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Real Time Classification and Segregation of Cashew Nut Using Computer Vision

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Abstract: The food quality is very essential to the farmer as well as the end users. The classification of food items performed manually which is less efficient, low speed, expensive and tedious work The automatic approach, based on computer vision classification, provided rapid and high throughput methods. Even though, the classification task is complex and challenging case at the varietal level. The present work proposes the classification of the cashew nut by identified its geometric features like shape, size and colour using deep neural network. The deep CNN which itself extract the features of the image for classification was the added advantage. This work proposed a framework for computer vision based grading and sorting system for cashew nut using deep neural network.

Keywords: Computer vision, Neural Network, Transfer learning, Classification

I. INTRODUCTION

Cashew nut is one of the world-famous nuts. India is the largest exporter & distributor of Cashew Nuts in the world. Today, various kinds of cashews are available in the market with different qualities. Grading of cashew kernels is done by identifying geometric quality and features such as color, size, and shape. The classification of cashew-nuts is a very perplexing process, and the grading of the cashew-nuts is done by the labour who have vast experience in this field, which is a waste of human resources s also manual classification is not reliable as the computer. This project aims to design a real-time computer vision based cashew nut grading and segregation system. Real-time calculation based on the computer vision system is an alternative to the mechanical method for sorting. The computer vision-based method offers an automated, high-speed, and cost-effective solution for classification. That solves the concerns of cashew-nuts export industries. It also provides benefits to the cashew growing farmers for accurate grading of their production. The present work proposes a deep learning-based approach that provides an accurate classification for cashew nut in four varieties. The proposed system consists of four phases namely image acquisition, pre-processing, feature extraction, and classification The images were acquired by webcam using an efficient background subtraction technique. External features are extracted by using SVM and neural network classifier. Different classifier and transfer learning approach were used and their performance in terms of accuracy was observed. After segmentation, morphological processing was applied to improve the background subtraction in which the unwanted small holes on the background region were identified and removed. The fixed color CCD camera on production line to achieve automatic classification by using image processing technique, the result of classifier is used for automatic sorting system. The mechanical assembly was proposed with motor mechanism for automatic sorting of cashew nuts.

II. WORKFLOW AND METHODOLOGY

1. Image Acquisition

The object i.e., the cashew-nut was placed at the base, and the camera Logitech C250 was placed at a height of some centimetres above the base. It is a 1.3 Megapixel camera which is capable of capturing video at 30 frames per second Cashew kernel images were acquired using the image acquisition toolbox of MATLAB software.

2. Image Pre-Processing

Image pre-processing techniques can be applied to make the subsequent steps easier and error-free. Certain samples were blurred and hence lfilter has been applied to eliminate the blurring effect. Then a high pass sharpened image can be obtained using wavelet transform which provides a good result for accurate segmentation.

3. Feature Extraction

The extracted features act as input to the classifier. The various feature extracted for subsequent classification were

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colour, texture, shape, and size. Since RGB is not recommended for color analysis, HSV color moments such as mean, standard deviation, and skewness were extracted as most of the color information is contained in these three moments. Out of these fourteen features, five of the texture features are considered to be most relevant for this proposed method. Those features are energy, contrast, correlation, and homogeneity, and entropy.

4. Image Segmentation

The image segmentation techniques have been applied to split the pixel of the image into two subsets : the object area, and the background. In this work, a black-gray background has been used, aiming to choose backgrounds with different spectral characteristics than the cashew kernel. In this way, maximal contrast between the white/ivory cashew kernel and the background was achieved. In real-time experiments also the color of the conveyor belt wherethe cashew kernel is passing through, chosen as black.

5. Classification:

In traditional approach features are extracted and the selected features are used to classification purpose. Using deep learning approach various neural network architecture and transfer learning algorithms are used to classify the images. Neural network is layered architecture and is mimic of our human brain. In deep learning approach feature extraction and classification are performed using neural network architecture. Supervised and unsupervised learning approach is used to train the neural network. In our model supervised learning was used for that labelled dataset was created and image pre processing and augmentation were used to train the neural network. MATLAB deep learning and neural network toolbox was used for classify the cashew nut and various performance matrices were evaluated. The cashews were classified as per their shapes and conditions like whole cashew and half cashew. For better result some additional features were also added like brightness, contrast, gain, sharpness, zoom strengths, resolution, exposure, saturation etc.

