi-disciplinary teams and can communicate effectively among team members with continuous learning.

PEO4: Pursue higher studies and develop their career in software industry.

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2. Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Project Course Outcomes (CO'S):

CO425.1: Analyse the System of Examinations and identify the problem.

CO425.2: Identify and classify the requirements.

CO425.3: Review the Related Literature

CO425.4: Design and Modularize the project

CO425.5: Construct, Integrate, Test and Implement the Project.

CO425.6: Prepare the project Documentation and present the Report using appropriate method.

Course Outcomes – Program Outcomes mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C425.1		✓											✓		
C425.2	✓		✓		✓								✓		
C425.3				✓		✓	✓	✓					✓		
C425.4			✓			✓	✓	✓					✓	✓	
C425.5					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C425.6									✓	✓	✓		✓	✓	

Course Outcomes – Program Outcome correlation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C425.1	2	3											2		
C425.2			2		3								2		
C425.3				2		2	3	3					2		
C425.4			2			1	1	2					3	2	
C425.5					3	3	3	2	3	2	2	1	3	2	1
C425.6									3	2	1		2	3	

Note: The values in the above table represent the level of correlation between CO's and PO's:

1. **Low level**

2. **Medium level**

3. **High level**

Project mapping with various courses of Curriculum with Attained PO's:

Name of the course from which principles are applied in this project	Description of the device	Attained PO
C3.2.4, C3.2.5	Gathering the requirements and defining the problem, plan to develop a software for flower species recognition	PO1, PO3
CC4.2.5	Each and every requirement is critically analyzed, the process model is identified and divided into different modules	PO2, PO3
CC4.2.5	Logical design is done by using the unified modelling language which involves individual team work	PO3, PO5, PO9
CC4.2.5	Each and every module is tested, integrated, and evaluated in our project	PO1, PO5
CC4.2.5	Documentation is done by all our three members in the form of a group	PO10
CC4.2.5	Each and every phase of the work in group is presented periodically	PO10, PO11
CC4.2.5	Implementation is done and the project can be handled easily and in future updates in our project can be done by increasing the type of flowers that can be classified.	PO4, PO7
CC4.2.8 CC4.2.	The design includes software components like model and python application.	PO5, PO6

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1. INTRODUCTION

1.1 Introduction

Many times see a flower and get curious to know more about it. But it is nearly impossible for a common man with less knowledge of flower species to accurately identify them. What makes it impossible is their existence in wide varieties of colour and shape. It is just a matter of browsing on the internet to know more about a flower. But what if the link between the flower image and flower name is missing. Here comes the significance of involving machine learning algorithms in aiding such nature enthusiasts. Flowers are the most attractive and distinguishing feature of a plant. Therefore flower recognition can help to know more about the plant. The two main common features of flowers are their colour and shape. Those features can be used to train the model such that it can later identify an unknown flower.

It is very important to identify naturally occurring objects and recognize its type. It is useful to identify flower type in various fields such as gardening, botany research, Ayurveda, treatment, farming, Floriculture etc. Nature has many different kinds of flowers, similarity in some features is found between the flowers. For example, many flowers share the red colour. On the other hand, these red flowers are different from other features. Red flowers do not necessarily share the same shape. These similarities and differences highlight the difficulty of identifying each flower species automatically. Traditional flower recognition task is done by a botanist. Many challenges are facing botanist through flower recognition task.

Our project aim is to providing an automated system that detects and recognizes flower species. The importance of building automated flower recognition method stands out in many benefits such as providing fast recognition for educational purpose, as automated method accelerates the learning process. Automated flower recognition gives the people with limited experience in flower species, the ability to recognize the species of a flower, with the advantages.

Computerized picture preparing manages control of advanced pictures through a computerized PC. It is centers around building up a PC framework that can perform preparing on a picture. Computerized picture preparing advancements, for example, Classification, Feature extraction, Pattern acknowledgment and so forth are helpful to order the pictures.

1.2 Existing System

Most of the existing systems provide inefficient results such as providing the probabilities of a few predicted flowers. Thus our objective is to help common people in easily identifying a flower that they have seen in a very efficient and accurate manner.

Disadvantages:

1. Computation time is very high.
2. Generates not effective results.
3. Manual work is more.
4. They have not generated details like scientific names of the flower.

1.3 Proposed System

In this proposed system we develop an efficient model for flower image classification using convolutional neural networks. The previously collected images of several flowers and their corresponding labels will be used to train the model. Once trained, the model takes as input, the image of a flower and predicts the common name as well as the family name of the flower. It also displays the major uses of the identified plant thus increasing the functionality of the system.

Advantages

1. Generates accurate and efficient results.
2. Computation time is greatly reduced.
3. Reduces manual work.
4. Our Project generates details like scientific names of the flower.

1.4 System Requirements

1.4.1 Software Requirements

- Browser: Any Latest browser like Chrome
- Operating System: Windows 10 and above
- Language: Python
- Platform: Google COLAB

1.4.2 Hardware Requirements

- Processor: Intel(R) Core™2 i7-5500U CPU @ 2.50GHz
- RAM: 8GB (gigabyte)
- System Type: 64-bit operating system, x64-based processor

2. LITERATURE SURVEY

2.1 Deep Learning

Deep learning is an artificial intelligence (AI) function that imitates the working of the human brain in processing data and creating patterns for use in decision making. Deep learning is a subset of machine learning in artificial intelligence that has networks capable of learning unsupervised from data that is unstructured or unlabeled. Also known as deep neural learning or deep neural network. Deep Learning is a subfield of machine learning concerned with algorithms inspired by the structure and function of the brain called artificial neural networks.

2.2 Deep Learning Methods

Deep learning uses artificial neural networks to perform sophisticated computations on large amounts of data. It is a type of machine learning that works based on the structure and function of the human brain. Deep learning algorithms train machines by learning from examples. Industries such as health care, ecommerce, entertainment, and advertising commonly use deep learning. There are many models available in Deep learning, model selection plays a vital role. Few examples are: LSTM, RNN, CNN etc. Deep learning has evolved over the past five years, and deep learning algorithms have become widely popular in many industries. Deep learning algorithms train machines by learning from examples. Industries such as health care, eCommerce, entertainment, and advertising commonly use deep learning.

While deep learning algorithms feature self-learning representations, they depend upon ANNs that mirror the way the brain computes information. During the training process, algorithms use unknown elements in the input distribution to extract features, group objects, and discover useful data patterns. Much like training machines for self-learning, this occurs at multiple levels, using the algorithms to build the models.

Deep learning models make use of several algorithms. While no one network is considered perfect, some algorithms are better suited to perform specific tasks. To choose the right ones, it's good to gain a solid understanding of all primary algorithms.

Defining Neural Networks

A neural network is structured like the human brain and consists of artificial neurons, also known as nodes. These nodes are stacked next to each other in three layers:

- The input layer
- The hidden layer(s)
- The output layer

Data provides each node with information in the form of inputs. The node multiplies the inputs with random weights, calculates them, and adds a bias. Finally, nonlinear functions, also known as activation functions, are applied to determine which neuron to fire.

Long Short Term (LSTM)

Long Short Term Memory Networks are a type of Recurrent Neural Network (RNN) that can learn and memorize long-term dependencies. Recalling past information for long periods is the default behaviour.

LSTMs retain information over time. They are useful in time-series prediction because they remember previous inputs. LSTMs have a chain-like structure where four interacting layers communicate in a unique way. Besides time-series predictions, LSTMs are typically used for speech recognition, music composition, and pharmaceutical development.

