Flower Recognition System Using Deep Learning and Image Captioning

Manasi.N. Musale[1], Shraddha.T. Sarate[2], Priyanka.D. Patil[3], Akshata.J. Patil[4]
[1,2,3,4]*Department of Computer Science and Engineering, D. Y. Patil Education Society's,D. Y. Patil Technical Campus, Faculty of Engineering & Faculty of Management, Talsande, Kolhapur, India.*

***Abstract*—Conventional flower identification techniques demand human labor and specialized knowledge. In order to automatically identify flower species, this study suggests a Flower Recognition System that uses deep learning techniques. Flower recognition is crucial for environmental monitoring, botany, and agriculture. pictures. The system generates meaningful descriptions of the observed flowers using BLIP for image caption creation and YOLOv8 for object identification. Streamlit is used to create an intuitive web interface that lets users upload or take pictures for prediction. For research and record-keeping purposes, the system further keeps prediction history in a MySQL database. According to experimental results, the suggested system can reliably identify flowers and produce pertinent captions with a high degree of confidence.**

***Index Terms*—Flower Recognition, Deep Learning, YOLOv8, Image Captioning, Streamlit**.

I. INTRODUCTION:

In the domains of botany, agriculture, environmental monitoring, and biodiversity conservation, identifying flowers is a crucial task. Identifying various flower species supports agricultural endeavors, aids botanists and gardeners in preserving plant health, and helps researchers understand plant diversity. In the past, experts have manually identified flowers using their color, shape, texture, and petal structure, among other visual traits. However, manual identification is time-consuming, prone to human error, and requires specialized knowledge, particularly when dealing with a large number of flower species. Automated image recognition systems are becoming more and more common as artificial intelligence and computer vision technologies advance at a rapid pace. Computer analysis and pattern recognition are made possible by machine learning and deep learning techniques. Deep learning models have become increasingly popular in recent years.

YOLOv8 (You Only Look Once Version 8) and other object detection algorithms have greatly increased the effectiveness and precision of real-time object detection systems. By analyzing the entire image in a single pass, YOLOv8 can quickly and accurately detect objects in images. For applications that need quick and accurate object recognition, this makes it appropriate. Apart from object detection, a significant field of study that integrates computer vision and natural language processing is image captioning techniques. The purpose of image captioning models is to produce textual explanations of images that are descriptive. The BLIP model is a potent vision-language model that comprehends both visual content and linguistic context to produce meaningful captions. The system is able to provide a detailed description of the image in addition to identifying the type of flower by combining object detection with image captioning. This study proposes a Flower Recognition System that combines BLIP for caption generation with YOLOv8 for flower detection. From input photos, the system is built to automatically identify different species of flowers and produce informative captions that offer more details about the identified flowers. A web application created with Streamlit, which enables users to upload or take pictures for real-time prediction, is used to deploy the Python-implemented system. In order to store prediction results, such as flower category, generated caption, confidence score, and prediction timestamp, the system also incorporates a MySQL database. With the help of this feature, users can keep track of their predictions and examine past outcomes. The primary goal of this research is to create an intelligent, user-friendly system that uses deep learning techniques to accurately identify flower

species and produce meaningful descriptions. The goal of the suggested system is to make things simpler.

II. LITERATURE REVIEW

1. Implementation of Flower Recognition using Convolutional Neural Networks - Djarot Hindarto, Nadia Amalia (Published December 10, 2023): This paper presents "Blossom Insight," a CNN-based system for automatic flower recognition using the Keras framework. It highlights the need for accurate flower classification due to the vast diversity of floral species. The study focuses on image preprocessing, data augmentation, and optimization of CNN parameters to improve accuracy, recall, and F1-score. The results demonstrate the model's capability to classify flowers effectively.

2. Flower Recognition Using Machine Learning - Sunil Bhutada, K. Tejaswi, and S.Vineela 2021 (Published on 30 May 2021): This paper explores flower classification using machine learning techniques to identify and categorize flower species efficiently. It discusses preprocessing steps such as data cleaning, feature extraction, and dimensionality reduction to improve classification accuracy. Algorithms like Random Forest and Association Rule Mining are used to recognize flower species based on their attributes. The study aims to make flower recognition faster and more reliable, benefiting agriculture, gardening, and ecological research.

3. Flower Identification and Classification using Computer Vision and Machine Learning Techniques - Isha Patel, Sanskruti Patel 2019 (Published August 2019 in IJEAT, Volume 8, Issue 6) : This paper focuses on automating flower identification using computer vision and machine learning techniques. It discusses image preprocessing, segmentation, and feature extraction methods (such as RGB, HSV, and shape features) to classify flower species accurately. The authors propose a hybrid methodology that combines image processing with ML algorithms like SVM for effective classification. The study highlights improvements in accuracy and demonstrates how these techniques can be applied in agriculture, biodiversity monitoring, and ecological research.

