GRADING OF PROCESSED ARECANUT USING MACHINE LEARNING

ABSTRACT

This system's major goal is to come up with a way to anticipate the various grades of arecanut based on their color, size, and texture. Several Indian states regularly cultivate arecanut, also known as betelnut. Most farmers now use human labour for sorting and Arecanut quality grading, which takes a lot of time and requires a lot of labour, leads to categorization irregularity. Since no tools or cutting-edge technologies are available. The creation of machine vision-based technologies could be useful for arecanut grading a benefit for farmers and assistance to society. Color, size, and shape are used to characterize the arecanuts carefully evaluated according to texture. These factors have a significant impact on how customers shop. For the quality grading of several categories of arecanut, image processing and machine vision have been utilized to extract exterior attributes like color, size, form, etc.

I. INTRODUCTION

An essential part of marketing is the grading of arecanut. By examining several traits, it permits the classification of the produce into various homogeneous categories. This makes it easier for the producer to get pricing that reflect the produce's quality. Grading as a language is a useful tool for producers, merchants, or both to translate customer wants into action. In India, areca nuts are a common nut that are consumed by all demographic groups, regardless of caste, class, region, religion, age, or gender. Arecanuts have been used since the Vedic time and are a necessary component of many religious and secular ceremonies. The main producer of arecanuts is India, and Karnataka is the country's most important arecanut-producing state. A substantial quantity of arecanut stock is managed by distributors, who can also use the grading equipment. The arecanuts are hand assessed according to their color and texture categories. These factors have a significant impact on customers' purchasing habits. For the purpose of rating the quality of arecanuts, image processing and machine vision have been utilized to extract exterior attributes including color, size, and shape. In this research, we divide arecanut into various grades using a machine learning technique.

A. Overview

The main goal of the solution is to simply divide arecanuts into two grades—Grade1 and Grade2—based on their color, texture, and size, with Grade1 having better quality features than Grade2 and vice versa. Ordinarily, grading arecanuts is a labor-intensive and time-consuming manual operation. As a result, the suggested technique improves grading accuracy while reducing grading time for arecanut.

B. Challenges

We encountered a number of issues, one of which being software failure. The number of software requirements was too high.

C. Objectives

The arecanuts identification, the process of grading arecanuts according to attributes like size, color, and texture. Automate the traders' labour so they can quickly grade the arecanuts based on quality. Reduce the amount of human involvement.

II. ARCHITECTURE

The project's initial component is an architectural design idea, which comes before all other steps in the design process. The project cannot start in earnest until the design idea has been created and refined. To adapt to the design challenges they encounter, designers utilise architectural principles.

