J. Banzi and T. Abayo in their research paper have implemented a CNN with integration of LSTM on top. The proposed CNN technique has been applied to classify 100 plant species with several state-of-the-art model architecture. The author attained 95.06% success rate in identifying the plant species. They also mentioned the resultant of CNN-LSTM model accuracy are far better than normal CNN model. The author has concluded their paper by discussing how it can be expanded to support and integrated plant species identification system to operate in real ecosystem services.

Sk Mahmudal Hassan in their research paper have proposed a novel depth=separable convolution neural network which in low in computation cost as compared to standard Convolution neural network model which require a large number of parameters and higher computation cost. Author used four different deep learning models (Inception V3, InceptionResnetV2, MobileNetV2 and EfficientNetB0) for the detection of plant diseases. Author achieved best accuracy of 99.56% in EfficientNetB0 model and the MobileNetV2 architecture is an optimized deep convolution neural network that limits the parameter number and operations as much as possible. The author concluded their paper by comparison of other deep learning approaches to their implemented deep learning models which has better predictive ability in terms of both accuracy and loss.

‘Skanda H N in their research paper they propose 2 methods for plant identification. First one is leaves can be identifies using digital fingerprint, by scanning the leaf by lasers different depth points can be marked and connected to form an image which can be plotted against a graph. The area enclosed by graph from the unique digital fingerprint of the leaf which can be used to recognize the plant. The second one is Leaf recognition can be done by tracing its outline on a digital screen such as a camera. The author has concluded their paper by discussing the challenges and future scope for plant identification.

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390,000 [3] in number, and each year, new species are

reported in different parts of the world [4]. Plants are very

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identifying the plants correctly is out of reach of an ordinary person as it requires specialized knowledge and only the experts of botanical background are able to pull off this task. Moreover, even botanists do not have knowledge of all the existing plants in this world for there is an unlimited number of plant species. Hence the task of plant identification is limited to a very small number of people. However, plant species knowledge is necessary for various purpose such as identifying a new or rare species, balancing of the ecosystem, medicinal purpose, agricultural industry, etc. To be able to achieve these objectives, automation of plant species identification is a necessity. There are enormous plant species in the world, which is nearly 390,000 in numbers, and each year, new species are reported in different parts of the world. Plants are very different from one another hence requiring in depth taxonomic knowledge to identify and assign them to a particular species. Many activities such as studying the flora of a particular area, investigation of the endangered species, discovering new plant species depends profoundly upon precise and accurate identification skills. With this, the need for automated identification of plant species is increasing but unfortunately, the number of plant systematics experts are limited.

Introduction

Problem definition

The diversity of plant species plays a very important role in various areas such as foodstuff, medical science, industrial growth, and environment protection. Many productive activities of all human beings depend on plants as it provides a lot of food and some necessaries. It also helps to maintain the balance of carbon dioxide and oxygen in the atmosphere. It is estimated that more than half of the world's medicines come from natural plant synthesis, and 1/4 of them are extracted directly from plants or plants are the sole raw materials. To this end, plants are of central importance to natural resources conservation. Plant species identification provides significance information about the categorisation of plants and its characteristics.

However, manual interpretation is not precise since it involves individual's visual perception. Sampling and capturing digital leaf images are convenient which involves texture features that help in determining a specific pattern. The most important feature to distinguish among plant species are venation and shape of a leaf.

Project overview

This project aims at accurate and effective development of an application that helps people to identify plant species using simples plant leaves image without begin concerned about the knowledge of botany (study of plants). This application will help us to identification of new or rare plant species to improve the balance in the ecosystem. We are going to implement these by building our own CNN model on 184 distinct classes of plant species containing 7744 plant species images. The deep learning model with conventional neural network is going to be implemented using Tensorflow and will be used in the application using an API.

Software specification

The following software specification are required for the successful completion of the proposed project:

Python 3.7 or higher

Jupyter/Colab Notebook

Numpy, Scikit-Learn, Deep Learning and other machine learning libraries

TensorFlow/Keras deep learning framework

Flask web development framework

VSCode code editor for editor for editing the python script

Hardware Specification

A minimum of 8GB RAM and GPU with at least 2GB VRAM

A minimum of 20GB hard drive space

Internet connection for accessing online GPU such as Kaggle or Google Colab