Sr No	Research Paper	Released Year	Authors	Research Gap
1.	Flower Image Classification using Deep CNN.	2025	Haowei Zhao	a. Requires large dataset b. No semantic understanding (no captioning)
2.	Automated Flower Species Recognition using Deep Learning	2025	Regalagadda Chaitra, Dr.N.Ravinder	a. High computational cost b. No real-time user interaction
3	Further Exploration on Deep Learning in Flower Recognition	2024	Xiaoyu He	a.Focus only on accuracy b. No deployment system
4.	Implementation of Flower Recognition using Convolutional Neural Networks.	2023	Djarot Hindarto,Nadia Amalia	a. Focuses mainly on CNN-based classification and lacks real-time object detection. b. Does not provide descriptive captions for the detected flower images
5	Flower Recognition Model based on Deep Neural Network with VGG19	2022	Zi Yuan Ong, Kah Kien Chye, Huay Wen Kang, Chi wee Tan	a.High computation required b. No image captioning
6.	Recognition and Classification of Flower Species based on AI	2021	Jianghao Chen, Yiming Huo,Junyu Li	a.Limited dataset b. No real-time system
7.	Identification of Plant Species using Deep	2021	Gargi Chandrababu,Ojus	a.Not specific to flowers b. No user interface

	Learning		Thomas Lee,Rekha K S	
8.	Flower Recognition Using Machine Learning	2021	Sunil Bhutada, K. Tejaswi, and S.Vineela	a. Uses traditional machine learning algorithms which may provide lower accuracy compared to deep learning models. b. Does not support real-time detection or advanced image understanding.
9	Automated Flower Species Detection using Neural Network	2020	RekhaA.Shidnekoppa, Deepti.Aralikatti, Vinuta.Bangarshettr, Ashwini.Koti ,Shree.Halbhavi	a.Uses traditional ANN b. Low accuracy
10.	Flower Identification & Classification using Efficient Deep Learning	2020	Rupali Jena, S ujataChakravarty	a. Complex hybrid model b. Requires preprocessing

III. METHODOLOGIES AND MODELS:

Deep learning techniques are used by the suggested Flower Recognition System to identify flower species from photos and produce informative captions. The system combines models for object detection and image captioning to produce precise recognition outcomes. The steps in the methodology are as follows.

1. Image Acquisition:

Image Acquisition Gathering the user's image of the flower is the first step. Through the web interface created with Streamlit, users can upload an image or take a picture with a camera. After that, the input image is sent to the processing phase.

2. Image Preprocessing:

This step involves processing the input image to enhance its quality and prepare it for model analysis. Resizing the image, normalizing pixel values, and eliminating noise are examples of preprocessing techniques. These procedures improve the model's ability to extract significant visual characteristics.

3. Flower Detection:

YOLOv8, a deep learning-based object detection algorithm, is used to examine the processed image. The model finds the flower in the picture, determines its class, and produces a confidence score that shows how accurate the prediction was.

4. Caption Generation:

The system uses BLIP to create a textual description after identifying the species of flower. This model creates a meaningful caption that describes the flower by analyzing the image's visual elements.

5. Result Display:

The web interface shows the user the name of the detected flower, the caption that was created, and the confidence score. This makes it easier for users to comprehend the prediction results.

Formula:

1. confidence_percent=⌊confidence×100⌋ where confidence ∈ [0,1].

Used for:

1. Progress bar width
2. Displaying confidence in history

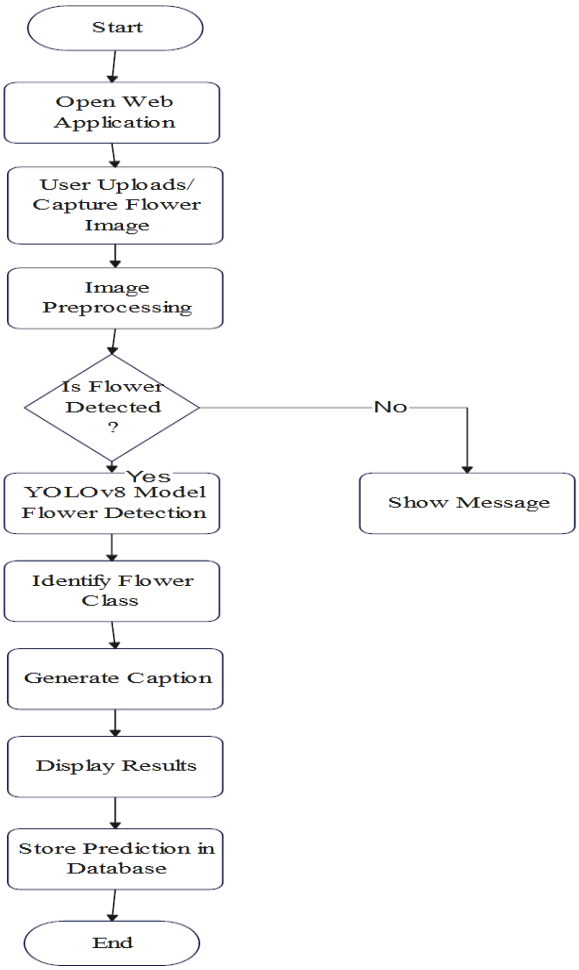
2. bar_width (%) =confidence×100

Used For: Scale progress bar length based on model confidence.

