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Deep Learning Based Approaches for Identification of Medicinal Plants

Shrisha H S[1] and Saumya Y M[2]
Department of Computer Science and Engineering[1,2]
St. Joseph Engineering College, Mangaluru, India
shree.1259@gmail.com, saumya2087@gmail.com

Abstract: *The classification and identification of medicinal plants often pose challenges to botanists, chemists, and healthcare professionals due to the sheer diversity of plant species, morphological similarities, and environmental factors. This difficulty can impede research, application in healthcare, and the effective use of medicinal plants in traditional and modern treatments. M-net, as proposed, aims to bridge this gap using a machine learning approach tailored for medicinal plant identification. The core of M-net is the VGG16 convolutional neural network (CNN) architecture, which is renowned for its deep layers and ability to extract rich, hierarchical features from images.*

Keywords: Medicinal plant identification; M-net

I. INTRODUCTION

Since ancient times, medicinal plants have been utilised to cure a wide range of illnesses and conditions. It is essential to select the suitable plant species for the efficient treatment of various ailments as a result of the rising demand for herbal medicine. However, identifying medicinal plants based on their physical characteristics can take a while and requires a lot of knowledge. The interest in creating automated techniques for identifying medicinal plants has increased in response to this difficulty [1]. A potential method for identifying medicinal plants is deep learning, a branch of machine learning that has demonstrated promising results in the fields of image recognition and classification [2].

Since medicinal plants come in a wide variety and may share some morphological characteristics, it can be challenging to precisely identify them [3]. This issue can be solved by creating a system that classifies and identifies therapeutic plants based on their distinctive characteristics using deep learning techniques. Due to human error, information gaps, and subjective interpretations, traditional techniques of identifying medicinal plants based on visual qualities may result in mistakes [4]. The development of precise deep learning models for medicinal plant identification is significantly hampered by the paucity of accessible datasets with annotated photos of medicinal plants [5]. In order to train deep learning models, a sizable dataset of medicinal plants must be compiled. The literature survey suggests that there is a lack of custom datasets for training deep learning networks for identifying medicinal plants. Also, the existing models achieved an accuracy of 92.8%. And many approaches did not use state of the art neural networks. To address these shortcomings M-net and its associated dataset is proposed. M-net is a VGG16 architecture [6] trained on custom collected dataset comprising 3000 samples of medicinal leaves across 10 species of plants. M-net is then integrated to android app to be used for recognizing plant species through images captured through the camera module of the android device (mobile phone). M-net achieved the accuracy of 99.4%, precision value of 99.6%, recall value of 99.5% and F1 Score value of 98.8%.

II. LITERATURE SURVEY

Using a machine learning technique, the study "The Classification of Medicinal Plant Leaves Based on Multispectral and Texture Feature Using Machine Learning Approach" (MLC) [8] successfully classifies medicinal plant leaves with an accuracy of 87.3\%. The Convolution Neural Network (CNN) is trained with the dataset of 600 leaf images from 10 different medicinal plant species. The study highlights how combining multispectral and texture features can lead to accurate classification outcomes. The suggested method exhibits promising outcomes in the classification of medicinal

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plant leaves by utilising these traits. The study promotes improvements in this field by advancing the investigation of machine learning approaches for accurate identification and classification of medicinal plants.

Ayurleaf [9] classifies medicinal plants with 92.5\% accuracy using deep learning technology. A collection of 1,300 leaf pictures covering 12 different medicinal plant species is used for training and evaluation. The study emphasises how CNNs and Support Vector Machine (SVM) are effective in correctly classifying medicinal herbs. AyurLeaf shows promising outcomes in the classification of medicinal plants by utilising the power of CNNs. This research advances deep learning methodologies for the accurate identification and classification of medicinal plants.

With an accuracy of 88.2%, the paper "Automatic Medicinal Plants Classification using Multi-channel Modified Local Gradient Pattern with SVM Classifier" (MM-SVM) [10] suggests a technique for classifying medicinal plants automatically. The study makes use of the dataset of 900 images of leaves from 20 different types of medicinal plants. The study illustrates the efficacy of SVM classifiers in conjunction with multi-channel modified local gradient pattern features for precise classification [11]. This method shows promising outcomes in the automatic classification of medicinal plants, emphasising the possibility of using multi-channel modified local gradient pattern features with SVM classifiers for accurate identification and classification of medicinal plants.

With an accuracy of 85.6%, the study "Identification of Ayurvedic Medicinal Plants by Image Processing of Leaf Samples" (AMC) [12] suggests a way for identifying Ayurvedic medicinal plants. 400 leaf samples from 20 different Ayurvedic medicinal plant species are used in the training and evaluation procedure. The study shows that it is possible to accurately identify Ayurvedic medicinal plants using image processing techniques. This work advances the understanding of image processing techniques as a practical way for precisely classifying and identifying Ayurvedic medicinal plants and exhibiting promising outcomes in this area.

