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Mobile Based Ayurvedic Leaf Detection and Retrieving Its Medicinal Properties Using Deep Learning and NLP

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Abstract: The Indian ancient medical system AYURVEDA provides treatment to multiple diseases traditionally by using the parts of various medicinal plants which reduces the cost and side effects of Allopathy medicines. The Botanical Survey of India declared that India has around 8000 species of medicinal plants. Identifying the parts of the medicinal plants help the pharmaceutical industries and healthcare professionals for producing good medicines. This paper proposes a mobile based application to detect ayurvedic leaves and retrieving its medicinal properties using deep learning and NLP. The proposed application uses IneptionV3 for training and testing the images of 75 Indian medicinal species leaves in which each medicinal species consists of 1000 images makes a dataset of 75000 images. The model got an F1 accuracy of 95% and deployed in cloud so that it can be accessed anywhere. The application is integrated with ChatGPT to retrieve the medicinal properties of the detected leaves and has the facility to translate and listen the retrieved medicinal properties in English, Telugu, and Sanskrit.

Keywords: *Ayurveda, Medicinal Plants, Deep Learning, Image Processing, Inception V3, Flutter, ChatGPT, Translator Module*

1. Introduction

The word Ayurveda means life science [1]. Indian medical council starts the setup for Ayurveda practice from 1971 which promotes the importance for traditional Ayurveda practices such as Unani, Siddha and Ayurveda [2]. The large amount of Indian population uses ayurvedic medicines exclusively or along with modern medicines. As Ayurveda medicine do not have high profile drugs which are not dangerous to the internal parts of the body and the sources of Ayurveda such as roots, leaves and fruits are included in synthetic drug then the chances for the side effects will be reduced.

Ayurveda medicinal plants information need to convert-ed as digital data and need to be stored in databases will help advanced technologies such as Artificial Intelligence and Natural language pro-cessing to use it efficiently in synthetic drug design and precision medicine. Identification of medical leaves or ayurvedic leaves is a key factor for Ayurveda drugs. Any wrong identification will create unnecessary health is-sues to patients.

This paper proposes a deep learning-based flutter mobile app to identify Indian ayurvedic leaf and uses a dataset having 75 classes with 80 images per class. The model produces a train accuracy of 99% and test accuracy of 95%. The app can find the information about the identified leaf from ChatGPT and translate English into Sanskrit and Telugu and also provides the functionality to listen to the audio of the Sanskrit and Telugu translation. The paper is organized as follows:

Section 2 discusses the related word, Section 3 discusses the dataset and the proposed model, Section 4 explains identified leaf information retrieves in English and con-version of text to speech, translation from English to Sanskrit and Telugu and the audio facility to listen to the translated information.

2. Literature Survey

Xiaoyue Xie et al [3] proposed De-IACmr – a Deep learning model to identify grape leaf disease detection. Model represents double – RPN (Regional Proposal Network) with inception module and attention structure. They trained 4449 images of grape leaf diseases dataset (GLDD) for four dis-ease categories. The DR – IACmr identify disease spot in the grape leaf which sees the losses in grape industry. The model uses image processing technique to augment the data by equipment fac-tors are imitated by Gaussian noise. PCA jittering [4] is used to simulate real environment for data acquisition. Total 14 number of augmentations is applied and the dataset is increased 14 times and produces 81% accuracy. Andrew J et al [5] and Sharada Prasanna Mohanty [6] applied DenseNet 121 [7] GoogleNet [8] deep learning model to detect plant diseases and crops which improve food production quality and reduces economic losses in

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agriculture sector. The model is trained and tested on plant dataset [9] having 54,305 images of 38 classes for various plant disease species and DenseNet produced 95% accuracy and GoogleNet produces 98% accuracy. Roopashree et al [10] discuss about the traditional Indian herb's classification can be a better alternative to the cost and side effects of mod-ern synthetic medicine. They applied scale invariant feature transformation (SIFT) [11] with various machine learning classification of Indian herbs. They used their custom dataset as well as Flavia dataset [12] for Indian herbs classification and model attained an impressive accuracy of 94%. Chittabarni Sarkar et al [13] summarized existing machine learning based and deep learning-based classification for leaf disease classification. The summarized that the machine learning based classifiers such as SVM, Random Forest and multiple twin SVM (MTSVM) are best ML approaches for diseased leaf classification as well as CNN, VGG and ResNet are best DL models for disease leaf classification.