Working of LSTMs

- First, they forget irrelevant parts of the previous state
- Next, they selectively update the cell-state values
- Finally, the output of certain parts of the cell state

Autoencoders

Autoencoders are a specific type of feed forward neural network in which the input and output are identical. Geoffrey Hinton designed autoencoders in the 1980s to solve unsupervised learning problems. They are trained neural networks that replicate the data from the input layer to the output layer. Autoencoders are used for purposes such as pharmaceutical discovery, popularity prediction, and image processing.

Working of Autoencoders

An autoencoder consists of three main components: the encoder, the code, and the decoder.

- Autoencoders are structured to receive an input and transform it into a different representation. They then attempt to reconstruct the original input as accurately as possible.
- When an image of a digit is not clearly visible, it feeds to an autoencoder neural network.
- Autoencoders first encode the image, then reduce the size of the input into a smaller representation.
- Finally, the autoencoder decodes the image to generate the reconstructed image

Restricted Boltzmann Machines (RBMs)

RBMs are stochastic neural networks that can learn from a probability distribution over a set of inputs.

RBMs consist of two layers:

- Visible units
- Hidden units

Each visible unit is connected to all hidden units. RBMs have a bias unit that is connected to all the visible units and the hidden units, and they have no output nodes.

Working of RBMS

RBMs have two phases: forward pass and backward pass.

- RBMs accept the inputs and translate them into a set of numbers that encodes the inputs in the forward pass.

- RBMs combine every input with individual weight and one overall bias. The algorithm passes the output to the hidden layer.

- In the backward pass, RBMs take that set of numbers and translate them to form the reconstructed inputs.

- RBMs combine each activation with individual weight and overall bias and pass the output to the visible layer for reconstruction.

- At the visible layer, the RBM compares the reconstruction with the original input to analyse the quality of the result.

Recurrent Neural Networks (RNNs)

RNNs have connections that form directed cycles, which allow the outputs from the LSTM to be fed as inputs to the current phase.

The output from the LSTM becomes an input to the current phase and can memorize previous inputs due to its internal memory. RNNs are commonly used for image captioning, time-series analysis, natural-language processing, handwriting recognition, and machine translation.

Convolutional Neural Network (CNN)

A **Convolutional Neural Network (ConvNet/CNN)** is a Deep Learning algorithm which can take in an input image, assign importance to various aspects/objects in the image and be able to differentiate one from the other. Sequential model in CNN allows to build a model layer by

layer. There are three types of layers in a convolutional neural network: convolutional layer, pooling layer, and fully connected layer.

Convolutional layer:

Convolutional layer is the first layer that is used to extract the various features from the input images. This layer separates and identifies the various features of the image for analysis in a process called as **Feature Extraction**. Various parameters such as filter, kernel size, activation, padding and input shape are used. The Activation function used in this layer Rectified Linear Unit(ReLU) and it returns 0 if it receives zero input but for any positive value x it returns the x value.

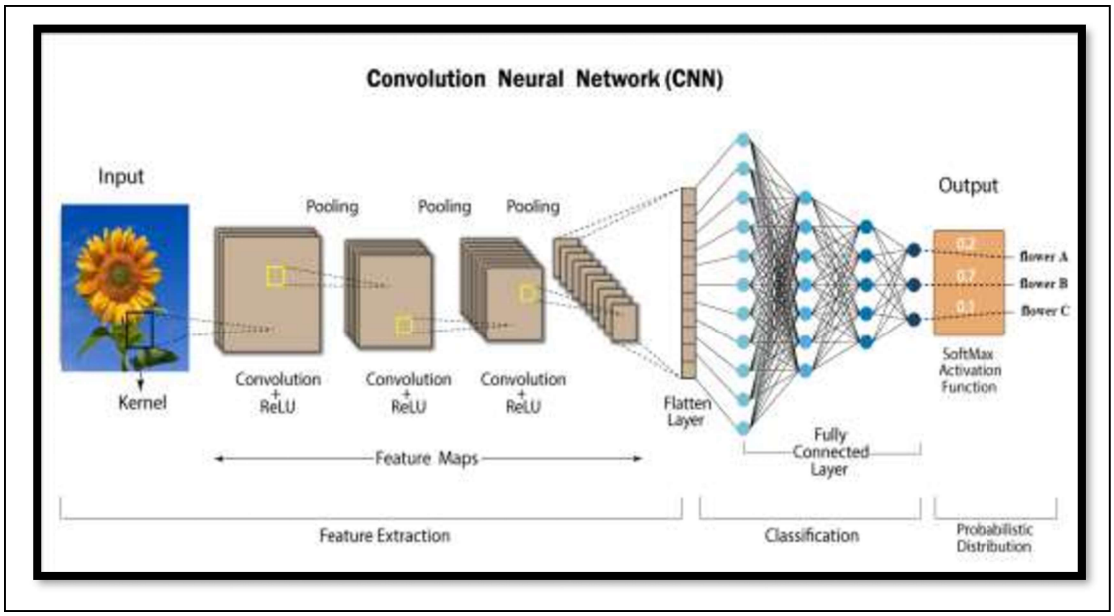

Fig:2.1 Convolutional Neural Networks

Rectified Linear Unit (ReLU):

- CNN's have a ReLU layer to perform operations on elements. The output is a rectified feature map.

Pooling Layer

- The rectified feature map next feeds into a pooling layer. Pooling is a down-sampling operation that reduces the dimensions of the feature map.

- The pooling layer then converts the resulting two-dimensional arrays from the pooled feature map into a single, long, continuous, linear vector by flattening it.

Fully Connected Layer

A fully connected layer forms when the flattened matrix from the pooling layer is fed as an input, which classifies and identifies the images.

2.3 Applications of Deep Learning:

1.Self-Driving Cars
2.Visual Recognition
3.Fraud Detection
4.Healthcare
5.Personalisations
6.Detecting Developmental Delay in Children
7.Colorization of Black and White Images
8.Adding Sounds to Silent Movies

2.4 Importance of Deep Learning:

Deep Learning is a branch of artificial intelligence that uses data to enable machines **to** learn to perform tasks on their own. This technology is already live and used in automatic email reply predictions, virtual assistants, facial recognition systems, and self driving cars. Breakthroughs in this technology are also making an impact in the health care sector. Using these types of advanced analytics, we can provide better information to health care.

The ability to process large numbers of features makes deep learning very powerful when dealing with unstructured data. However, deep learning algorithms can be overkill for less complex problems because they require access to a vast amount of data to be effective. If the data is too simple or incomplete, it is very easy for a deep learning model to become overfitted and fail to generalize well to new data. As a result, deep learning models are not as effective as other techniques (such as boosted decision trees or linear models) for most practical business problems such as understanding customer churn, detecting fraudulent transactions and

other cases with smaller datasets and fewer features. In certain cases like multiclass classification, deep learning can work for smaller, structured datasets.

2.5 Implementation of Deep Learning using Python

Python is a popular programming language. It was created in 1991 by Guido van Rossum.

It is used for:

• Web development (server-side),
• software development,
• mathematics and
• System scripting.

The most recent major version of Python is Python 3. However, Python 2, although not being updated with anything other than security updates, is still quite popular.

It is possible to write Python in an Integrated Development Environment, such as Thonny, PyCharm, NetBeans or Eclipse, Anaconda which are particularly useful when managing larger collections of Python files.

