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Classification of Leaf using Teachable Machine

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Abstract: ***Leaf classification is an important stage in plant science. Manual classification of leaf is a quite difficult task for unknown person.***
For identification and classification of leaf type, machine learning (ML) based approach is simplest way. Henceforth, Google Teachable Machine (GTM) is an intuitive visual tool that provides workflow-oriented support for the development of machine learning models.
This model helps to scan image object for leaf type identification. ML is a web-based tool allow user to train machine-learning model without any coding language. In the present work, Mango leaf, Orange leaf and Guava leaf has been selected for identification of its type.
For the classification of leaves, hundred images of each type has been taken from available data set and categorized into three classes by giving Guava leaf, Orange leaf and Mango leaf name to created three classes. Teachable machine provides image, sound and pose training option for classification of an object. In this work, we used image option to train the model. This platform automatically trains the model using pre-trained deep learning algorithm. Leaf type verification is done by uploading new image of each leaf type that was not included in the training data set. After successful completion of experiment, result shows classification of each leaf type accurately.
Keywords: Leaf identification, Google teachable machine (GTM), Machine learning (ML), Deep learning

I. INTRODUCTION

Everyone see various types of plants in their day-to-day life. Some people have ability to classify it while some one cannot classify it properly [1]. Classification of plant or leaf type is quite difficult task for beginners. Generally, peoples believe on experience and dataset to classify an image, which is tedious, and time consuming work [2]. Use of technology makes us user friendly in carrying out image classification [3].

Image classification minimizes the gap between human perception and computer eyesight by training machine with available data set [4]. Modern computer with application of machine learning provide a deeper technical and economical farm management for identification of plant or leaf.

ML techniques show great potential in agriculture domain [5]. Artificial intelligence (AI) based machine learning (ML) algorithm is an excellent alternative for classification of leaf images. Prediction based on AI and ML becoming popular in research related to image classification [6].

It provides ability to learn automatically from experience. AI centers around the development of codes that can get to information and use it to find out on their own. The most common way of learning starts with perceptions or information, like models, direct insight, or guidance, to search for designs in information and pursue better choices later on in light of the models that we give. The main thing is to permit the PC learn automatically without human help and change actions accordingly [7]. The traditional approach of leaf classification needs prior knowledge of leaves. New Approach avoids human errors and identifies the leaf accurately. It can exhibit smart intelligence, precise sensing along with good identification [8]. Google Teachable Machine (GTM) is a web-based GUI tool for creating custom machine learning classification models without any programming language and specialized technical expertise. It is developed to help students, teachers, designers, and others learn about ML by creating and using their own classification models.

In the present work, Google Teachable Machine based approach has been taken for classification of Guava leaf, Orange leaf and Mango leaf. The dataset for developing a well-trained machine-learning model has been taken from respective plant leaf available in surrounding.

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II. METHODOLOGY

Figure 1 shows workflow of this research work.

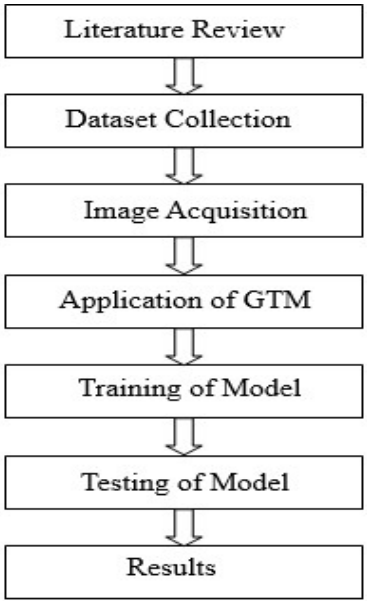


Figure 1: Workflow of Present Work

1) Literature Review

A literature review is carried out to find out the references relevant to image classification and Google teachable machine. The study used in this work uses recent references from 2021 to till date.

2) Data Collection

At this stage, data collection has been done related to Guava leaf, Orange leaf and Mango leaf. Three classes have been created and correspondingly Guava leaf, Orange leaf and Mango leaf name are given to class1, class 2 and class 3 respectively. Hundred images of each leaf type have been taken to train the model. Figure 2 shows the sample images of Guava leaf, Orange Leaf, and Mango leaf collected in this work.