Gayathri et al [14] ad-dresses in their research about the challenges of accessing ayurvedic information by leveraging ontology and semantic web technologies. It includes data pre-processing ontology construction, concept extraction and KNN based classification to enhance the under-standing and accessibility of ayurvedic knowledge.

ChatGPT, an OpenAI product, is a large multimodal which produces answers as text for any prompts in the form of text. GPT-3.5 possesses the infrastructure and optimized algorithms to predict the answers for the que-ry. GPT-3.5 outperforms then other traditional NLP such as MMLU [15]. GPT-3.5 per-forms well on 24 of 26 languages other than English [[16], [17]].

Text – to – speech (TTS) technology accepts the text as input and generates voice speech synthesis as output. The main quality of TTS is, it should resemble human voice and good levels of understanding. Various technologies such as speech ap-plication programming inter-face (SAPI) and java speech API (JSAPI) are used in voice speech synthesis. The database of sounds for each word, human experts on notation and domain specific knowledge makes involvement of AI algorithms such as RNN based models like Tacotron series [18], CNN based models like Deep voice series [19] and trans-former-based models like Fastspeech series [20] in voice/speech synthesis [[21], [22]].

The main limitation from the existing literature is, there are no adequate datasets available publicly for Indian ayurvedic medicine which affects the involvement of AI models and ad-vanced research on Indian Ayurvedic medicine.

3. Proposed Work

The proposed model uses MepcoTropic leaf ayurvedic dataset [[23], [24]] for the identification of medical plants. The dataset contains 75 leaf species. Each class of dataset contains of 80

images and the total number of leaf species images are around 6000 images of size 299*299. After augmentation the number of images is in-creased to 72,000 images by applying Horizontal flip, contrast, resize, blur, noise addition, crop, vertical flip, zoom, shear, brightness, af-fine, adaptive equalization for each 75 classes.

The proposed work uses inceptionV3 [25] to predict the medical plants. Incep-tionV3 improves the computation performance of the deep learning network by adding small suitable factorized filters for convolutions, which removes more un wanted parameters and speeds up the training. Incep-tionV3 is having sparsely connected architecture then densely connected architecture. Internal layers of incep-tionV3 selects suitable filters to learn the required features.

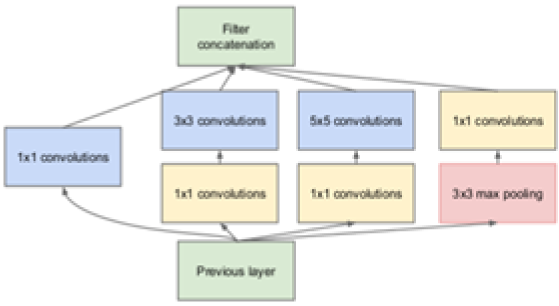

Fig:1 Inception Architecture [26]

The factorized suitable small convolution filters such as 1*1, 3*3 and 5*5 applied separately connected architectures and parallel max pooling makes faster training of the model [26].

The model trains 72,000 labelled images of size 299*299 for 15 epochs and produces training accuracy 99 and testing accuracy 98.

The model prediction shown is fig 1 and fig 2.