A machine learning approach is used in the study named "Identification of Medicinal Plant Using Machine Learning Approach" (IMP) [13] to identify medicinal plants, with an accuracy rate of 90.2%. 800 leaf photos from 16 different medicinal plant species are used in the training and evaluation procedure. The study demonstrates the potential of machine learning strategies for precisely classifying therapeutic plants. With promising outcomes in this area, this study advances the investigation of machine learning methodologies for accurate identification and classification of medicinal plants.

M-NET Architecture

M-net follows the architecture layers of VGG16 [2]. The input RGB image Ii is resized at 224 x 224 x 3. The coevolution layers of M-net use filters with dimension 3×3 and stride is set to the value 1. A padding of 1 pixel is used for each 3 x3 convolution layer along with spatial pooling of five max pooling layers. Max pooling layers have stride value 2 over an 2×2 pixel window. Three fully connected layers follow the convolution layer stack. Hidden layers use ReLU [4]. The architecture of VGG16 based M-net is shown in Figure 1.

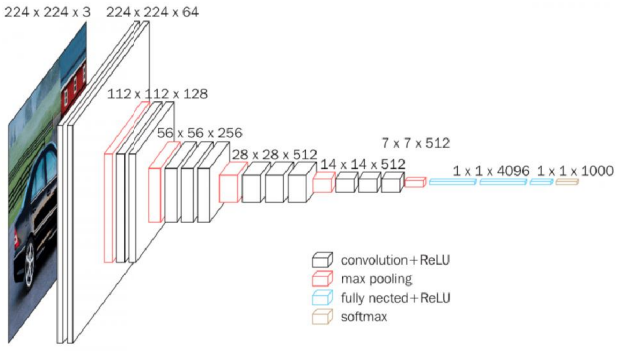

Fig. 1 VGG16 Architecture

III. RESULTS

Figure 2 gives the multi-class confusion matrix for the medicinal plants classification by M-net. The confusion matrix demonstrates 99.4% classification accuracy with respect to the collected dataset. The metric of precision achieves

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99.6% , recall achieves 99.5% and F1 Score achieves 98.8% value. Figure 3 shows that both training (green line) and testing (blue line) reached 99.4% accuracy (X-axis) with respect to the dataset instances which is in conformance with the confusion matrix.

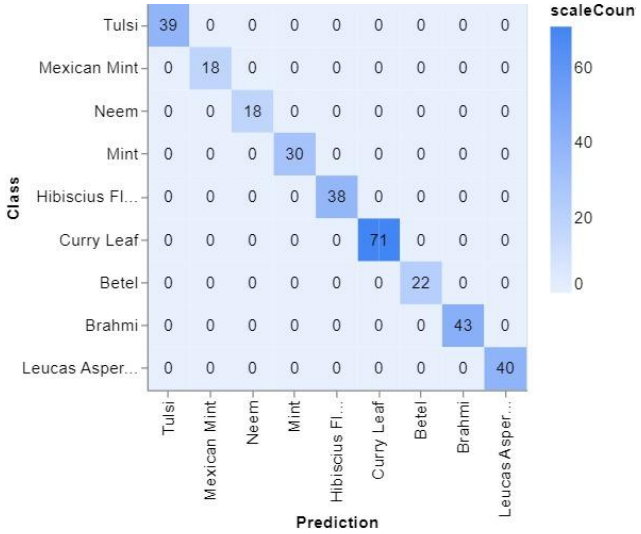

Fig. 2 Confusion Matrix

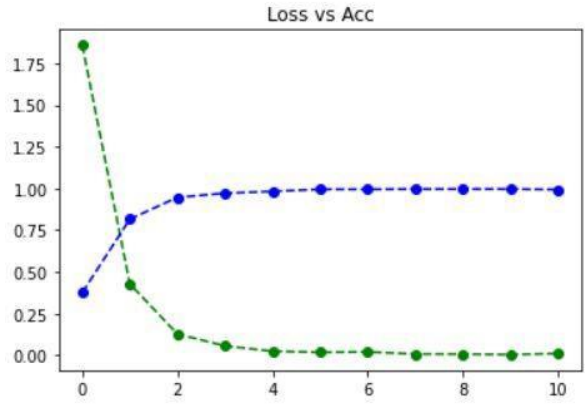

Fig. 3 Loss Vs Accuracy

IV. CONCLUSION

M-net is a custom trained VGG16 model based on the proposed dataset featuring 3000 annotated samples spread over 10 medicinal plant species. The literature survey showed the need for the requirement of new dataset which can provide the deep learning models with better training and accuracy. M-net is evaluated for accuracy (99.4%), precision (99.6%), recall (99.5%) and F1 Score (98.8%). M-net was integrated into android application and was found useful for education purposes. Future work involves expanding the dataset samples and designing state of the art models for medicinal plant species prediction.