Python was designed for its readability. Python uses new lines to complete a command, as opposed to other programming languages which often use semicolons or parentheses.
Python relies on indentation, using whitespace, to define scope; such as the scope of loops, functions and classes. Other programming languages often use curly-brackets for this purpose.
In the older days, people used to perform Deep Learning tasks manually by coding all the algorithms and mathematical and statistical formula. This made the process time consuming, tedious and inefficient. But in the modern days, it is become very much easy and efficient compared to the olden days by various python libraries, frameworks, and modules. Today, Python is one of the most popular programming languages for this task and it has replaced many languages in the industry, one of the reason is its vast collection of libraries.
Python libraries that used in Deep Learning are:
1.Pandas
2.Numpy
3.Matplotlib

4.Tensor flow

5.Keras

Pandas: It is a popular Python library for data analysis. It is not directly related to Deep Learning. As we know that the dataset must be prepared before training. In this case, Pandas comes handy as it was developed specifically for data extraction and preparation. It provides high-level data structures and wide variety tools for data analysis. It provides many inbuilt methods for groping, combining and filtering data.

NumPy: It is a very popular python library for large multi-dimensional array and matrix processing, with the help of a large collection of high-level mathematical functions. It is very useful for fundamental scientific computations in Deep Learning. It is particularly useful for linear algebra, Fourier transform, and random number capabilities. High-end libraries like TensorFlow uses NumPy internally for manipulation of Tensors.

Matpoltlib: It is a very popular Python library for data visualization. Like Pandas, it is not directly related to Deep Learning. It particularly comes in handy when a programmer wants to visualize the patterns in the data. It is a 2D plotting library used for creating 2D graphs and plot. A module named pyplot makes it easy for programmers for plotting as it provides features to control line styles, font properties, formatting axes, etc. It provides various kinds of graphs and plots for data visualization, histogram, error charts, bar chats, etc.

TensorFlow: It is an open-source library developed by Google primarily for deep learning applications. It also supports traditional machine learning. TensorFlow was originally developed for large numerical computations without keeping deep learning in mind.

Keras: It is a powerful and easy-to-use free open source Python library for developing and evaluating deep learning models. It wraps the efficient numerical computation libraries Theano and TensorFlow and allows to define and train neural network models in just a few lines of code.

3. SYSTEM ANALYSIS

3.1 Scope of the project

The scope of this system is to maintain the different types of flower species details in datasets, train the model using the large quantity of data present in datasets and predict whether presence or absence of flowers on new data during testing.

3.2 Analysis

Importing Various Modules

- Loading the dataset
- Preprocessing the data
- Training Model
- Applying Algorithm
- Validating Data
- Result Analysis

