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A Review on Classification and Grading of Areca Nuts using Machine Learning and Image Processing Techniques

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Abstract: Areca nut, sometimes called betel nut, is a tropical crop. Areca nuts are produced and consumed in India, which is the world's second-largest producer and consumer. It suffers from a range of ailments during its life cycle. Farmers use their senses of sight to detect disease. Multiple image processing techniques for categorization of Areca nuts with various properties such as colour, texture are examined in this paper. Computer detection systems have been widely employed in the real world for retrieval tests because they can provide rapid, efficient, accurate, and clear testing. Until now, areca nut separation has been done by hand. Areca nut separation employing a complex colour sorting mechanism is made up of a variety of exterior properties of the nut, such as colour, texture, form, and size. Various approaches will be used to extract information from the captured image. The areca nut's colour can also be used to classify it. To efficiently plan the areca nut, all of these traits are essential. To extract composition characteristics, the co-occurrence matrix of wavelet coefficients at the second level of details, as well as contour let coefficients, is used. Separation is accomplished by mixing three texture elements namely strength, contrast, and homogeneity. This approach has been shown to work effectively in the contour let domain, allowing for a reduction in the vector dimension feature. When given training data, it categorises the data into healthy and unhealthy areca nuts based on colour and quality. Areca nut is separated using CNN and SVM classifiers.

Keywords: Convolution Neural Network (CNN), Support Vector Machine(SVM), Machine Learning (ML), Artificial Intelligence (AI), K-Nearest Neigbor (KNN), Artificial Neural Network(ANN), Gray Level Co-occurrence Matrix (GLCM).

I. INTRODUCTION

Areca nut is one of India's most important commercial plants. Currently, areca nut sorting is done by hand, which is a time-consuming and inefficient process. We'll need to segregate automatically for this. Machine Learning is a hidden AI platform that may be utilised to automate this procedure. The website is created to classify areca nuts according to their quality. When it comes to grading, the division of the areca nut is important. Sorting correctly aids in determining the appropriate yield. CNN is an In-depth Learning method that can capture an image, give value (readable weight and bias) to the various elements in the image, and differentiate between them. When compared to other classification methods, CNN requires extremely little prior processing Despite the fact that the filters are constructed by hand in traditional methods, CNN can interpret these filters / symbols with the right training.

II. LITERATURE REVIEW

S**iddesha S. et al., [1]** this interacts with the division of the green areca nut based on histogram color and color times with KNN separators. The experiment was developed utilising the KNN algorithm and an 800-photographic database of four classes with two-color characteristics and four-grade scales. A separate image is utilised in the second stage to extract elements. Color histogram and colour timing approaches were used to extract this colour information. The areca nut is divided into four classes in the third stage. KNN, ANN, and SVM are three well-known category designers that we employ to divide.

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Dhanuja K.C. et al., [2] advocated using imaging processing technology to identify areca nut disease, and the author employed grading based on areca nut stitching. The machine's viewing programme was created to recognise and identify areca nodes as distinct, dignified, and poor levels. The Deep Learning algorithm and imaging techniques are used to classify the data.

Anil kumar MG et al., [3] in this article, we focus on early detection of diseases in Areca nut using convolution neural networks. CNN is an in-depth Learning algorithm used to diagnose diseases of areca nut, which takes inputs as a picture, provides readable weights and variations objects in the picture, and then learn from the results to distinguish one from the other.

Dinesh R et al., [4] Areca nut used image processing and computer vision to partition and manipulate the data. The author distinguishes the areca nut category based on colour, size, and texture. The major goal of this article is to give a comprehensive review of the areca nut, Computer Vision, and the technological needs and applications based on the notion of areca nut categorization and grading.

Bharadwaj N K et al., [5] is proposed to determine the distance of the areca nut through pictures of areca nut. The proposed future extraction method uses the local binary pattern method. Supports a vector classified machine used to determine areca nut range. The accuracy, memory, and F -measure generated in the confusion matrix are all used for testing and grading system performance.

Ajit Danti et al., [6] Raw areca nut separation procedures and methods have been proposed. The author has devised a novel method for classifying areca nuts into two groups based on their colour. Segmentation, Masking, and Classification are all steps in the classification process. The classification is based on two different colours: red and green areca nut phases in the region. Test performance success rates ranged from 97 to 98 percent depending on the category.

Mallikarjuna S. B. et al., [7] proposed a CNN-based algorithm for classifying various diseases pictures of areca nut. Separate the various diseases such as rot, split and rot. Results from a four-phase data set shows that the proposed strategy excels in terms of classification, memory, accuracy, and F steps.

