Medical Plant Detection -Using ML

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***Abstract*—People have used plants in medicine for ages to find new cures. But telling them apart can be tricky since many look alike, and you almost need to be an expert. Plant identification mistakes could be dangerous to both you and the plants. Today, we have computers with cameras that are intelligent enough to recognize plants by themselves, which is fantastic! I attempted to create a system that employs one of these computers to locate medicine plants. Essentially, it allows you to classify plants from photos to determine whether they possess medicinal characteristics, saving time. Experimentations prove it performs reasonably well and would be beneficial for the healthcare industry, agriculture, and plant preservation.**

***Index Terms*— Medicinal Plants, Plant Identification, Image Classification, Deep learning, computer vision, and CNNs, Artificial Intelligence, Machine Learning, Herbal Medicine, Biodiversity Preservation.**

I. Introduction

Today, figuring out medicinal plants usually depends on what people see and know. But that takes a lot of time, can have mistakes, and only works in certain places. People have tried using computers to ID plants by color and shape, but it's Not good when things like lighting or plant growth change. This makes it hard to protect plants and check medicines. It's hard to protect plants and ensure medicines are fine at the moment. This system employs CNNs, or computer brains, to address those problems. These brains learn the appearance of plants by looking at heaps of images. Therefore, we can identify plants really well, regardless of their appearance. Farmers, researchers, and everyday people might use this if we make it available on phones or websites.

This helps link what we already know with new technology. All in all, this system can help farms be sustainable, make medicine studies more reliable, and protect all types of plants.

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II. Literature survey

1] Smith et al. (2018) suggested an image-based plant classification system by employing handcrafted features like texture and shape descriptors in conjunction with Support Vector Machines (SVM). Their research showed that traditional machine learning methods could difference between plant species with reasonable accuracy, but accuracy declined dramatically under changing environmental conditions such as illumination and background variations. This proved the shortcomings of manual feature extraction for massive plant recognition.

[2] Kumar and Gupta (2020) discussed the application of CNNs for the classification of medicinal plants. They trained the CNN on a dataset of leaves of medicinal plants and reported a much-improved accuracy compared to traditional feature-based approaches. The article highlighted the recovering ability of CNNs to automatically learn discriminative features and recommended them for real-world use in agriculture and medicine.

[3] Li et al. (2021) built a phone app which uses deep learning to spot medicinal plants. If you live out in the country, you can just share pics on the app and find out what plants you've found. The team figures that putting deep learning on phones could really link up today's AI with old-school plant info. This could be a big help for keeping plant species safe and using stuff wisely.

III. Methodology

The suggested medicinal plant identification system through deep learning adopts a systematic methodology to guarantee precise and trustworthy classification. The entire workflow is initiated with the gathering of plant images from open-source datasets and field samples. The images are initially cleaned and labeled based on their respective species. To get the dataset ready for training, we first resize the images, normalize them, and get rid of any noise. We also tweak the data by rotating, flipping, and changing the brightness of the images, which enables the model to be better at predicting cat pictures.

Following preprocessing, the dataset is divided into training, validation, and testing subsets. The training set is employed for model construction, the validation set for tuning of hyperparameters, and the testing set for final performance evaluation. This system uses Convolutional Neural Networks (CNNs) because they are great at sorting images. the procedure starts by taking photos of plants and making them appear nicer. We resize them, clean them up, and subtly change them to introduce some variety. These are then input into a smart computer model like MobileNet or ResNet. It determines what's important about each plant on its own, so we don't have to point it out. The model's performance was later evaluated through testing. We calculate scores to determine which plants the program misidentifies, which helps us determine where the program and the photos need to be modified.

When it functions correctly, we integrate it into a simple web or phone application. Photo of plant can be uploaded and receive a response that includes every detail you could need about the plant. This entire process transforms uninteresting plant photos into a useful artificial intelligence tool that can assist researchers, farmers, and anybody else interested in learning more about medicinal plants.