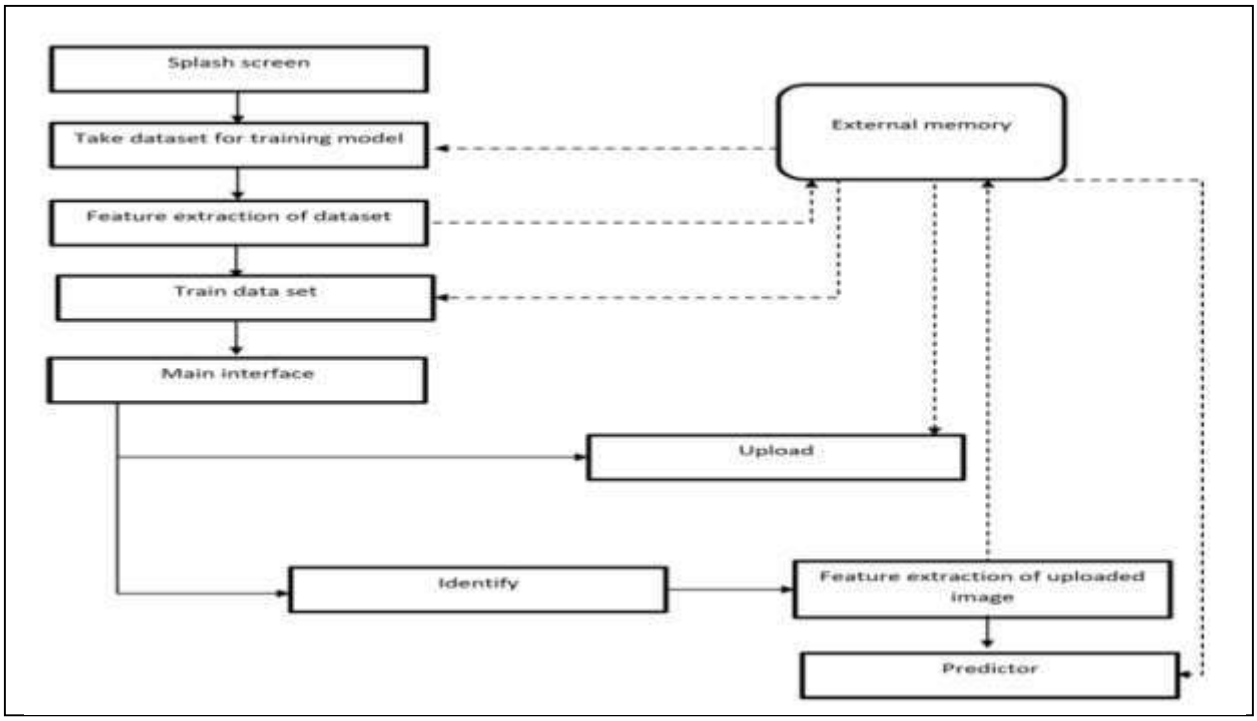

Fig:3.1 Dataflow Diagram

3.3 Data visualization

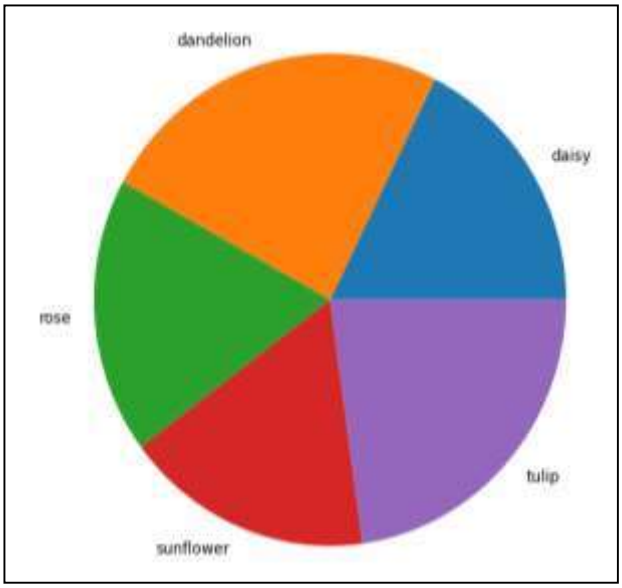

Fig:3.2 Pie chart related to dataset

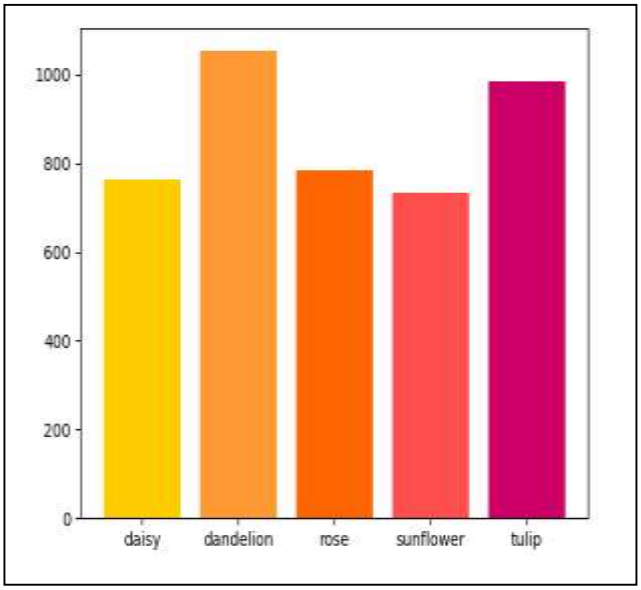

Fig:3.3 Bar chart related to dataset

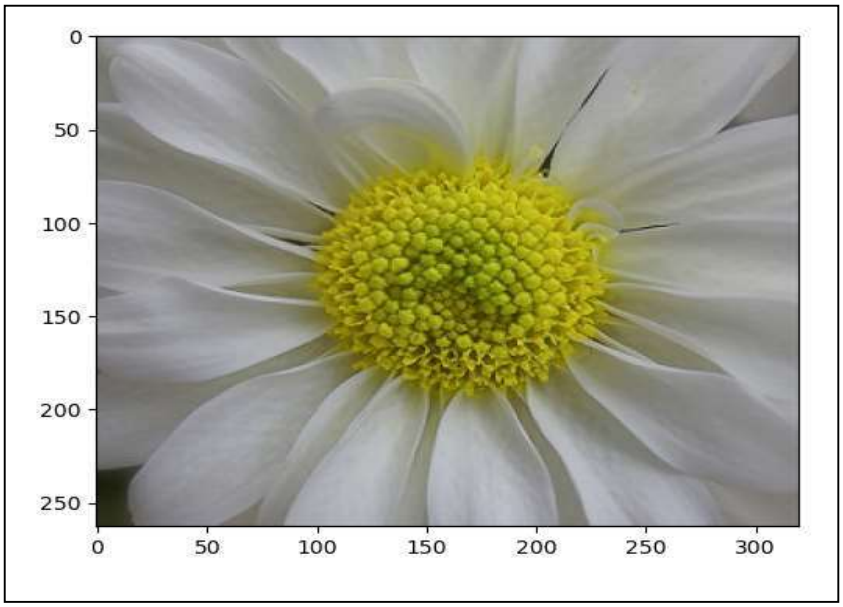

Fig:3.4 Visualization of image from dataset

4. DESIGN

4.1 Introduction

Software design sits at the technical kernel of the software engineering process and is applied regardless of the development paradigm and area of application. Design is the first step in the development phase for any engineered product or system. The designer's goal is to produce a model or representation of an entity that will later be built. Beginning, once system requirement have been specified and analysed, system design is the first of the three technical activities -design, code and test that is required to build and verify software.

The importance can be stated with a single word "Quality". Design is the place where quality is fostered in software development. Design provides us with representations of software that can assess for quality. Design is the only way that we can accurately translate a customer's view into a finished software product or system. Software design serves as a foundation for all the software engineering steps that follow. Without a strong design we risk building an unstable system – one that will be difficult to test, one whose quality cannot be assessed until the last stage.

4.2 Processing Steps

Step 1: Image acquisition: This step involves collecting images that can be used to train the model so that later when it comes across an unknown image, it can identify the flower based on the knowledge acquired during the training phase.

Step 2: Image Preprocessing: Here the images collected in the previous step were resized and augmented to increase the efficiency of the model. During augmentation, the size of the dataset would be increased by performing operations such as rotation, shear etc. Then the image will be split into 75% training and 25% testing sets.

Step 3: Training Phase: This is the step where the actual training of the model takes place. In this phase the model extracts features such as colour and shape of the flower used for training. Each of the training images will be passed through a stack of layers which includes convolutional layer, Relu layer, pooling layer and fully connected layer.

Step 4: Validation phase: Once the model completes its training from the training set it tries to improve itself by tuning its weight values. The loss function used is categorical cross entropy and the optimizer used is stochastic gradient descent.

Step 5: Output prediction: Once the validation phase is over, the model is ready to take an unknown image of a flower and predict its name from the knowledge it gained during training and validation phases. Once the classification is done by the model, it displays the common name as well as the family name of that flower.

Step 6: Benefits Module: Once the identity of the flower is found out, a previously created CSV file is imported and the benefits of the corresponding flower will be found out and displayed to the user.

Step 7: Web Application: Finally the developed model was deployed into a web application which further makes the system more user friendly.

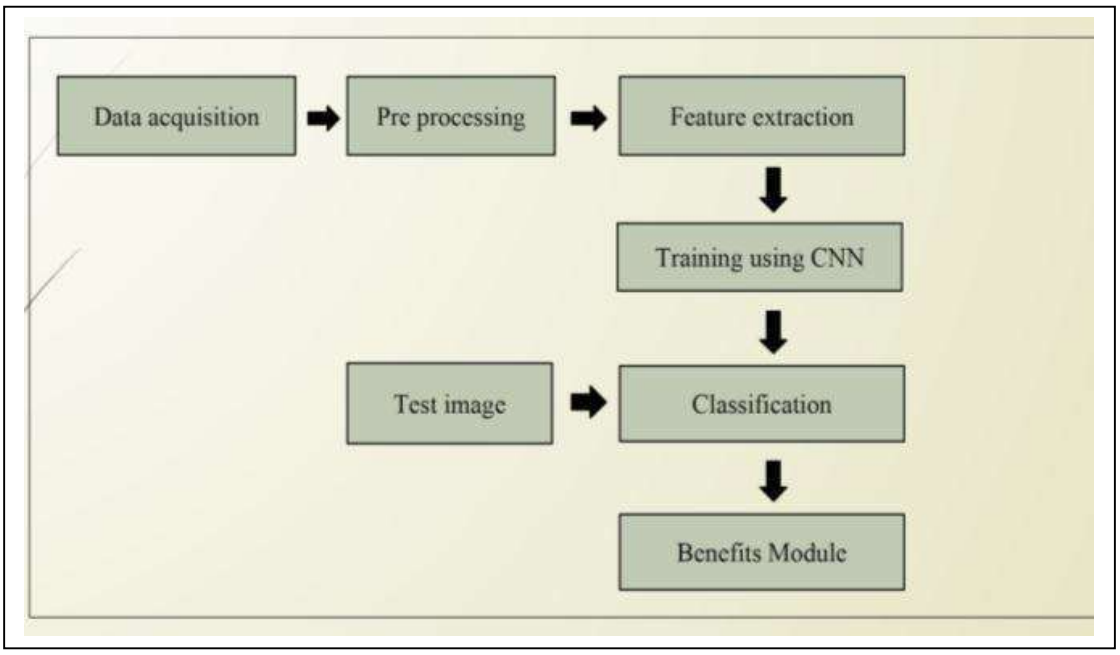

Fig:4.1 Flowchart

5. IMPLEMENTATION

5.1 Imported Packages

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
import os
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras.preprocessing.image import ImageDataGenerator,load_img,
img_to_array
```

5.2 Data Preprocessing

```
train_datagen=ImageDataGenerator(
    rescale=1./255,
    rotation_range=40,
    width_shift_range=0.2,
    height_shift_range=0.2,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True)
test_datagen=ImageDataGenerator(rescale=1./255)
print("train data")
train_generator1=train_datagen.flow_from_directory(
train_dir,
target_size=(224,224),
batch_size=11,
class_mode='categorical')
train_generator2=train_datagen.flow_from_directory(
train_dir,
target_size=(224,224),
```