Fig 2: Test Results

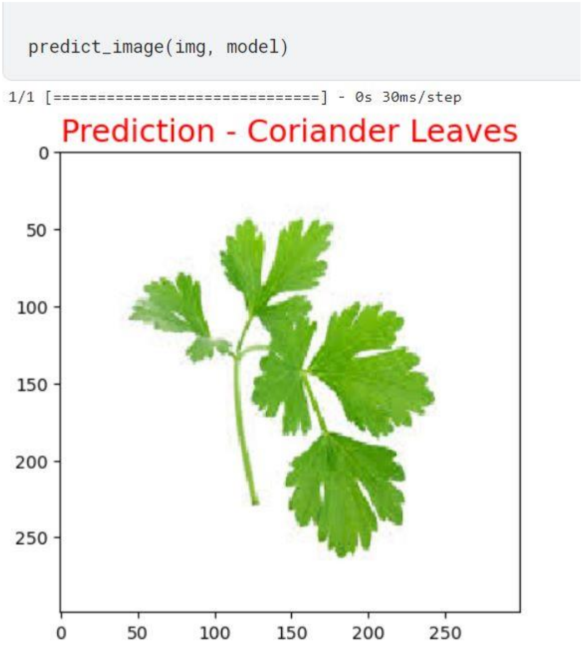

Fig 3: Sample Prediction

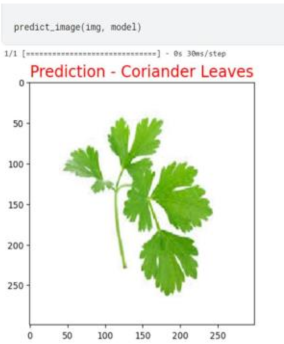

Fig 3: Sample Prediction

The trained model is connected to flutter front end by using flask by establishing a tunnel through a cross platform application leveraging AWS – Ec2 instance [27].

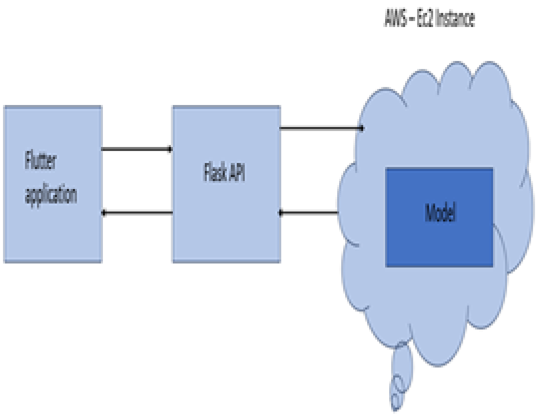

Fig 4: Application Window

The above fig.4 explains the cloud deployment of the flutter application. The mobile application is also connected with ChatGPT which helps to bring the information of identifying species in English. The information of identified medical plants can be translated both into Telegu and Sanskrit using flutter translator module (which internally uses google translator) [28].

Fig 5.1: Prediction results in Telugu

Fig 5.2: Prediction result in English

Fig 5.3: Prediction result in Sanskrit

The above images are the translation of medical plant in

Telugu and Sanskrit. The application also provides an audio option to listen to the medical plant's information in English, Telugu and Sanskrit through Flutter's TTS module [29].

4. Conclusion

In conclusion, our paper on "Mobile-Based Ayurvedic Leaf Detection and Retrieving Its Medicinal Properties Using Deep Learning and NLP" presents a significant advancement in leveraging technology for the identification of medicinal values in plants. The application developed serves as a tool for detecting various medicinal plant parts, providing valuable insights for pharmaceutical industries and healthcare professionals. By utilizing deep learning and natural language processing (NLP), we not only streamline the process of identifying medicinal properties but also contribute to the production of cost-effective and minimally side-effect-prone medicines. The implications of our work extend beyond mere plant detection, opening avenues for sustainable healthcare practices and promoting the integration of traditional medicinal knowledge with modern pharmaceutical approaches. This research holds promise for the continued development of innovative solutions in the realm of plant-based medicine, offering a bridge between traditional Ayurvedic wisdom and contemporary healthcare needs.

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Conflicts of interest

The authors declare no conflicts of interest.