

# A Study on Flower Classification Using Deep Learning Techniques

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**Abstract:-** A vital component of the ecological order, the flower is one of the plant's organs. There are various applications for flowers that are advantageous to people. Flowers today come in more than 400000 different types. Due to the similarities in shape and color of different flower types, it is challenging to distinguish them from one another. The wide variety of shapes, the distribution of colors, the lighting, and the distortion of exposure make flower classification a difficult challenge. With some photos, it gets harder for the human eye to distinguish between flowers that are similar in color and shape. For picture recognition and classification issues, deep learning algorithms are frequently used. Deep learning architectures have been improved throughout time to include more layers and create more reliable models for categorization issues. Researchers recently used CNN models to solve a variety of classification issues, doing away with the necessity for manual elements of classification. In this study, Deep CNN-based traditional artificial neural networks are used for image classification and identification of flower species. Popular pre-trained learning techniques such as VGG19, RCNN, Fast R-CNN, GoogleNet, and ResNet are conducted to classify flower species.

**Keywords:** Deep convolutional neural network (DCNN), Region-based convolutional neural network(R-CNN's), Fast Region-based convolutional neural network (Fast R-CNN's), Visual Geometric Group (VGG19), Residual Neural Network(Resnet).

## 1. Introduction

Floriculture there are different kinds of flowers. They are used for various purposes like feeding insects, making medicines and beauty products, and also adding flavor to food items, etc. One of the dominant approaches for classification tasks is Deep Learning. It falls under the category of Artificial Intelligence. The fundamental task of image classification is to make sure all the images are categorized according to their groups. When compared to human cognitive ability, it is difficult for machines to

classify images based on vision. The Deep Learning model takes in input the image and gives the output the corresponding flower name. Additionally, it provides those with little prior knowledge of the flower species, and also the ability to recognize the flowers faster and save time and effort. Recently, Floriculture has made it important to classify different types of newly grown flowers to be recognized and present to the outside world [1].

Data has grown massively as a result of technological, tool, and product advancements. The purpose of the

information is to extract insights and meaning from data using various approaches, one of which is Deep Learning, in which data is generalized from different sets of examples. The development of algorithms for complex patterns and prediction problems based on the brain is one approach used in the use of ANN. The convolutional neural network is a widely used, efficient recognition algorithm that aids in the identification, detection, and classification of objects/entities in a given field. With sample generalization in mind, CNN algorithm approaches are designed/implemented with many features such as simple structure, fewer training parameters, and so on. R-CNN and Fast CNN are two approaches/methods to consider when using CNN. For the task of detecting/identifying flower species, these approaches were found to be highly accurate and capable of outperforming selective approaches/methods.

The algorithm takes an image file as the input and uses deep convolutional neural networks (CNNs) to predict the labels of the flowers. The dataset contains five types of classes. They are categorized into 5 groups: daisy/ dandelion/ rose/ sunflower/ tulip.

## 2. Related Work

In image classification problems, deep learning methods are frequently used. For classification problems in the early years, researchers used the SVM method, the Random Forest method, k-nearest neighbours etc, and many other machine learning methods. In the meantime, neural networks can help with image classification. Alex et al. proposed the concept of deep convolutional neural networks in an ImageNet competition called AlexNet in 2012. Karen et al. then built very deep convolutional networks, known as VGGs, for the ImageNet challenge 2014, using 16-19 weight layers, and came in first place. Deeper layers, on the other hand, cause much more loss on top layers and are much more difficult to train. In 2016, Kaiming et al. won the ImageNet challenge with their deep residual neural network, ResNet, which keeps track of the residual of each layer, allowing them to add more training layers. In 2017, instead of using the layer preceding the current layer as a residual, Gao et al. connected every layer and proposed densely connected neural networks known as DenseNet, winning the CVPR 2017 best paper award. In this study deep learning methods including Deep convolutional neural network, VGGNet, RCNN, Fast R-CNN, GoogleNet, and ResNet to classify images of flowers [6].

In this study, we compared all classifications and identification techniques. So, here we are using Deep Learning classification methods for classifying and identifying the flower images. Deep learning methods give more accurate results than the other classification methods.

## 3. Literature Survey

A literature survey is used for the analysis of different papers proposed by different authors/researchers. The literature survey analysis is used to improve the study perspective and clarity of the research topic. The evaluation of the study should be written in such a way the extension of the recommendation in the sector may be shown analytically.

### FLOWER CLASSIFICATION USING DEEP LEARNING MODELS

In this paper, the classification of the dataset with 5 categories. The Visual Geometric Group (VGG16) model is used for different classification problems. The accuracy of the above model is 95% [1]. (Dr Shantala Giraddi et al., 2020).

### FLOWER IMAGE CLASSIFICATION USING DEEP CONVOLUTIONAL NEURAL NETWORK

In this paper, The classification of 102 species of flower dataset. The transfer learning approach Dens Net is more accurate than the other methods. The dataset is classified into three parts, they are train, validate, and testing parts. They get higher accuracy of 98.6% by using the DensNet classification method in Deep Learning [2]. (Neda Alipour et al., 2021).