6. Sorting System :

The model file from MATLAB software was deployed in Raspberry Pi**:**

It is a basic single-board microcontroller designed to make applications, interactive controls, or environments easily adaptive. It consists of features like a USB interface, Analog inputs, and GPIO pins which allow the user to attach additional boards. In our Model Raspberry Pi was used to control mechanical assembly ,conveyer belt mechanism for segregation of cashew nut based on their quality.

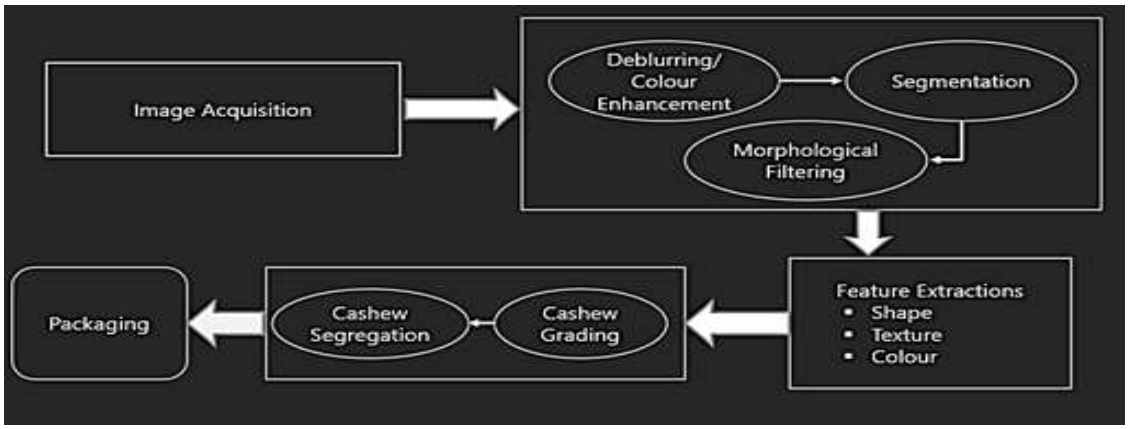

Fig.1 Process Flow Chart

III. RESULT

As shown in image, our system classifies the cashew nut in Half or Whole category and also creates a bounding box around it and indicates the accuracy. The training and validation accuracy was 100 % and testing accuracy was more than 80 %.

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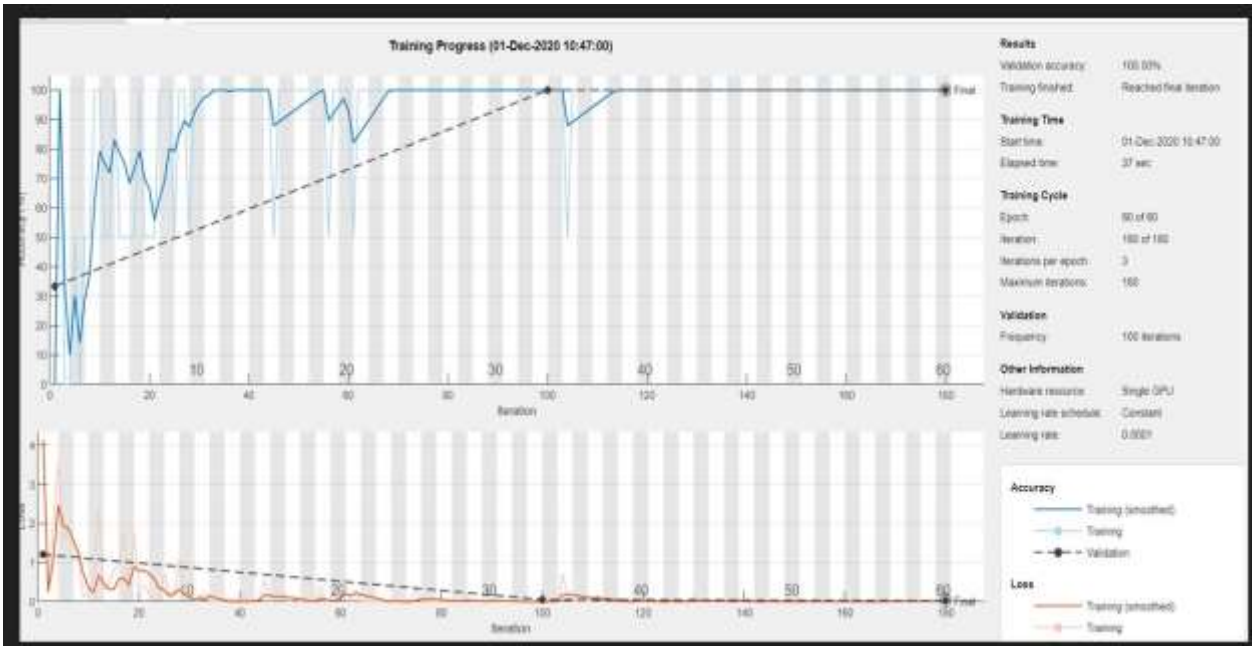

