Tree Species Identification Using Machine Learning Algorithm (CNN)

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Abstract- *Tree species identification is crucial for forest management. From the perspective of plant taxonomy, leaves, flowers, roots, and fruits all carry important information to distinguish different species. Roots, however, are buried in the ground and not easy to obtain. When the leaf image is uploaded to PC and then its essential features are identified and recorded using image processing methods. Feature extraction is a critical stage because the ability of a system to discriminate various types of leaves depends on the features extracted. The features have to be stable in order to make the identification system robust. Subsequently the plant leaf is recognized using techniques of machine learning.We will provide an effective approach to automatically identify tree species convolutional neural network(CNN) .The convolutional neural network is a widely-used classifier, and provides an alternative for the traditional image recognition approach.*

The work will identifies tree species by analyzing tree leaves, which have multi-dimensional features such as color, shape, and leaf vein signatures. Since it is difficult to find a single leaf feature to accurately identify tree species, convolutional neural networks are employed to integrate multi-dimensional leaf features

Keywords- tree species identification; machine learning techniques;classification; Convolutional Neural Network (CNN).

I. INTRODUCTION

On earth have different type of plant species.Now a day it is important to identify the correctly and quickly plant species in order to understand, manage and archive them before it's too late. However, correctly identifying plant species requires expert knowledge only botanists can provide.Due to the limited number of botanists,it is necessary to acquire some of their knowledge and automate the recognition process..Many times people doesn't know the tree and its value. Using identification of tree species from image we can easily identify tree name and importance of that tree. leaf can be classified according to there future(shapes, colours, textures and structures)due to the rapid development in computer technologies, there are now opportunities to improve the ability of leaf speciesidentificatioon[2]

A. Motivation

Tree species classification is significant for a lifetime forest ecosystem. It is important in sustainable forest management. In forest have a lot of tree but workers can not identify each and every tree, some tree have a high value in market. also some tree is used as medicine but unfortunately these tree cut it. So we want to save that tree.

Identification of tree species is taught to students in the elementary and in the secondary school. And also Normal human can not recognizes each and every trees.

Some tree leafs are same so identification of that trees are so difficult.

B. Need

We want to identify of trees easily. Many times forest worker doesn't know the tree and its value. Using identification of tree species from image we can easily identify tree name and importance of that tree.

Now a day only expertise identify the medicine tree but using this system Normal human identify also identify medicine and other system.

C .Objective

- To collect Data, since the photos are taken with any device the system has to deal with image resolution which can vary from model to model. Furthermore due to different lighting conditions during the moment of the photo taking and different specifications of the cameras the color can differ.
- To Study and analyze different algorithms used for tree identification and classification.

- Investigate and implement the algorithm which will identify the tree species with image processing and convolutional neural network algorithm.

II. LITERATURE REVIEW

Sr no	Author	Paper Title	Publisher	Dataset	Methodology	Drawbacks
1	Hong Zhau	Tree Species Identification Based on Convolutional Neural Networks	IEEE, pp.103-106, 2016	Leafsnap	Convolutional Neural Networks	Based on only 25 tree species from leafsnap dataset
2	Abdul Kadir	Leaf Identification Using Fourier Descriptors and Other Shape Features,	gtCVPR, vol. 1, pp.3-7, 2015	Medical herbal leaves	Feature Extraction :- Fourier Descriptors Classification :- Bayes Classifier	This accuracy is 80.03%when compared to other feature extraction methods. In future work, it adds with margin feature and other feature to increase.
3	Valliammal Narayan	An Optimal Feature Subset Selection Using GA for Leaf Classification	IAJIT, Vol. 11, pp.447.451, 2014	-	Feature Extraction :- Genetic Algorithm Classification :- SVM, K-Nearest Neighbor Classifier	
4	Hong Fang, Huijie Li	Plant Leaves Recognition and Classification Model Based on Image Features and Neural Network	IJCSI, Vol. 11, pp.100-104, 2014	Dracaena sanderiana	Feature Extraction :-HU invariant Classification :- BP neural network	The HU invariant moment is not a total portrayal of the sorts of leaf features, on the grounds that various types of plants have colossal distinctive attributive Characteristics.
5	Abdul Kadir	A Model of Plant Identification System Using GLCM, Lacunarity And Shen Features	RJPBCS, Vol. 5(2), pp. 1-10, 2014.	Flavia dataset, Foliage dataset	Bayesian classifier	Some experiments are still needed to combine GLCM, lacunarity and Shen features in order to improve the performance
6	AnantBhardwaj	Recognition of plants by Leaf Image using Moment Invariant and Texture Analysis	IJIAS Volume 3, pp. 237-248, 2013		Feature Extraction:- GLCM	GLCM is very much sensitive to the changes in the image. 14 different classes of leaves were identified using this method