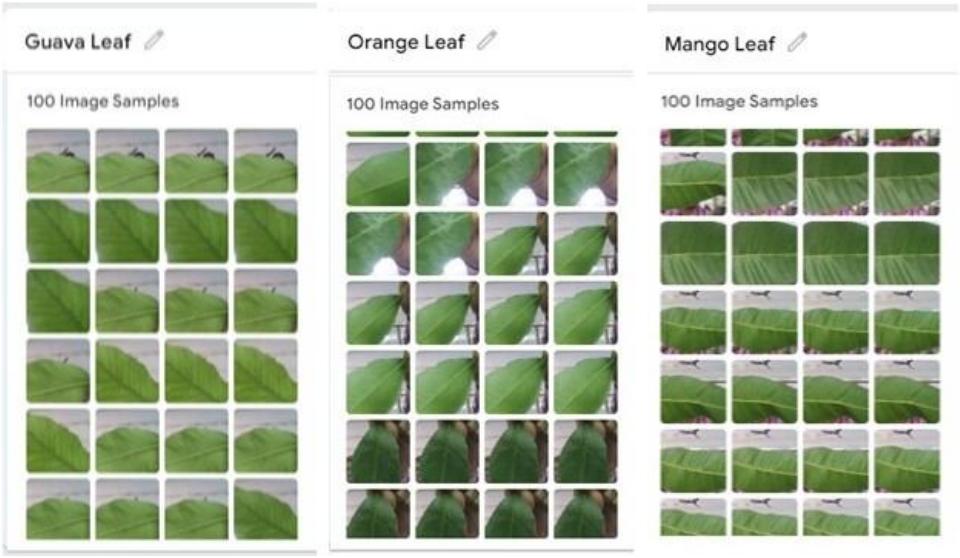


Figure 2: Sample Leaf Image

3) Image Acquisition

At this stage, one image of any type of leaf (guava leaf, orange leaf, mango leaf) has been taken. The purpose of this image acquisition is to facilitate the training and testing carried out. Figure 3 shows the guava leaf, orange leaf and mango leaf image acquired in this work to test the model.



Figure 3: Leaf Image Acquisition

4) Application of GTM

At this stage of application of GTM; the total dataset used are 300 images (100 images of each types). Learning is carried out to provide a learning model on machine learning, while testing is carried out to test the accuracy of learning model that has been formed previously. At this stage, the model is trained with three classes: Guava leaf, Orange leaf and Mango leaf. Google Teachable Machine is the application used in this work. Figure 4 shows the machine learning testing on classification of guava leaf, orange leaf and mango leaf.

