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***Abstract*- Rice is the most consuming food all over the world and the market for rice is always high. In rice manufacturing industries the market demand is always centered on quality of rice. In the evaluation of rice quality the examination of physical dimensions like length, width and thickness plays an important role. Traditional methods used for detection these factors are time consuming and imprecise as they are done manually. This paved the way for development of computerized vision in rice quality inspection. In the proposed method both image processing and machine learning techniques are clubbed to analyze and grade the quality of rice kernels with the help of Support Vector Machine (SVM) classifier in python platform.**

Keywords*- *Rice quality, image processing, machine learning, SVM, python.

I. INTRODUCTION

When considering the production of grain products all round the world; rice is the prime product following wheat and corn. As stated in a recent statistics, half the world population relies on rice as their main food. The quality of rice grain marks a significant impression on healthy life, which is getting deteriorated by increase in world population and change in climate condition. Many quality criteria are considered for rice production in our country such as physical appearance, aroma, taste and cooking characteristics to make it stand out on market shelves. After production, visual inspection of rice kernels is the only procedure that has been used highly in commercial environment for the assessment of rice quality. Conversely this manual method is time consuming, inconsistent and not reliable due to human errors. This increased the need for technological methods for calibrating and determining the types of rice variety. Hence machine vision technology is developed suitably to serve this purpose. Here the grains are evaluated in terms of many physical properties such as size, color, texture and quality. Many sophisticated algorithms are also introduced to grade the rice quality by using image processing based automated classifiers. These algorithms generally involve digital imaging, scanning and examining of the kernels using imaging tools.

II. LITERATURE SURVEY

Teresa Mary Philip et al., 2017 [1] describes that computerized classification of rice grains will help in detection of errors found in manual grading. Many studies are performed considering the morphological features of grains like area, shape etc. but still the shapes and sizes are too varied in diverse varieties. Hence to compose a general formula for covering all varieties becomes a tedious process. In this work, classification of 9 varieties of commercially popular grains from the South Indian region is done by using fourier transform. The spatial features are extracted from the images of grains along with the fourier features to classify the grain. The sorting is performed in two levels with the help of NB Tree classifier and SMO classifier. The study was able to bring notable accuracy as it used internal features of the grains along with the spatial features.Many researches are done to identify and classify the rice grains based on their quality. The quality of the rice is coined based on many parameters and one among them is the chalky region of rice. Chalky is the white part in the rice and this does not influence the taste but the quality of rice. The rice with minimum chalky area is branded as first quality rice. Zahida Parveen et al., 2017 [2], develops an algorithm to brand the rice grains on the basis of few traits like length, thickness, colour and also chalky area. Here image processing techniques are conducted using MATLAB codes and extended maxima operator is used to detect the chalky area in the rice. The dimension and colour of the rice is also calculated in this algorithm using 22 sample images of rice.Adulteration in the food grains have to be eradicated as it' s directly affects the health of a person. So many novel techniques have evolved to analyse the quality of the grains. Kuchekar et al., 2018 [3] have made an attempt to grade the rice grains based on image processing techniques. Quality of rice is determined based on the physical and chemical characteristics like area, length, width, moisture content, whiteness, milling degree etc., Here the rice grains are ranked and classified based on these features extracted from the samples using canny edge detection method. The results obtained are found to be motivating.Yuchen Kong et al., 2019 [4] has proposed a novel method to automatically