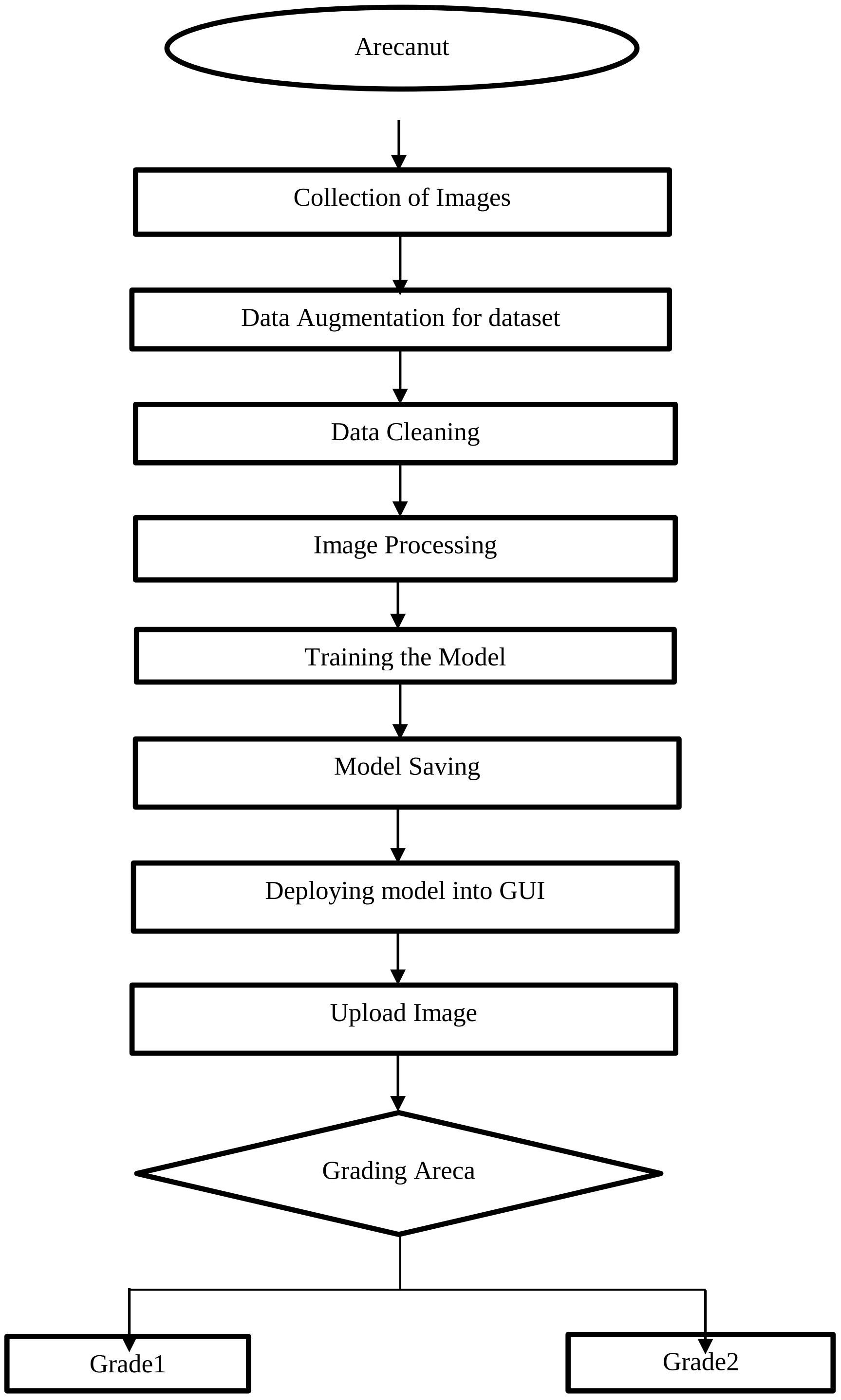

Fig 1. Workflow Model Architecture

A. **Steps Followed:**

Arecanuts are either collected when they are young or when they are fully ripe. The processed arecanut has been taken into account here.

Fig 2. Raw Arecanut

Figure 2. demonstrates an unprocessed, raw arecanut. Raw arecanuts are either ripe or delicate nuts that still have their outer shell on. For marketing purposes, these raw arecanuts must be processed. Even the nuts' outer shells are valuable and can be utilised for a variety of things. Numerous researchers are engaged in it..

(a) (b)

Fig 3. Partially Processed and Completely Processed Arecanut

This stage, peeling the areca nut to obtain the kernel, is one of the most crucial processes involved in the full areca nut processing. To get the kernel, the raw fruit must first be peeled. After the harvest, this must be done within a day or two. The arecanut is partially processed as seen in Fig. (a). As soon as the kernel is removed, it must be cooked at a high temperature for at least 12 hours. As can be seen in the image below, two enormous metallic jars with a combined capacity of 600 litres are being used. The arecanut kernel must be poured into the container and mixed with enough water. To achieve a beautiful hue, the arecanut precipitate must be blended with the water.

B. **Collection of Images**

Many arecanut samples were acquired to prepare the basic dataset. Several areca classifications, including Grade 1 and Grade 2, which are also used for grading, are included in this sample.