Fig.2 Traning progress & result

Fig.3 Cashewnut detection

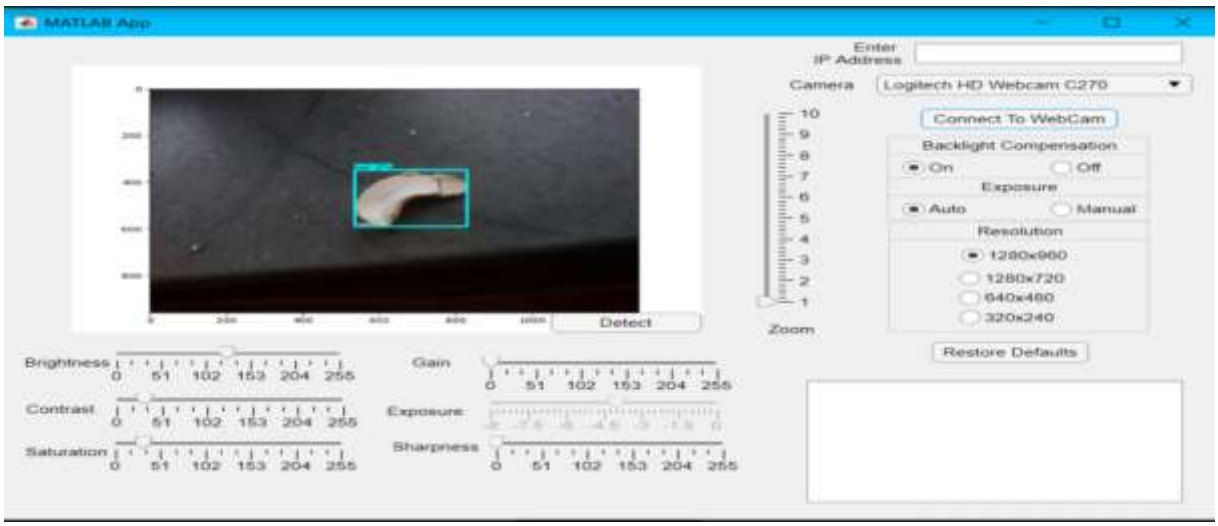

Fig.4 Final Result

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IV. ADVANTAGES

- Accuracy betterment
- Ease of implementation and high-speed performance
- Measurable and efficient in large data collection
- To improve the image data by suppressing unwanted distortions
- It allows a much wider range of algorithms to be applied to the input data
- Enhancement of some important image features so that our computer vision model can benefit from this improved data to work on.

V. CONCLUSION AND FUTURE WORK

We proposed the improvised deep learning algorithm for computer vision based cashew grading system. We developed a system based on computer vision that takes real time input, capture the image of cashew nuts, process the images and classify based on the quality of cashew nuts. The proposed system is useful in dry fruit industry as it is fast and accurate. The results of the computer vision based approach is outperforming over classical techniques.

In future to improve the classification accuracy we could try to combine various deep learning architecture. We could also try to improve the performance by optimize and tune the parameters for our neural network architecture and by using this framework we could implement a computer vision based system to classify and sorting various products for agriculture and food industries..

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