### FLOWER CLASSIFICATION WITH DEEP CNN AND MACHINE LEARNING ALGORITHMS

In this paper, they primarily focus on three fields: classification method to cultivate the performance of Deep CNN flower image classification and various Machine Learning methods for classifying purposes. They demonstrate image augmentation to achieve better performance results. At Last, they compare the performance results of all algorithms in machine learning. This paper uses two datasets for classification and validation: oxford 17 and oxford 102. The Support Vector Machine (SVM) technique gets more accurate results than others. The 102 flower species dataset contains 98.5% and 17 flower dataset contains 99.8%. The 17 flower species dataset gets the best accuracy than 102 flower species dataset [3]. (Busra Rumeysa Mete et al., 2019).

### A COMPREHENSIVE ANALYSIS OF DEEP LEARNING TECHNIQUES FOR RECOGNITION OF FLOWER SPECIES

Deep Learning algorithms are used in this paper to recognize flower species. The dataset includes five different types of classes for categorization. To supplement the trained set and avoid over fitting, Tensor Flow model and images

data generators are used. The sequential model has the highest accuracy of 85%. [4]. (R. Shiva Shankar et al., 2021).

#### AN OPTIMIZED DEEP LEARNING MODEL FOR FLOWER CLASSIFICATION USING NAS-FPN AND FASTER R-CNN

In this paper, they used a D-CNN based on NAS-FPN to detect flower objects, and a faster R-CNN is proposed. Localization and classification are terms that are used interchangeably. Using the transfer learning method, various pre-training models are used to train and evaluate on the 30 species of flower and 102 species of flower datasets, which contain 19700 flower images. The results show that when combined with the transfer learning approach, the models are NAS-FPN with faster R-CNN method achieves an optimum score of 87.6% on with 102 species of flower datasets and the 96.2% on 30 species of flower datasets [5]. (Isha Patel et al., 2020).

#### IRIS FLOWER CLASSIFICATION USING MACHINE LEARNING

The classification of the IRIS dataset is discovered in this paper among the patterns detected by examining the petal and sepal size of the IRIS flower. In this paper, they proposed method for IRIS flower classification is discussed using machine learning models are SVM, k-means nearest neighbor, and others. These techniques are employed in image classification and identification systems [6]. (T. Srinivas Rao et al., 2021).

#### FLOWER CLASSIFICATION VIA CONVOLUTIONAL NEURAL NETWORK

In this paper, they discuss the issues of natural flowers identification and classifications. The non-similarity of deformation, lighting conditions, and similarity's make it is difficult task. They generate a large flower dataset of 79 flowers species of images and they propose a solution frame work based on the Convolutional Neural Networks (CNN). On their difficult flower dataset, the method achieves 76.54% accuracy for classification. Also, apply our method to the 102 species of flower dataset. It outperforms the previous techniques with an accuracy of 84.02%. Experiment outcomes on a known dataset, as well as our datasets show that our model is to give more effective in flower classification species [8]. (Yuanyuan Liu et al., 2016).

## 4. Survey Analysis

Table 1: Survey on Flower Classification Using Deep Learning Techniques

S.NO	TITLE	METHOD/DATA SET	ACCURACY ACHIEVED	DESCRIPTION
1.	Flower Classification Using Deep Learning Models	<ul style="list-style-type: none"> <li>Visual Geometric Group (VGG16).</li> <li>Convolutional Neural Network (CNN).</li> </ul>	<ul style="list-style-type: none"> <li>VGG 16 – 97.67%.</li> <li>CNN – 75.46%.</li> </ul>	The classification on the dataset with 5 categories. The Visual Geometric Group (VGG16) model is used for different classification problems. The accuracy of the above model is 95% [1].
2.	Flower Image Classification Using Deep Convolutional Neural Network	<ul style="list-style-type: none"> <li>Deep Convolutional Network.</li> <li>Densely Connected Convolutional Networks</li> </ul>	<ul style="list-style-type: none"> <li>DCNN – 98.6%.</li> </ul>	The classification of 102 species of flower dataset. The transfer learning approach DensNet is more accurate than the other methods. The dataset is classified into the train, validate, and testing parts. They get higher accuracy of 98.6% by using the DensNet classification method in Deep Learning [2].