```
batch_size=11,
class_mode='categorical')
train_generator=CutMixImageDataGenerator(
train_generator1,
train_generator2,
img_size=224,
batch_size=11,)

print("validation data")
val_generator=train_datagen.flow_from_directory(
val_dir,
target_size=(224,224),
batch_size=28,
class_mode='categorical')

print("test data")
test_generator=test_datagen.flow_from_directory(
test_dir,
target_size=(224,224),
batch_size=26,
class_mode='categorical')
```

5.3 Training & Testing

```
#model creation
from tensorflow.keras import layers
from tensorflow.keras import models
from tensorflow.keras.applications import InceptionResNetV2
model=models.Sequential()
conv_base=InceptionResNetV2(weights='imagenet',include_top=False,input_shape=(224,22
4,3))
model.add(conv_base)
model.add(layers.Flatten())
model.add(layers.Dense(512,activation='relu'))
```

```
model.add(layers.Dense(5,activation='sigmoid'))
model.summary()

#optimizer
from tensorflow.keras import optimizers
model.compile(loss='categorical_crossentropy',optimizer=optimizers.Adam(learning_rate=0.
0001),metrics=['acc'])
#running model

from keras.callbacks import ModelCheckpoint
filepath='/best_model.epoch{epoch:02d}-acc{val_acc:.2f}.h5'
checkpoint1=ModelCheckpoint(filepath=filepath,monitor='val_acc',verbose=1,save_best_onl
y=True,mode='max')
filepath='/best_model.epoch{epoch:02d}-loss{val_loss:.2f}.h5'
checkpoint2=ModelCheckpoint(filepath=filepath,monitor='val_loss',verbose=1,save_best_on
ly=True,mode='min')
callbacks=[checkpoint1,checkpoint2]
history=model.fit(
train_generator,
epochs=25,
steps_per_epoch=train_generator.get_steps_per_epoch(),
validation_data=val_generator,
validation_steps=76,
callbacks=callbacks)
```

5.4 Front End Code

```
import streamlit as st
from tensorflow.keras import optimizers
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import matplotlib.pyplot as plt
import numpy as np
import os
```

```
st.title('Flower Classifiction')
def load_image(img_path):
    img = image.load_img(img_path, target_size=(224, 224))
    img_tensor = image.img_to_array(img)
    img_tensor = np.expand_dims(img_tensor, axis=0)
    img_tensor /= 255.  # imshow expects values in the range [0, 1]

    return img_tensor
def save_uploadedfile(uploadedfile):
    tempDir=os.getcwd()
    with open(os.path.join(tempDir,uploadedfile.name),"wb") as f:
        f.write(uploadedfile.getbuffer())



model = load_model("best_model.epoch25-acc1.00.h5", compile=False)
model.compile(loss='categorical_crossentropy',
optimizer=optimizers.Adam(learning_rate=0.0001), metrics=['acc'])

uploaded_files = st.file_uploader("Choose a image", accept_multiple_files=True)
for uploaded_file in uploaded_files:
    bytes_data = uploaded_file.read()
    st.write("filename:", uploaded_file.name)
    st.image(uploaded_file)

    save_uploadedfile(uploaded_file)
    img=load_image(uploaded_file.name)
    pred = model.predict(img)
    classes = ['daisy', 'dandelion', 'rose', 'sunflower', 'tulip']
    sci_name=["Bellis perennis","Taraxacum","Rosa","Helianthus","Tulipa"]
    Family=["Asteraceae","Asteraceae","Rosaceae","Asteraceae","Liliaceae"]

    pred = pred[:][0].tolist()