Hubert Cecotti. et al., [8] have found grape clusters using the neural convolution network. A separate classification techniques used to separate two grape varieties of white and red grapes at the same time Use the CNN algorithm to perform 99% accuracy.

Ashish Nage et al.,[9] this paper focuses on a method based on image processing to find plant diseases. Here is the paper the author made the helpful Android app growers in diagnosing plant diseases by uploading a leaf image to a program using CNN leaf-cutting algorithm.

Prasanna Mohanty et al., [10] has proposed how to diagnose plant diseases by training a CNN. The CNN model is trained to identify 14 healthy and diseased plants. The model achieved 99.35% accuracy in test set data. When using a model in pictures purchased from reliable online sources, the model achieves 31.4% accuracy, while this better than a simple random selection model, a very different set of training data can help to increase accuracy. And some variation of model or neural network training may produce high accuracy, thus opening up a way to make the diagnosis of plant diseases more easily accessible for everyone.

Ashfaqur Rahman et al., [11] presented an image processing and artificial intelligence process for locating mature areca nut. The entire process is divided into two steps: the first step separates the areca nut images from the background image, and the second step classifies the areca nut. Image based on the mature group and achieved an overall accuracy of 96 percent.

Hubert Cecotti et al. [12], A convolution neural network was used to recognise grape bunches. The CNN algorithm was used to segment the two types of grapes, white and red grape bunches, using several segmentation techniques. It performed with 99 percent accuracy.

Scarlett Liu et al., [13] suggested an image-based grape bunch detecting algorithm. The grape bunches are counted from photos using an image processing and support-vector machine technique, with an overall success rate of 88 percent for red grapes.

Lucas Mohimon et al., [14] have been compared deep-learning and machine-learning algorithms for grape bunches cluster segmentation. There were 200 photos of white grapes in typical light in the collection, and the accuracy was 86 percent. When compared to traditional segmentation techniques, the results demonstrated that deep-learning algorithms are more robust in detecting white colour grape bunches.

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Ashfaqur Rahman et al., [15] To locate the mature grape bunches, a series of image processing and intelligence processes were applied. The complete procedure is divided into two steps: the grape bunches photos are removed from the background image in the first phase, and the grape bunches are classified based on the mature group in the second step, with an overall accuracy of 96 percent.

Alharbi et al., [16] Different diseases on apples have been identified and classified. On testing images, the classification accuracy was 90%.

Ajit Danti et al., [17] proposed raw arecanut segmentation and classification algorithms. The author has devised a revolutionary method for classifying arecanuts into two colour groups. Segmentation , Masking and Classification. The classification is based on the red and green components of the segmented section of the arecanut. In the experimental efficiency, the categorization success rate was around 97 to 98 percent.

Ajith Danti et al., [18] suggested a system for grading arecanuts that is both efficient and effective. For successful arecanut segmentation, three sigma control limits on colour features were created.

Ajit Danti et al., [19] described techniques for rating arecanuts based on textural qualities. Classification is based on mean around features, GLCM features, and combination (Mean around-GLCM) features. A decision tree classifier is used to divide arecanuts into six groups. GLCM and Mean Around-GLCM features were employed by the Decision Trees classifier. The cross validation approach is used to do the testing. The experimental results show that GLCM features are 97.65% successful, Mean Around features are 98.28 percent successful, and Mean Around-GLCM features are 99.05 percent successful.

Sameer Patil et al., [20] Pre-processing techniques should be used to classify the grade of arecanuts, according to the author. A Raspberry Pi system with a 5 Megapixel camera module was used to take the photos. Image filtering, contrast enhancement, and an image segmentation algorithm are used to pre-process the captured image. Canny edge detection and the K-means segmentation algorithm were used to locate the nut's boundary while cropping the arecanut images. To offer the best results for the arecanut segregation method in this study, the author categorised eight alternative picture pre-processing methods.

AjitDanti et al., [21] proposed an arecanut grading system. For improved results, the author combined two algorithms, KNN and SUV, to classify the nuts.

Dhanesha R. et al., [22] The HSV colour model was used to determine and identify the automated maturation stage of arecanut bunches. 200 photographs of arecanut bunches at varying stages of ripeness were used in the experiments.

Dhanesha R. et al., [23] determined the maturity degree of arecanut bunches. The YCgCr colour model automatically splits an arecanut bunch from a given image, allowing the maturity level of the arecanut to be determined. The author produced a database of 1000 photos using a smartphone camera. The testing result demonstrates that this method can accurately link input images with an accuracy of 80%.