7	Mythili.C and Dr.V.Kavitha,	Recognition of Plant Leaf in Medicine	JCIT Volume 9, Issue 2, pp.61-69, 2014.	Flavia dataset	Feature Extraction:- ERKFCM Classification : SVM	consists of 1907 color leaf images of 33 plants, where each species has 40 to 60 leaf image samples.
8	E. Sandeep Kumar and Viswanath T alasila,	Leaf Features Based Approach for Automated Identification of Medicinal Plants	IEEE, pp. 210-214, 2014.	Medicine dataset	Classification : SVM PNN	80.55% accurate system
9	ZalikhaZulkifli,	Plant Leaf Identification Using Moment Invariants &General Regression Neural Network	IEEE pp. 430-435, 2011.		Feature Extraction:- LMI,TMI,ZMI Classification:- GRNN	The number of images used is less which has resulted in over-fitting of GRNN giving 100% classification accuracy.

III. METHODOLOGY

A. Dataset

For our algorithm we used leafsnap dataset. This dataset contains 184 different tree leafs images. This images are not taken at the same time or with same condition. Below figure shows dataset sample. We are using some tree species from the dataset to validate our algorithm.[1].

Figure 1 samples of Leafsnapdataset[1]

B. **Convolutional neural networks model:**

i. Convolution
ii. ReLU Layer
iii. Pooling
iv. Fully Connected

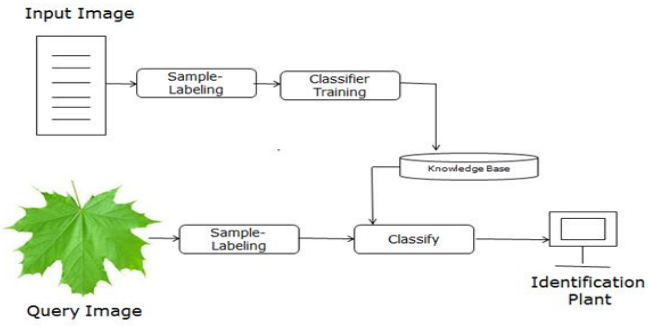

Figure 2.architectureofTree Species Identification Using Convolutional Neural Networks

- **INPUT [32x32x3]** will hold the raw pixel values of the image, in this case an image of width 32, height 32, and with three channels R,G,B.
- **CONV layer** will compute the output of neurons that are connected to local regions in the input, each computing a dot product between their weights and a small region they are connected to in the input volume. This may result in volume such as [32x32x12] if we decided to use 12 filters.
-

$\sum$ *Input feature* $*$ *Training image*

Σ *each pixel* / total number of pixel

- **RELU layer** will apply an elementwise activation function, max(0,x). This leaves the size of the volume unchanged ([32x32x12]).

$$\text{Activate Function } f(x) = \begin{cases} 0 \; if \; x < 0 \\ x \; if \; x >= 0 \end{cases}$$

- **POOL layer** will perform a down-sampling along the spatial dimensions (width, height), resulting in volume such as [16x16x12].