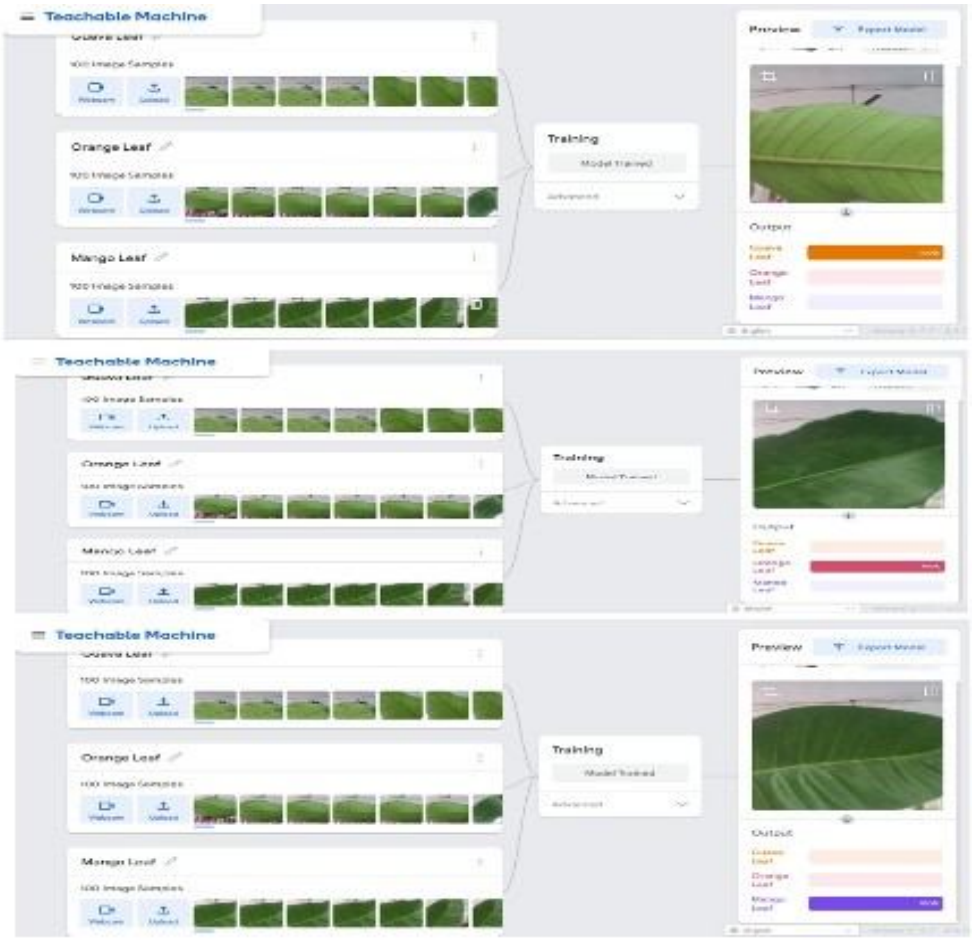


Figure 4: Machine-Learning Testing on Classification of Leaf Type

III.RESULT AND DISCUSSIONS

1) In this work, the GTM model is used to obtain the classification of leaf. This test uses Epochs 50 with learning rate 0.001 and batch size = 16. Figure 5 shows application of GTM selected in this work to train the model.

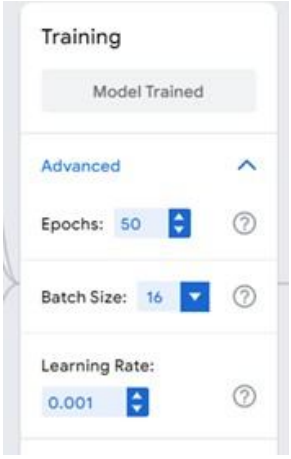


Figure 5: GTM Application

2) At this stage of machine learning model, accuracy per class obtained for guava leaf, orange leaf and mango leaf is shown in figure 6.

Accuracy per class

CLASS	ACCURACY	# SAMPLES
Guava Leaf	1.00	15
Orange Leaf	1.00	15
Mango Leaf	1.00	15

:

Figure 6: Accuracy per Class

Figure 7 shows results Accuracy per Epoch and Loss per Epoch for tested model.

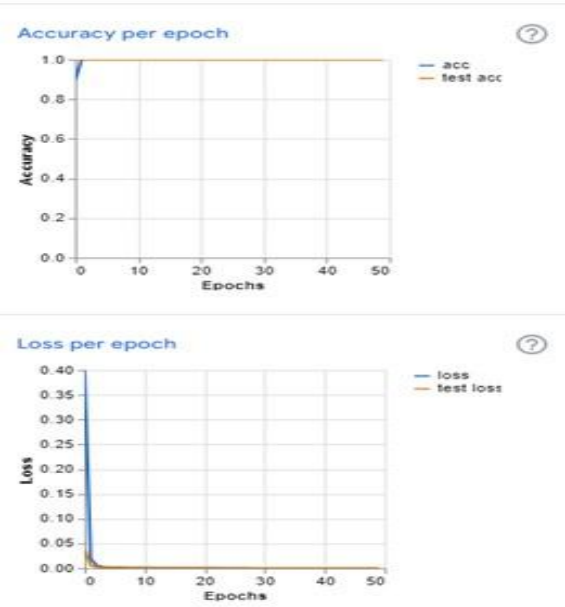


Figure 7: Accuracy and Loss per Epochs

Figure 8 shows the confusion matrix for above tested model.