REFERENCES

[1] V. Anupama and A. Geetha Kiran, “Extrapolating z-axis data for a 2d image on a single board computer,” in Proceedings of International Conference on Data Science and Applications, M. Saraswat, S. Roy, C. Chowdhury, and A. H. Gandomi, Eds. Singapore: Springer Singapore, 2022, pp. 503–512.

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[2] A. V and A. G. Kiran, "Synthnet: A skip connected depthwise separable neural network for novel view synthesis of solid objects," Results in Engineering, vol. 13, p. 100383, 2022. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S25901230 2000536
[3] A. V and A. G, "Sida-gan: A lightweight generative adversarial network for single image depth approximation," Results in Engineering, vol. 16, p. 100636, 2022. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2590123022003061
[4] A. Gyaneshwar, A. Mishra, U. Chadha, P. M. D. Raj Vincent, V. Rajinikanth, G. Pattukandan Ganapathy, and K. Srinivasan, "A contemporary review on deep learning models for drought prediction," Sustainability, vol. 15, no. 7, 2023. [Online]. Available: https://www.mdpi.com/2071-1050/15/7/6160
[5] S. Saralaya, V. Saralaya, and R. D'Souza, "Cross-layer impact analysis and adaptation of hierarchical service-based applications," Service Oriented Computing and Applications, vol. 14, no. 1, pp. 49–63, Mar 2020. [Online]. Available: https://doi.org/10.1007/s11761-019-00282-w
[6] A. Nagaraja, B. Uma, and R. k. Gunupudi, "Uttama: An intrusion detection system based on feature clustering and feature transformation," Foundations of Science, vol. 25, no. 4, pp. 1049–1075, Dec 2020. [Online]. Available: https://doi.org/10.1007/s10699-019-09589-5
[7] N. Harivinod and B. H. Shekar, "A bimodal biometric system using palmprint and face modality," in Data Analytics and Learning, P. Nagabhushan, D. S. Guru, B. H. Shekar, and Y. H. S. Kumar, Eds. Singapore: Springer Singapore, 2019, pp. 197–206.
[8] K. Simonyan and A. Zisserman, "Very deep convolutional networks for large-scale image recognition," in International Conference on Learning Representations, 2015.
[9] S. Roopashree and J. Anitha, "Deepherb: A vision based system for medicinal plants using xception features," IEEE Access, vol. 9, pp. 135 927–135 941, 2021.
[10] S. Naeem, A. Ali, C. Chesneau, M. H. Tahir, F. Jamal, R. A. K. Sherwani, and M. Ul Hassan, "The classification of medicinal plant leaves based on multispectral and texture feature using machine learning approach," Agronomy, vol. 11, no. 2, 2021. [Online]. Available: https://www.mdpi.com/2073-4395/11/2/263
[11] M. Dileep and P. Pournami, "Ayurleaf: A deep learning approach for classification of medicinal plants," in TENCON 2019 - 2019 IEEE Region 10 Conference (TENCON), 2019, pp. 321–325.
[12] U. Habiba, M. R. Howlader, M. A. Islam, R. H. Faisal, and M. M. Rahman, "Automatic medicinal plants classification using multi-channel modified local gradient pattern with svm classifier," in 2019 Joint 8th International Conference on Informatics, Electronics Vision (ICIEV) and 2019 3rd International Conference on Imaging, Vision Pattern Recognition (icIVPR), 2019, pp. 6–11.
[13] J. Ananda Babu, K. S. Keerthi, R. M. Tejonidhi, S. Sangeetha, and R. Kumar, "Eye blink to speech conversion for paralyzed (mnd) patients using ml based algorithm," in 2022 IEEE International Conference on Data Science and Information System (ICDSIS), 2022, pp. 1–6.
[14] P. M. Kumar, C. M. Surya, and V. P. Gopi, "Identification of ayurvedic medicinal plants by image processing of leaf samples," in 2017 Third International Conference on Research in Computational Intelligence and Communication Networks (ICRCICN), 2017, pp. 231–238.
[15] A. Sabu, K. Sreekumar, and R. R. Nair, "Recognition of ayurvedic medicinal plants from leaves: A computer vision approach," in 2017 Fourth International Conference on ImageInformation Processing (ICIIP), 2017, pp. 1–5.
[16] A. Krizhevsky, I. Sutskever, and G. E. Hinton, "Imagenet classification with deep convolutional neural networks," Commun. ACM, vol. 60, no. 6, p. 84–90, may 2017. [Online]. Available: https://doi.org/10.1145/3065386