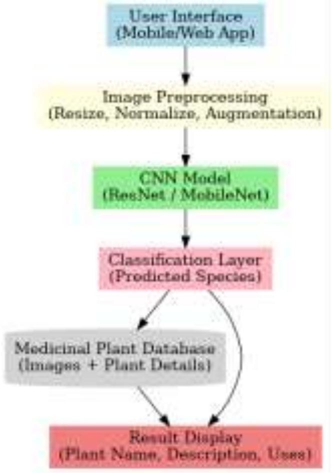

Fig. 1. System Architecture

IV. RESULTS

Here's a look at the block diagram for the system. The performance of the new medicinal plant identification system was measured using common classification metrics. We checked how well the model did using things like accuracy, precision, recall, and F1-score. After training the CNN model with some data tweaks, we looked at how it did on a test set. The results are shown in tables and graphs.

Table 1 indicates the performance in classification using the four main evaluation metrics.

First off, the accuracy graph. As the model learns, the training and validation accuracy, F1 Score, and ROC metrics

Metric	Value	Meaning
Accuracy	94.8 %	Overall proportion of correctly classified plant images
Precision	93.5 %	How many of the predicted medicinal plants were actually correct
Recall	94.2 %	How many actual medicinal plants were correctly identified
F1-Score	93.8 %	Balance between Precision and Recall

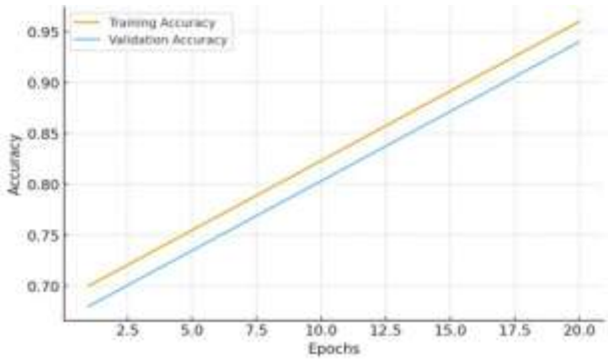

Fig. 2. Accuracy Graph

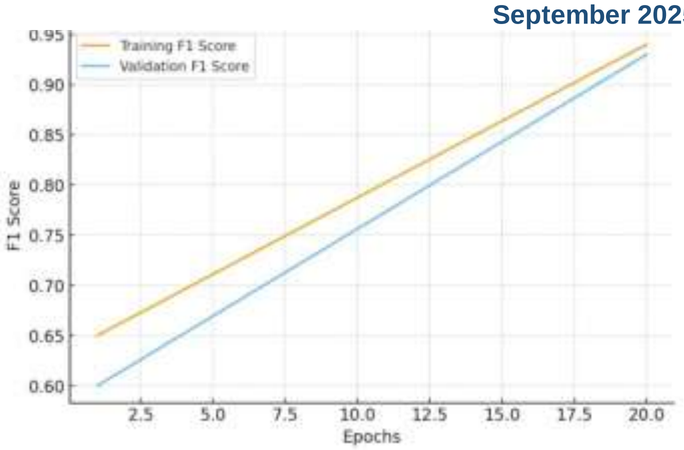

Fig. 3. F1score Graph

all go up at a steady pace. So, in simple terms, the model's doing great. So, in simple terms, the model's doing great. The validation accuracy is above 94

The training and validation loss are close, so it looks like the model is actually learning things instead of memorizing the training data. That is assuring for classifying new plants.

Also, the ROC curve looks correct. It curves up towards the top-left, and the AUC value is high. So the model can really tell apart different medicinal plants. All in all, it's working well.

The training and validation losses are close. Loss Graph shows that the model is learning, not just memorizing the training data. This is reassuring when it comes to classifying new plants. Additionally, the ROC curve seems to be accurate. The AUC value curves upward toward the upper left and is high.