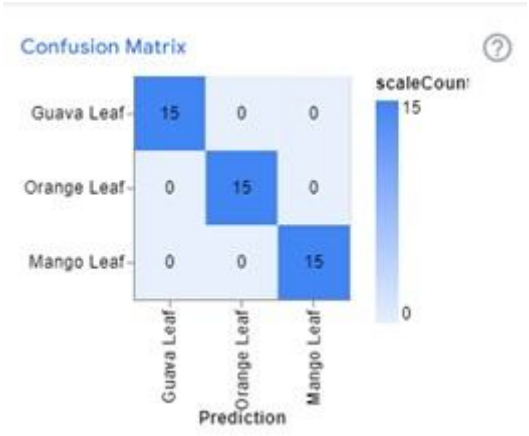


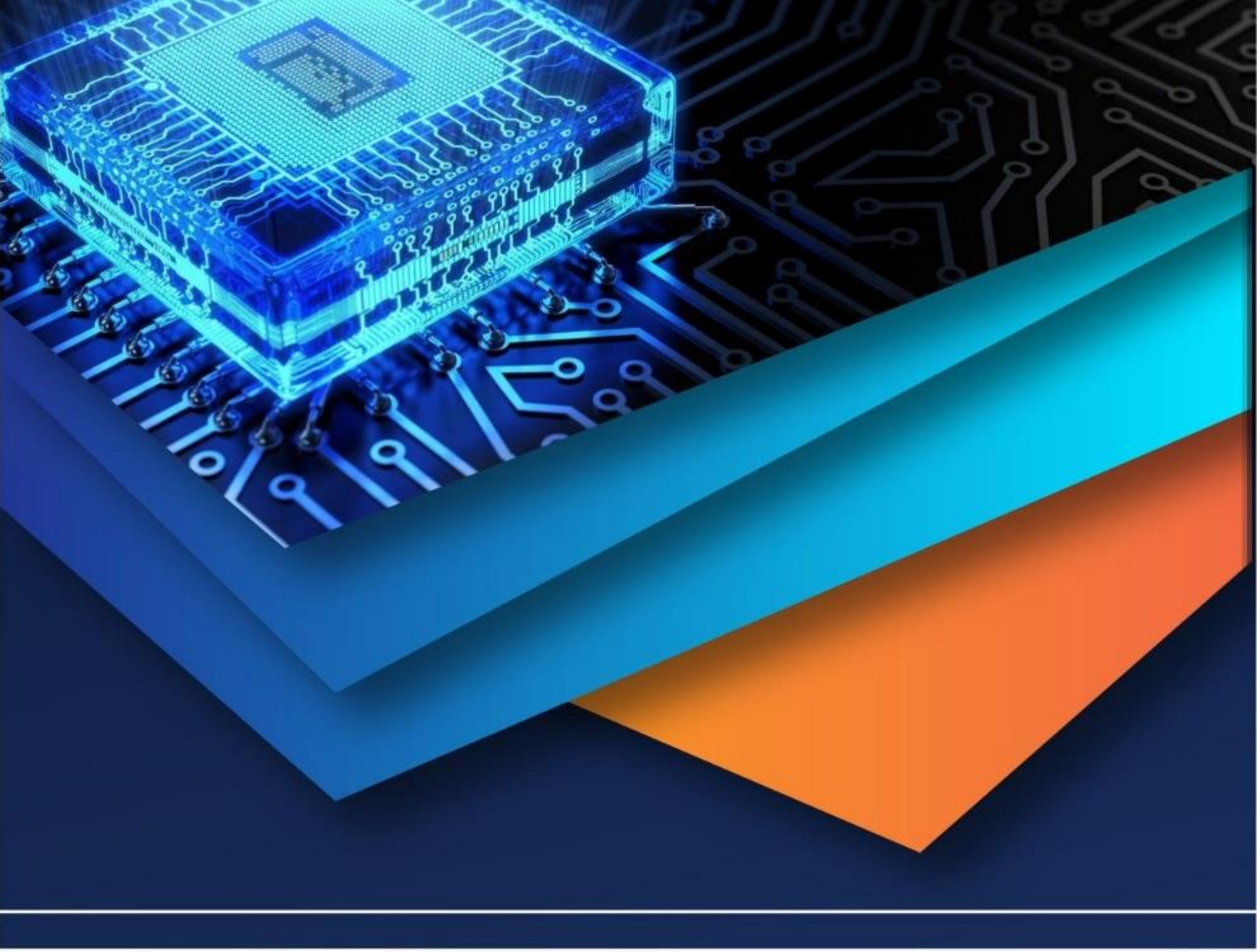
Figure 8: Confusion Matrix

IV. CONCLUSION

Teachable Machine is not only an education tool, but a way for anyone to quickly and easily create a ML classifier using only their web browser in a matter of minutes. In this work, GTM is used for classification of leaves. It is the simplest way of classification of leaves without any programming skills. Figure 7 shows the classification accuracy of the proposed approach in comparison with other implementations.

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