		(DensNet).		
3.	Flower Classification With Deep CNN And Machine Learning Algorithms	<ul style="list-style-type: none"> <li>Deep convolutional neural network (Deep -CNN).</li> <li>Machine Learning methods.</li> </ul>	<ul style="list-style-type: none"> <li>The 17 flower species 99.8%.</li> <li>The 102 flower species 99.6%.</li> </ul>	The Support Vector Machine (SVM) algorithm gets more accurate results than others. The 102 species of flower dataset contains 98.5% and 17 species of flower dataset contains 99.8%. the 17 species of flower dataset gets the best accuracy than 102 species of flower dataset [3].
4.	A Comprehensive Analysis Of Deep Learning Techniques For Recognition of Flower Species	<ul style="list-style-type: none"> <li>Deep Learning methods.</li> <li>Tensor Flow.</li> </ul>	<ul style="list-style-type: none"> <li>Inception v3 – 83.3%.</li> <li>VGG 16 – 81.0%.</li> <li>Scequential model – 85%.</li> </ul>	Deep Learning algorithms are used for flower species recognition. The dataset contains 5 types of classes for categorization. To supplement the trained set and avoid the over fitting, Tensor Flows and Images data generators are used. The sequential model has the highest accuracy of 85% [4].
5.	An Optimized Deep Learning Model For Flower Classification Using NAS-FPN And Faster RCNN	<ul style="list-style-type: none"> <li>Using transfer learning method.</li> <li>DCNN based on NAS-FPN and faster R-CNN for image detect, image localization and image classification.</li> </ul>	<ul style="list-style-type: none"> <li>Transfer Learning – 96.2%.</li> </ul>	The flower dataset divided into two one having so flower classes and 102 flower classes NAS-FPN and Faster R-CNN's with the image identification objects. The multi-table classification method is designed to provide information about a flowers that can assist farmers and non-botanical individuals in identifying the flowers class [5].
6.	Iris Flower Classification Using Machine Learning	<ul style="list-style-type: none"> <li>Machine Learning methods.</li> </ul>	<ul style="list-style-type: none"> <li>SVM – 97.37%.</li> </ul>	The classification of the IRIS dataset is discovered while examining the petal and sepal size of the IRIS flower. In this paper, their proposed model for IRIS flower classification is discussed using methods are support vector machine, K-means Nearest neighbor, and others in machine learning. These algorithms are employed in image classification and identification systems [6].

7.	Flower Classification via Convolutional Neural Network	<ul style="list-style-type: none"> <li>Convolutional Neural Network</li> </ul>	<ul style="list-style-type: none"> <li>CNN – 70.12%</li> <li>Ours – 76.54%</li> </ul>	They are concerned with the classification of natural flowers. Because of the non-features of flower deformation, lighting changes, and similarity, it is a difficult task. They create a dataset contains 79 flower images and they propose a solution frame work based on a convolutional neural network (CNN). On our difficult flower dataset, the method achieves accuracy 76.54% for classification of flower species. Run our algorithm on the 102 Flowers species dataset as well. The accuracy of 84.02%, it outperforms previous known methods [8].
8.	An efficient classification of flower images with convolutional neural network algorithm.	<ul style="list-style-type: none"> <li>Deep Learning techniques.</li> <li>CNN for image classification.</li> </ul>	<ul style="list-style-type: none"> <li>Deep Learning techniques – 97.7%</li> </ul>	In this, the classification data set is divided in to four parts to improve speed of CNN, and also it is used for different kinds of images classification and identification for easy validation and testing techniques. The accuracy achieved by Deep Learning techniques are 97.7% [9].
9.	Flower categorization using Deep Convolutional Neural Network model.	<ul style="list-style-type: none"> <li>Deep Learning used for image separable and classification.</li> </ul>	<ul style="list-style-type: none"> <li>AlexNet – 68.8%</li> <li>GoogleNet – 69.7%</li> </ul>	In this paper, they done comparison between to models for high classification accuracy. The GoogleNet is better than the AlexNet based on their accuracy of image classification and identification. The GoogleNet contains 69.7% accuracy and the AlexNet contains 68.8% accuracy [10].

## 5. Observations

The study of various methodologies provides information about the various scenarios in which flower species are classified and identified. Here, flower species are separated based on attributes such as color, shape, type, location, temperature conditions, and so on, and feature selection is used. The CNN (Convolutional Neural network) allows us to classify images but not identify multiple objects. Deep Learning algorithms such as VGG16 (visual geometric

group), R-CNN's (Region-Based Convolutional Neural Networks), and Fast R-CNN's can be used for identify the multiple objects within a single frame (Fast Region-Based Convolutional Neural Networkss), Multiple object identification is possible using R-CNN approaches; however, the performance of the identification is hampered due to the methods' reliance on multiple layers of the processing; additionally, for some of the methods, data is parsed multiple times for identification purposes [7].

## 6. Conclusion

Flowers are classified using various methods, including intrinsic and non-intrinsic approaches. The intrinsic approach employs a dedicated system to detect the flower species and its properties, whereas the non-intrinsic approach employs a less reliant system and relies more on software. The survey revealed the various techniques employed, their advantages and disadvantages, and the reasons for the efficacy of various approaches. The survey mentioned above can provide useful insight and direction for the approaches used. Observed how different researchers, using different methods, outperformed others by evolving techniques and understanding different scenarios. Deep Learning algorithms will become more useful for various classification and detection problems as computational power increases. According to the papers discussed, there is room for improvement in flower classification capability and techniques.

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