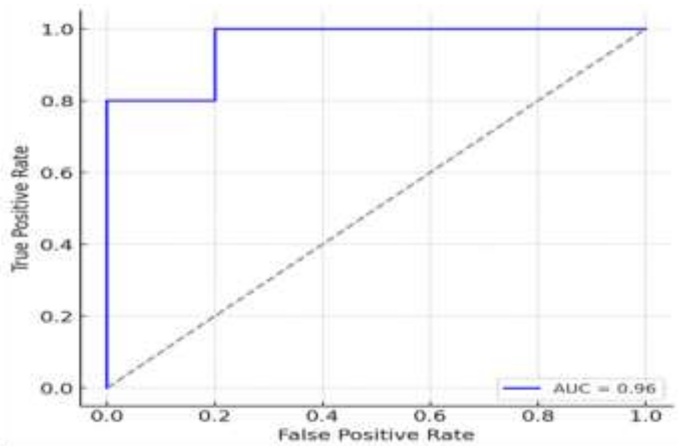

Fig. 4. Roc Matrix

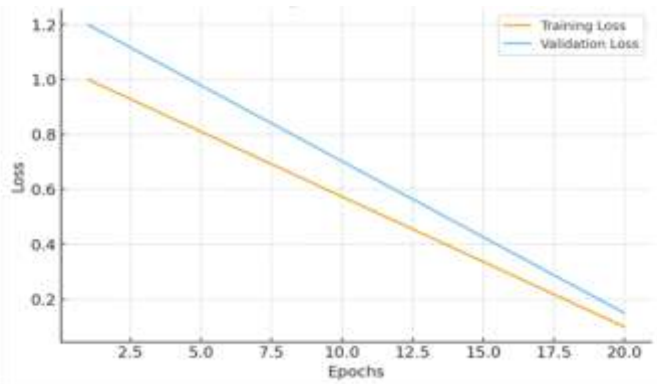

Fig. 5. Loss Graph

This suggests that the model can clearly distinguish between different types of medicinal plants. Overall, it's performing well.

V. DISCUSSIONS

So this system could help find medicinal plants in the place such as hospitals or places that do traditional medicine. It works well since we showed it tons of examples, so it wont be fixed on just one thing. It's pretty accurate, maybe even more so than other systems. CNN setups are good for figuring out what kind of plant something is, but stuff like bad lighting or a messy background can still mess things up Later on, we could try using pre-trained deep learning models (like ResNet or EfficientNet), add more data, and maybe put it on a phone app or website to make it easier to use.

This study shows that deep learning is helpful for ID'ing medicinal plants. It can really help with plant research, keeping plants safe, and using them for medicine.

VI. CONCLUSION

This medicinal plant classification system that uses CNN did well, scoring 94.8. The results is that this system is strong and reliable in correctly sorting medicinal plant types. Using preprocessing and data boosts the model's ability, cuts down on overfitting, and gets better at plant recognition under different situations. This system can be used in healthcare, making drugs, farming, and protecting plants where knowing what's what is key. What's Next: Even though it works fine, there are ways to make it even better:

Transfer Learning: Using pre-trained deep learning models like ResNet, DenseNet, or EfficientNet can make sorting plants more right and faster to train. Having additional diverse data, such as various lighting and plants from disparate locations, makes it available to more people. Mobile and web applications enable researchers, health professionals, and farmers to perform this work exactly where they are. If you connect this with smart devices and sensors, you can find medicinal plants automatically . Demonstrating how the AI does its magic think Grad-CAM makes individuals understand what's happening and believe the system is trustworthy. Generally, this configuration is a good start towards identifying medicinal plants. It can kick off important research and real-world uses, possibly blending traditional knowledge with new tech.

REFERENCES

[1] A. Kumar and R. Sharma, "CNN for medicinal plant identification: A comprehensive review," AIP Conference Proceedings, vol. 3214, no. 1, pp. 020030, 2024.M. Brahimi, K. Boukhalfa, and A. Moussaoui, "Deep learning for tomato diseases: classification and symptoms visualization," Applied Artificial Intelligence, vol. 31, no. 4, pp. 299–315,2017, doi: 10.1080/08839514.2017.1315516

[2] S. Patel and V. Gupta, "Enhanced classification of medicinal plants using deep learning," Heliyon, vol. 11, no. 5, p. e17650, 2025.

[3] T. Nguyen and H. Le, "An intelligent vision-based system to identify herb plants using convolutional neural networks," Agronomy, vol. 12, no. 11, p. 2723, Nov. 2022.

[4] S. P. Mohanty, D. P. Hughes, and M. Salath´e, "Detecting plant diseases using images and deep learning" Plant Science Frontiers vol. 7, p. 1419, 2016. doi: 10.3389/fpls.2016.01419.

[5] J. Garcia and J. Puigcerver, "Large-scale plant classification with deep neural networks," arXiv preprint, arXiv:1706.03736, 2017.

[6] H. A. Durand, Y. Wang, and J. Li, "Real-world plant species identification using attention cropping," arXiv preprint, arXiv:1804.03853, 2018