Dhanesha et al., [24] showed dynamic contouring segmentation in which arecanut bunches in pictures were segmented. The author photographed 20 different arecanut bunches at various stages of ripeness. VOE and DSC performance measures were used to examine the data's accuracy.

Siddesha et al., [25] Oil palm crop bunch photos were segmented using trained and unsupervised methods. The author used Hill climbing, Grow cut, Random Walker, MSRM algorithms for supervised techniques and K-Means, Fuzzy-C-Means algorithms for unsupervised techniques on a dataset of 100 bunch pictures. The impact would be better if the same approaches were used on a bunch of arecanuts.

Yashima Ahuja et al., [26] presentedthe concept of Multiclass classification and many classification approaches were discussed. Support Vector Machines has a good record in Binary classification. The study of fitness of SVM in multiclass classification is done in this paper.

T. Liu et al.,[27] paper is about the problem solving of betel nuts by manual ways, the automatic classification method on the basis of computer vision is discussed in this paper.

S.R. Kodituwakku et al., [28] determines which color or texture is better to represent the similarity of colors images. Color moment and color histogram descriptors are not effective since image pixels aren't into considerations. CCV and co-occurrence matrix features shows more effective images other than color and texture feature.

A.Danti et al., [29] paper is about the classification techniques of arecanut based on text feature is done. GLCM and mean around GLCM features, based on this classification is done. Six classes classification is done based on Decision tree.

André Silva Aguiar et al., [30] proposed employing several image-processing and deep-learning models to recognise the grape bunch at various phases of development. The collection contains 1929 photos of the bunch at various phases

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of development. The results revealed that detecting the bunches in the early and intermediate stages of growth was difficult, with a detection accuracy of 66.96 percent.

III. SUMMARY AND OBSERVATION

Agriculture contributes significantly to the country's socioeconomic development. It is the backbone of the India*n* economy, accounting for 18.5 percent of the country's GDP. There is a need for every agricultural product. concentrated quality assessment, which is more accurate and dependable. We employ classification and grading processes that we do manually. entirely rely on humans to discern between different sorts of fruits and veggies. To do this, an automated system must be implemented. Reduce the amount of effort, the time it takes to complete the procedure, and the number of errors. Areca nut is a India's key cash crops Every Indian's day-to-day life revolves around it. As a source of rejuvenation as well as tradition and culture, family is important. Our project's goal is to classify the areca nut using machine learning and image processing in order to improve yield and assist farmers. Farmers will benefit from image analysis based on texture and colour features. Sorting and grading according to colour and quality. Our goal with this project is to use image processing to create an automated areca nut classification technique as well as a machine learning method that will result in lower production costs. There are five stages to the approach. The acquisition of images is the first step, where the photographs of areca nuts can be found. The second stage is pre-processing, which is completed to improve the dataset's accuracy and reduce its complexity, The third and final stage is the process of identifying the items that is known as segmentation. The photograph recognising which object each pixel belongs to This is done to prevent shadows from appearing in the image while it is being captured. The fourth stage was utilised to extract characteristics from the data.image that has been segmented The colour histogram is used to extract the colour feature in this case. strategies for colour moments The sorting of the areca nut into five categories is completed in the fifth stage. Two classes are held, one for good quality and the other for poor quality. We used the following classification system: CNN, and SVM. In this paper, processing-based methodologies are taken into account for the Areca nut classification based on numerous features such as colour, shape, and size texture, and so forth In the actual world, computer vision systems have been employed widely for the purpose of inspection and evaluation. The accuracy of SVM will be approximately 93.5 and CNN will be approximately 97.

IV. CONCLUSION

Arecanut is grown by many farmers in the coastal district, primarily for commercial use. Arecanut is currently one of the most in-demand and highly regarded crops. Because of the high rate, arecanut has piqued the interest of nearly all farmers in Uttara Karnataka and the Mysore region. Chemical fertiliser, chemical liquid spraying, climate changes such as heavy rain, and temperature variations have all contributed to the sickness of the arecanut Hence Farmers suffer a loss. Every year before the monsoon, then every 40 days, this practice is followed by all farmers. a long time If the farmers are aware of the diseases and whether or not the crop is afflicted, Preventing the disease before the monsoon, followed by a spray, will be effective. Taking care and Controlling bunches using polythene bags is another option. Our purpose is to educate farmers by providing them with information. The use of technology to locate and classify illnesses in arecanuts. The focus of our research is on putting in place a system that uses machine.

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