    max_prob=max(pred)
```

```
    x=pred.index(max_prob)
    cls = classes[x]
    sci_n=sci_name[x]
    fam=Family[x]
    print(pred)
    if max_prob>0.83:
        st.write("The predicted class of flower is", cls)
        st.write()
        st.write("The Scientific Name of the flower is ",sci_n)
        st.write()
        st.write("The flower belongs to ",fam,"Family")
    else:
        st.write('your input may not be a flower belonging to','daisy', 'dandelion', 'rose',
'sunflower', 'tulip')
        st.write('if it was a flower belonging to these classes than it would be',cls)
```

6. RESULT ANALYSIS

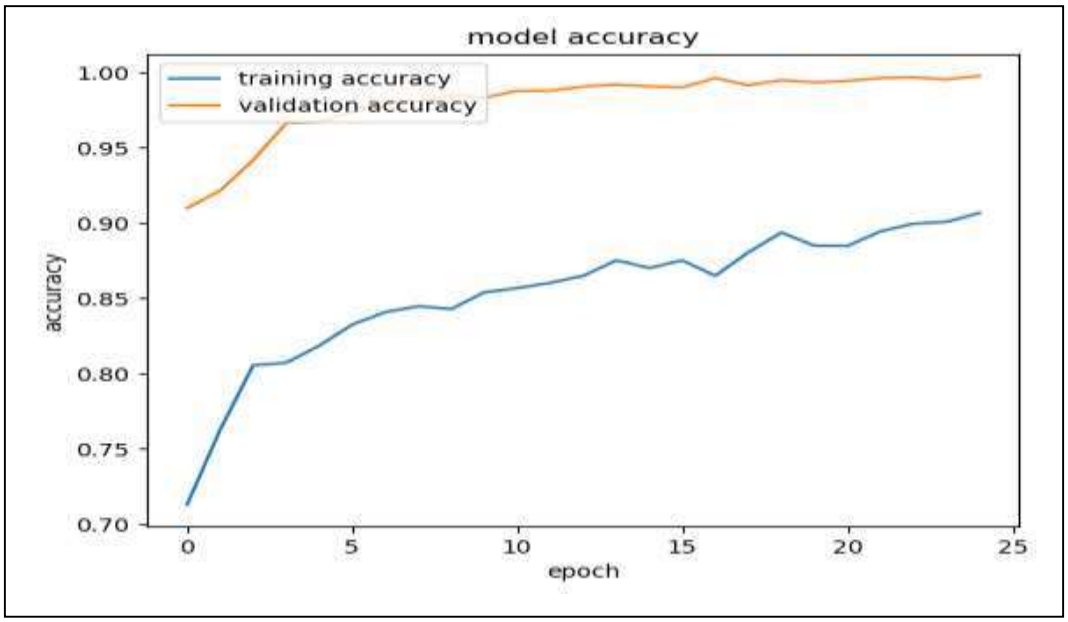

Fig:6.1 Accuracy result analysis

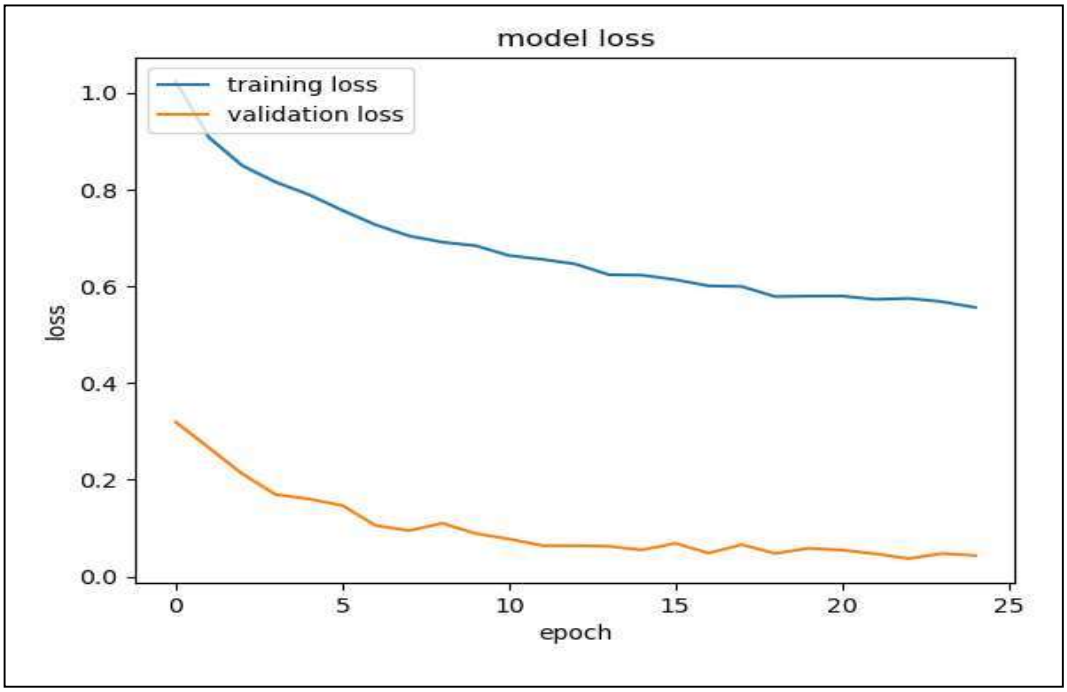

Fig:6.2 Loss result analysis

We have trained the model for 25 epochs and validated each epoch using loss and accuracy. We have saved the models which have the best accuracy and loss. We got the best accurate model at 25th epoch which has a validation accuracy of 99.76%. We got a best validation loss of 0.03699. After testing the accurate model we got a testing accuracy of 99.75%.

7. SCREEN SHOTS

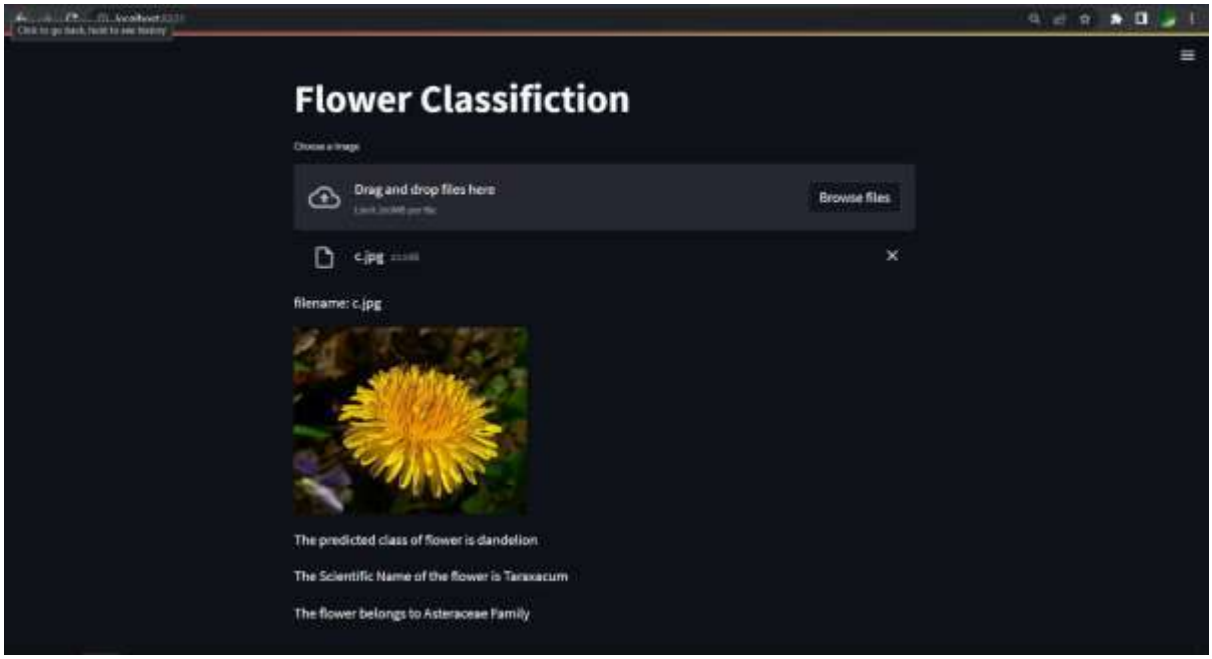

Fig:7.1 project screenshot 1

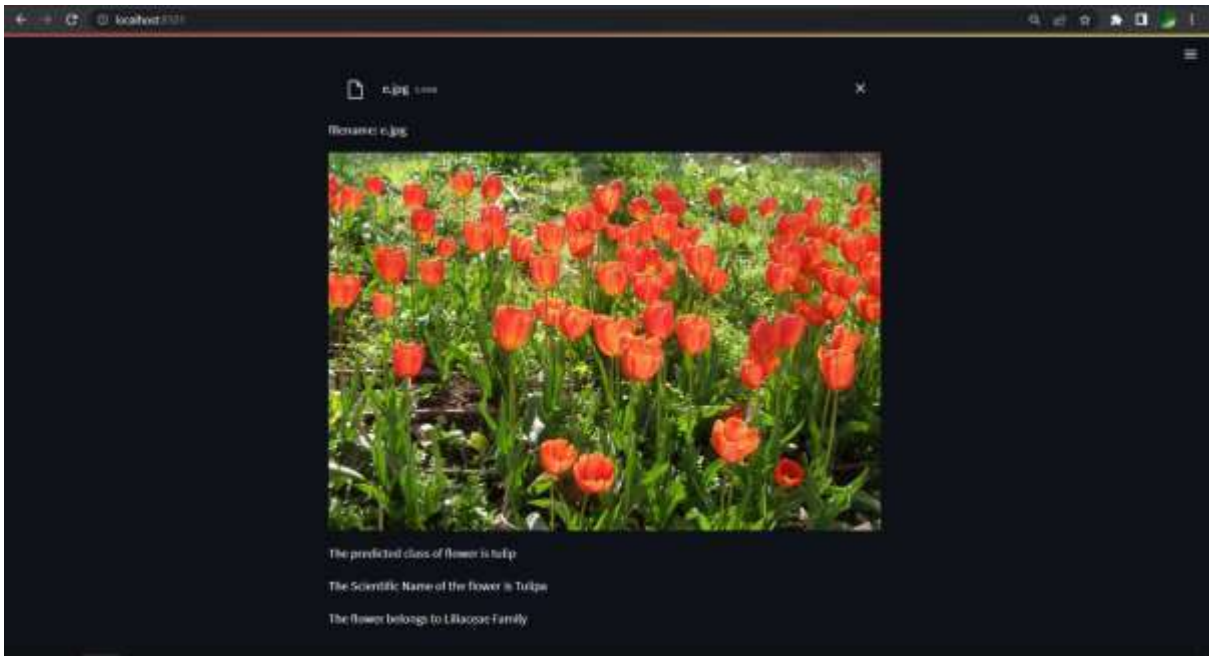

Fig:7.2 project screenshot 2

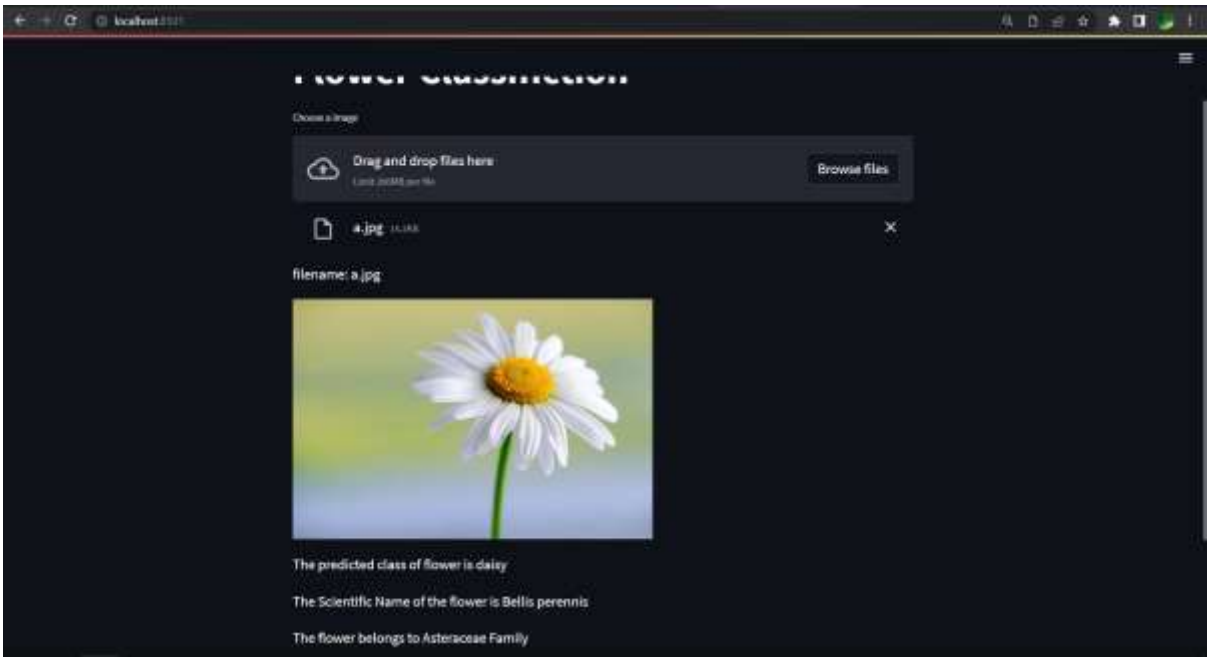

Fig:7.3 project screenshot 3

8. CONCLUSION

In future, the scope of using flowers in ayurvedic medicines is more. These flowers are also used in beauty products. New techniques are being designed to use these flowers in Air purifiers also. There are many more advantages of using flowers in different fields, few more are yet to come. The flower classification and recognition based on text processing by taking existing flowers and their attributes in order to find their characteristics. The user can enter the flower attributes or just the name and get that the advantages and disadvantages of the flower as soon as we enter the flower details. The usage of the flowers are to be known in order to know the advantage by medicinal and other therapeutic uses.

9. FUTURE SCOPE

In future, the scope of using flowers in ayurvedic medicines is more. These flowers are also used in beauty products. New techniques are being designed to use these flowers in Air purifiers also. There are many more advantages of using flowers in different fields, few more are yet to come. The flower classification and recognition based on text processing by taking existing flowers and their attributes in order to find their characteristics. The user can enter the flower attributes or just the name and get that the advantages and disadvantages of the flower as soon as we enter the flower details. The usage of the flowers are to be known in order to know the advantage by medicinal and other therapeutic uses.

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FLOWER SPECIES RECOGNITION

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***Abstract* - Flowers have been used for centuries to convey emotions and communicate messages, from expressing affection to offering condolences and sympathies. However, identifying the different flowers and their information is not an easy task.**

With the help of machine learning algorithms, it is possible to create a system that can accurately identify flowers and provide information about their meanings and uses. By analysing images of different flowers and their associated metadata, machine learning algorithms can learn to recognize the unique characteristics of each species and match them to their corresponding meanings.

Keywords---convolutional neural network, Deep learning, Flower classification

I. INTRODUCTION

Flower gardens are a source of beauty and inspiration for many people, but identifying the different flower species can be a challenge, especially for those who are new to gardening. Flowers come in a wide variety of colours, shapes, and sizes, making it difficult to know which flowers will work well together in a garden. By incorporating machine learning algorithms, it is possible to create a system that can identify different flower species and provide information about their characteristics and growing requirements. By analysing the unique features of each flower species, such as their petal shape, colour, and growth habits, machine learning algorithms can learn to distinguish between different species and provide accurate identifications. flower classification is an important tool in understanding and managing the natural world around us. One of the key benefits of flower classification using machine learning is that it can help identify rare and endangered species. Many rare flowers are difficult to identify and can easily be confused with other, more common species. With machine learning algorithms, it is possible to accurately identify these rare species and track their populations over time.