C. **Data Augmentation for dataset**

In order to artificially expand the size of an actual dataset, data augmentation techniques produce several copies of the dataset. Data augmentation is a technique used by computer vision and natural language processing (NLP) models to deal with data scarcity and lack of diversity. The following benefits are provided by data augmentation technique:

- Horizontal shift
- Vertical shift
- Rotation
- Brightness

- Zoom
- Flipping

D. **Data Cleaning**

Before conducting data analysis, a data set must be cleaned of any inaccurate, corrupt, or extraneous information. This procedure enhances data quality by identifying and eliminating mistakes and abnormalities. Data preparation, data cleansing, and data scrubbing are terms that are frequently used to describe the process of transforming unclean, possibly dangerous data into clean data.

E. **Image Processing**

The act of performing various procedures on an image is known as image processing. In image processing, we start with an input image, make the necessary adjustments, and then output the finished image. Additionally, when using computer vision, we search for any features or other data pertaining to the supplied image. OpenCV an image processing library has some functions as

- Image: **Open()** and **show()**
- Reading the image – **imread() syntax:** img = cv2.imread(f1)
- Saving the image – **imwrite()** using the syntax**: cv2.imwrite(filename, image)**
- Splitting the Channels – We can get the grayscale image using the 'cv2.IMREAD_GRAYSCALE' parameter and we can get the blue, green, red channels using the **split()** functions.
- Resize image – **resize() syntax**: img = cv2.resize(img, (xdim,ydim))
- Converting image – **convert() syntax**: img = cv2.cvtColor(img,cv2.COLOR_BGR2RGB)

F. **Training the Model**

Simply said, training a model entails learning (deciding) appropriate values for each weight and bias from labelled samples. In supervised learning, an algorithm constructs a model by analysing numerous examples and tries to discover a model that minimises loss.

The consequence of a poor prediction is loss. In other words, loss is a measure of how poorly the model predicted a single case. The loss is zero if the model's forecast is accurate; otherwise, the loss is higher. Finding a set of weights and biases that, on average, have low loss across all examples is the aim of training a model.**.**

We can split the dataset in half:

- **training set**,a subset to train a model.
- **test set,** a sample set used to evaluate the training model.

The single data set might potentially be divided into the following chunks:

Fig 4. creating training and test sets from a single data source.

Never should we practise using test data. We may be unintentionally training on the test set if we are getting unexpectedly good outcomes on our assessment measures. High accuracy, for instance, would suggest that training set data has gotten into the test set somehow.

G. **Model Saving**

Model progress can be saved during and after training. This means a model can resume where it left off and avoid long training times. Saving also means we can share our model and others can recreate our work. There are different ways to save TensorFlow models depending on the API you're using. Such as tf.keras—a high-level API to build and train models in TensorFlow. For other approaches, refer to the Using the SavedModel format guide and the Save and load Keras models guide.

H. **Upload Image**

We have a section in our project named "test" where we save the photographs we upload for predicting grades. Additionally, there are two subfolders called Grade1 and Grade2 in the test folder that include the grade 1 and grade 2 areca images used as test sets, respectively. The uploaded photographs will thereafter be stored in the input folder.

I. **Grading Areca**

As was already noted, different buttons are made using the Tkinter GUI for uploading images and determining their grade. Our model will therefore be able to forecast the image after uploading it and will be able to determine if the areca is Grade1 or Grade2. The Predict/Classify button performs the job of a predictor, and the grade of the image to which it corresponds is displayed as the outcome.

CONCLUSION AND FUTURE ENHANCEMENT

To determine the best algorithm for categorization, a thorough assessment of the literature has been done in this study. There was no conclusive proof that one algorithm was the best classification strategy. As a result, a collection of algorithms was selected that includes classification based on various criteria. The arecanut images were used to train the chosen algorithms. Each algorithm is trained using a data set containing thousands of images of arecanut in order to assess the accuracy of machine learning models. The trained algorithms were evaluated using accuracy performance metrics.

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