6. Data Storage:

Lastly, a MySQL database is used to store the prediction results. The flower category, generated caption, confidence score, and prediction date are all included in the stored data. Users can now view their prediction history at a later time.

IV. PROPOSED SYSTEM:



V. WORKING OF THE PROPOSED SYSTEM:

Several steps are involved in the proposed system's operation:

Step 1: Image Input

Using the Streamlit interface, the user uploads a picture of a flower or takes a picture.

Step 2: Image Processing

To prepare the input image for model prediction, it is preprocessed.

Step 3: Flower Detection

The YOLOv8 model uses trained dataset classes to analyze the image and identify the flower category.

Step 4: Caption Generation

The image is described in a natural language caption by the BLIP model.

Step 5: Result Display

The detected flower name, generated caption, and prediction confidence level are all displayed by the system.

Step 6: Data Storage

For later use, the prediction results are kept in the MySQL database.

VI. FUTURE WORK:

Even though the suggested Flower Recognition System uses deep learning models to accurately detect flowers and provide captions, there are a number of areas that could be improved in the future.

1. Expansion of Flower Dataset

A small number of flower categories are used to train the current system. A wider range of flower species from various regions could be added to the dataset in the future. This will enhance the system's capacity to identify unusual and rare blooms.

2. Mobile Application Development

At the moment, Streamlit is used to implement the system as a web application. A mobile application for iOS and Android smartphones may be created in the future. This will enable consumers to instantly identify flowers using the cameras on their smartphones.

3. Real-Time Video Detection

At the moment, the algorithm uses still photos to identify flowers. Future research could expand the technology to enable YOLOv8-based real-time flower recognition from live video broadcasts. This would make it possible to continuously identify and track flowers in farms, gardens, and other natural settings.

4. Integration with Botanical Information Systems

The system can be improved by incorporating botanical databases that offer supplementary information regarding the identified flower. For instance, the system might present details including flower species, scientific nomenclature, medicinal applications, and habitat data.

5. Improved Caption Generation

By using specialized flower datasets to train or refine sophisticated vision-language models like BLIP, the caption generation process can be further enhanced. This will result in more precise and thorough

descriptions of the flowers that were found.

6. Multi-Object Flower Detection
Future iterations of the system might be able to recognize and identify several flowers in one picture. When multiple flower species coexist in a single image, this would be helpful.

7. Cloud Deployment and Scalability
Large-scale usage can be supported by deploying the system on cloud platforms. Multiple users will be able to access the application at once and process images effectively thanks to cloud deployment.

VII. CONCLUSION

This study introduces an automated Flower Recognition System that uses deep learning methods to identify flower species from photos. The system uses BLIP to create insightful image captions and YOLOv8 for precise flower detection and classification. Users can upload or take pictures of flowers and instantly receive prediction results, including the flower category, sub-category, caption, and confidence score, using a web-based interface created with Streamlit. To keep track of past outcomes, prediction data is also kept in a MySQL database. The experimental findings show that the suggested system is capable of accurately identifying pictures of flowers and offering helpful descriptive data. The system is useful for educational, botanical, and agricultural applications because deep learning models are integrated with an interactive interface. Overall, the suggested method shows that automated flower recognition is a dependable and effective solution.

REFERENCES

[1] H. Zhao, “Flower image classification using deep CNN,” 2025.
[2] R. Chaitra and D. N. Ravinder, “Automated flower species recognition using deep learning,” 2025.
[3] X. He, “Further exploration on deep learning in flower recognition,” 2024.
[4] D. Hindarto and N. Amalia, “Implementation of flower recognition using convolutional neural networks,” 2023.
[5] Z. Y. Ong, K. K. Chye, C. H. Wen, C. W. Kang, and W. T. Tan, “Flower recognition model based on deep neural network with VGG19,” 2022.
[6] J. Chen, Y. Hu, and J. Li, “Recognition and classification of flower species based on AI,” 2021.
[7] G. Chandrababu, O. T. Lee, and K. S. Rekha, “Identification of plant species using deep learning,” 2021.
[8] S. Bharada, K. Tejaswi, and S. Vineela, “Flower recognition using machine learning,” 2021.
[9] R. Ashokkumar, D. Aralikatti, V. Basavaraj, A. Koti, and S. Halbhavi, “Automated flower species detection using neural network,” 2020.
[10] R. Jena, S. Sinha, and M. Chakravarty, “Flower identification and classification using efficient deep learning,” 2020.
[11] S. Giri, “Image-based flower recognition using CNN,” 2019.