II. LITERATURE REVIEW

Some of the works related to flower species recognition are

TABLE I. Literature Review

Authors	Dataset	Details
Steven Puttemans et al	Dataset of Orchid flowers	They have used SVM For orchid flower detection.[1]
Yuanyuan Liu et al	79 categories of flowers and Oxford 102 dataset	They have used Cnn for 79 categories dataset they got 76.54% of accuracy and for Oxford 102 dataset they got 84.02% of accuracy.[2]
Shantala Giraddi et al	5 categories of flowers	They have used CNN and got 97.67% validation accuracy and test [3]
Mengxiao Tian et al	Oxford university Dataset	Accuracy of 83.64% based on evaluation standard of Pascal VOC2007 and 87.4% based on evaluation standard of Pascal VOC2012.[4]
Saiful Islam et al	Dataset of 10 local flowers	They have used CNN and got 85% accuracy.[5]
Isha Patel et al	102 categories of flowers	They have used MKL and SVM and got 76.92% accuracy.[6]

These are the existing methodologies used for classification of flowers.

III. EXISTING SYSTEM

Many current flower identification systems often provide limited and inaccurate results, leaving users frustrated and confused. Our goal is to create a user-friendly and efficient flower identification system that empowers individuals to easily and accurately identify any flower they come across.

IV. PROPOSED SYSTEM

Our proposed system aims to leverage the power of convolutional neural networks to create a highly efficient and accurate flower image classification model. By training on a database of flower images and their corresponding labels, our model will be able to quickly and accurately identify any flower that is inputted. Additionally, our system will provide users with detailed information about the identified flower,

including its common name, family name. With this comprehensive functionality, our flower identification system will be an invaluable tool for both botanists and amateur nature enthusiasts alike.

V. Dataset And Dataset Visualization

We have used the dataset available in Kaggle which consists 5 categories of flowers [7].The Five categories are daisy, tulip, rose, sunflower, dandelion. In total there are nearly 4000 images in the dataset. The dataset is split into training validation and testing using splitfolders package. The training data is 80% of the total dataset, validation data is 10% of dataset and testing data is other 10% of the dataset.

Data visualization is an important tool for data analysis and communication that enables us to visually represent complex datasets and identify patterns and relationships within the data. Visualizations can take various forms, such as scatter plots, line charts, bar charts, histograms, heatmaps, box plots, tree maps, and many more. The choice of visualization technique depends on the type of data and the specific insights being communicated. The goal of data visualization is to communicate complex information clearly and effectively, making it easy for the audience to understand the key insights and trends in the data.

Data visualization can take many forms, including charts, graphs, maps, infographics, and other visual aids. It is often used in fields such as business, science, engineering, medicine, and social sciences to present data in a way that is accessible and easy to understand. The purpose of data visualization is to provide a clear and concise representation of complex data, allowing users to quickly and easily analyse and interpret large amounts of information. By utilizing data visualization techniques, organizations can better understand and make informed decisions based on their visual data, ultimately leading to improved performance and outcomes.

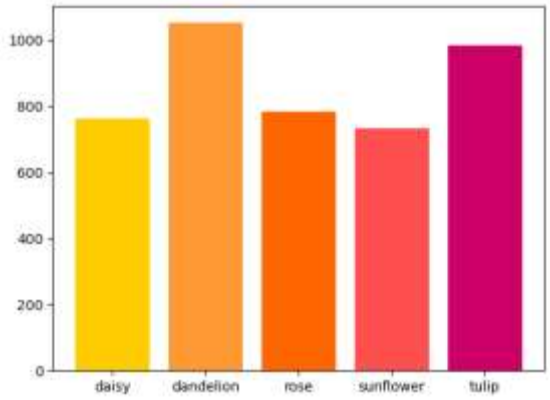

Fig. 1 Visualization of number of images in the dataset

VI. Prepeocessing

Preprocessing is an essential step in image processing and computer vision tasks, including flower recognition. It involves preparing and transforming raw input images into a suitable format that can be easily processed by the machine learning model.[8] Here are some common preprocessing steps for images:

Resizing: Images can be of different sizes, and resizing them to a fixed size is a common preprocessing step. Resizing ensures that all images have the same dimensions and reduces the amount of data that the model needs to process. We have resized our dataset to (224,224) images [9].