- **FC (i.e. fully-connected) layer** will compute the class scores, resulting in volume of size [1x1x10], where each of the 10 numbers correspond to a class score, such as among the 10 categories of CIFAR-10. Each neuron in this layer will be connected to all the numbers in the previous volume.

- Pros and Cons of Classifiers:

Convolutional Neural Network:-

Pros-

1. Gives higher accuracy as 95% in image reorganization.
2. CNN are more useful in large dataset, large number of features and complex classification task.
3. Training of data again and again is not essential.
4. For Crop Disease application those contain noise in date still gives better results.
5. Low error rate.
6. CNN is designed to work better in image dada.

Cons-

1. High Complexity.
2. CNN require more training data.
3. Because of Complex Structure More powerful hardware require.

IV. RESULTS

Performance Analysis Of classifiers:-

Table 2-Performance of classifier

No. of leaf Images for Training	Accuracy	loss
50	69%	141%
100	83%	70%
200	89%	40%
500	94%	15%
1000	95%	8%

Classification analysis accuracy

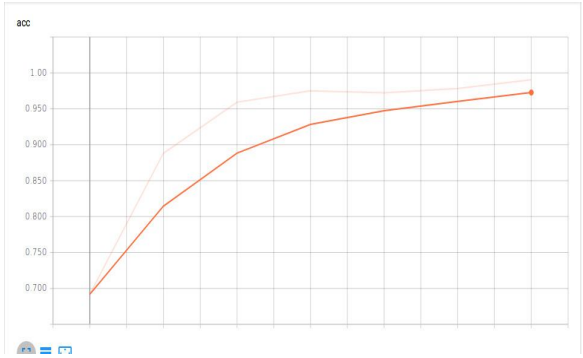

Figure3. Classifier Analysis accuracy

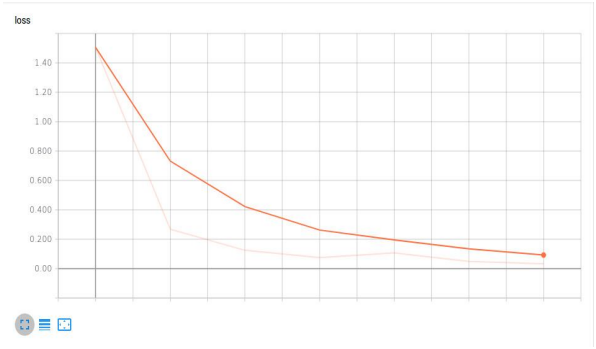

Figure3. Classifier Analysis loss

Table 3-Evaluation of classifier

No. of trained Images	No. of tested Images	Correctly classified	Misclassified	Accuracy
1000	50	48	4	92%
1000	100	96	5	92%
1000	200	192	10	95%
1000	500	480	22	95.6%
1000	1000	960	45	95.6%

Analysis of Classifiers:

It can be easily represent Convolutional Neural Network achieve highest accuracy (95.6%).Convolutional Neural Network gives balanced classification.

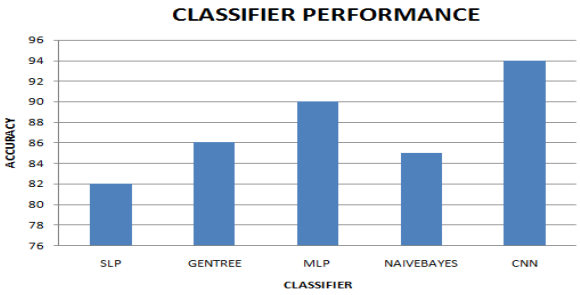

Fig. 5 Classifier Performance

V. CONCLUSION

Using the image processing and machine learning we identify leaf species and classification using Convolutional neural networks(CNN). CNNs are designed to work with image data.CNN are mostly useful very large dataset, large number of feature and complex classification task.In our project we took a large dataset that's why we used Convolutional neural networks(CNN)and its give a better result than other machine learning and classification algorithm. The traditional system was only detect leaf and identify that tree.But in our system we identify that tree and give some information about that tree. In this project we got a 95.6% accuracy.

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