Normalization: Normalizing the pixel values of images can make the data more consistent and easier for the model to process. Common normalization techniques include scaling the pixel values to a fixed range, such as [0, 1], or standardizing the values to have zero mean and unit variance.

Data Augmentation: Data augmentation involves generating new training data by applying various transformations to the original images, such as flipping, rotating, or changing the brightness and contrast. Data augmentation can help prevent overfitting and improve the model's robustness to variations in the input data [10]. Some of data augmentation techniques used by us are

1. rotation
2. width shift
3. height shift
4. shear
5. zoom
6. horizontal flip

VII. System Analysis

Flowers can be difficult to distinguish from one another because of their intricate and diverse characteristics, including variations in colour, shape, texture, and scent, making flower recognition a complex and challenging task. The ability to recognize and classify flowers accurately and efficiently could have significant practical benefits in numerous fields, such as agriculture, environmental conservation, and floral design, as well as industries like cosmetics and perfumery that rely on natural plant materials.

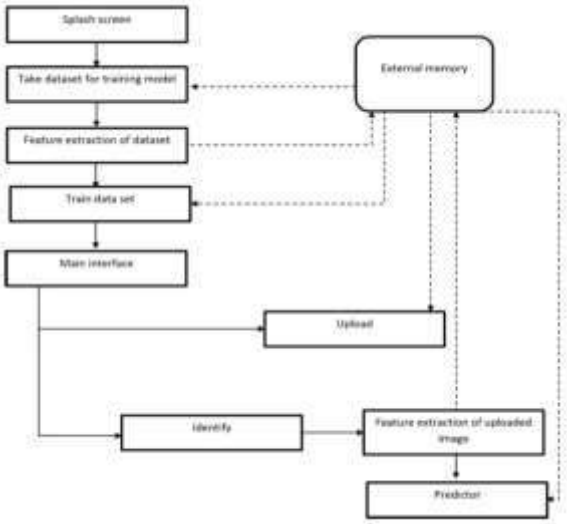

Fig.2 Dataflow Diagram

VIII. Methodology and Implementation

To develop an accurate and reliable flower recognition system, a deep learning approach is used. CNN models are ideal for image classification tasks as they can automatically extract relevant features from images and learn patterns from them. The process of training a CNN model involves feeding a large dataset of flower images with their corresponding labels into the network. The model then learns to recognize and classify different flower species based on the features it extracts from the images. With sufficient training data and proper tuning of the model's hyperparameters, the resulting model can achieve high accuracy and performance in recognizing different flowers. we have used a sequential model in which layers are stacked one after other [11][12].

Transfer learning is a machine learning technique that involves leveraging a pre-trained model to solve a new task. In transfer learning, the knowledge and insights gained from solving one problem are transferred to a new and different problem. The pre-trained model has already been trained on a large dataset and has learned to recognize relevant features and patterns that can be useful for solving other tasks. By using transfer learning, it is possible to significantly reduce the amount of data and computing resources required to train a new model for a specific task. We have used inception resnet v2 available in keras as first layer of our model. Flatten layer is used to convert spatial data into channel data. Two dense layers with Relu and Softmax activation functions are used as the last two layers of the model.

XI. Result and Analysis

We have trained the model for 25 epochs and validated each epoch using loss and accuracy. We have saved the models which have the best accuracy and loss. We got the best accurate model at 25th epoch which has a validation accuracy of 99.76%. After testing the accurate model we got a testing accuracy of 99.75%.

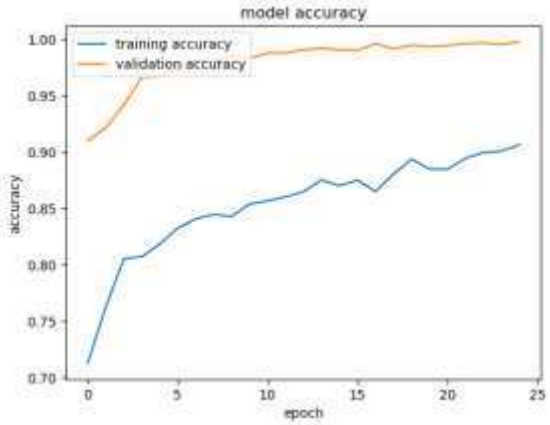

Fig.3 Graph representing training and validation accuracy at each epoch

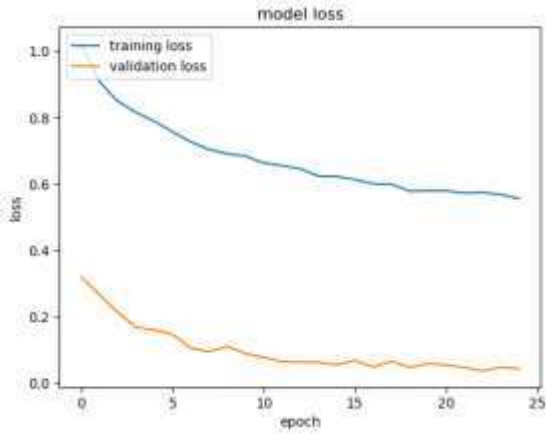

Fig.4 Graph representing training and validation loss at each epoch

X. CONCLUSION

With the help of modern machine learning techniques, flower classification has become a reliable and efficient process. Transfer learning, in particular, has proven to be an effective method for training convolutional neural networks to recognize a wide range of flower species. By analysing the unique visual features of flowers, these systems are able to accurately classify them and provide valuable information about the plant species.

Identifying the flowers of a plant can provide insights into the plant's taxonomy, morphology, and ecology. This information is crucial for many fields, including agriculture, horticulture, and ecology.

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International Conference on

PAPER ID
NECICAIEA2K23046

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Certificate of Presentation

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