detect the thickness of rice using photogrammetry concept. The rice edges are determined by considering the factors like length, width and thickness. Here the binocular stereovision principle is used for extracting all the features of rice except for the texture as it' s hard to match the respective points in 3D reconstruction of the image. First the shape features are considered to find the length and then by using the way of space intersection the height of rice is obtained. Finally by using the hypothesis that the average thickness of various rice will be twice the height of the rice, the thickness of rice is extracted. Considering the hulling process the experiment was conducted on six types of rice or grain. From the results obtained the error was not more than the acceptable range of the industrial standard. Hence the proposed algorithm validated that the thickness of rice can extracted using edge detection method.While assessing the quality of rice, the size and mass of the kernels plays an important role especially in head rice yield. Samrendra .K.Singh et al., 2019 [5] developed a new methodology that merges image processing and machine learning (ML) ensemble to precisely measure the size and mass of many rice kernels concurrently. Here, with the help of recursive method an image processing algorithm was developed to identify each and every rice kernel from an image and calculate the size of the kernels based on the pixels occupied by the same. The size and mass of the rice kernel was predicted based on the number of pixels it represents. Many popular machine learning models were employed to build a stacked ensemble model (SEM), to project the mass of the individual rice kernels based on the traits obtained from the pixels of the each kernel in the image. The three types of rice grains used for the analysis were Calhikari-202 (small grain), Jupiter (medium grain) and CL153 (long grain). The developed algorithm showed satisfactory results in predicting the size and mass of rice kernels when quantified.Dr. T. Avudaiappan et al., 2019 [6] focused on a study to analyse visual features such as shape, colour, texture of rice seed images. Here image processing technique was combined with classification techniques like MLP, SVM, Decision tree and Bayesian network to diagnose and classify rice seeds from assorted samples in a non-contact mode. Using a camera the images of the grains were captured pre-processed, filtered, segmented and the features are extracted using edge detection method. These features obtained were fed to the machine learning algorithm and the results were displayed in LED.Wyawahare. M. V et al., 2020 [7] proposes an automatic method for grading milled rice. Broken rice plays an important role in grading of rice. This method is useful in detecting the proportion of broken rice from the sample' s image. The coloured images of the samples are processed using special preprogramed processing techniques and the required features are extracted to form the regression model. As simple regression models are involved, lesser runtime compared to existing methods is required for estimating percentage of broken rice. The whole procedure is executed using MATLAB and produces minimum root mean square error. Kantip .K et al., 2020 [8] developed a method to inspect the quality of rice kernels using database of 14 varieties of rice from Thailand. They have used a large dataset of 3500 samples of these varieties obtained from different areas to check the quality. After the initial steps like pre-processing and feature extraction the rice varieties are classified using the traditional machine learning and modern deep learning techniques. They have used four methods of machine learning and five models of deep learning for evaluation. The investigation of the performance of each classification was done in individual variety of rice in subgroups and collective groups. In the experiment performed, SVM of statistical method and InceptionResNetV2 model of deep learning shows high range of accuracy.

III. PROPOSED SYSTEM

The focus of the suggested work is to introduce an automated structure to identify and classify rice grains according to the market expectations. To meet this expectation and attain a consistent standard quality some of the physical and chemical characteristics of rice have to be analyzed. Here machine vision based approach is employed to recognize, process, extract and classify the rice grains in a non-contact manner. To aid this process image processing and machine learning techniques are utilized by applying python language since it is incorporated with number of packages which are helpful for machine learning tasks. The architecture of the system describes the process involved in this work for proper diagnosis of the rice quality. The main processes involved are image processing and image classification. Image processing is vast area and sectioned into many sections and each of these sections are explained in detail in this paper.

A. Image Acquisition:

This is the first step in any image processing technique. Different variety of rice are identified and taken as samples and image of these rice kernels are captured by high quality camera system with uniform and adequate light. The rice kernel size is an important aspect to determine the class of the rice. So proper placement of rice grains is a key point in this module of image acquisition. The rice is randomly seeded on the plane background and the images are captured. These images are

further cropped to ensure that no other objects appear along with the kernels.

B. Pre-processing:

The preprocessing procedure is used to obtain a new value for brightness and color in the output image. The term preprocessing of images comprises the following essential steps:

Resize **:** The images captured by a camera vary in size and it is necessary to create a base size for all images. The term image resizing or scaling is used to increase or decrease pixels of an image to change its size and this helps in zooming of the picture. When decreasing the size of the image it will lead to loss of data in reconstruction process but it helps in avoiding complexity in network by reducing the time required for training.

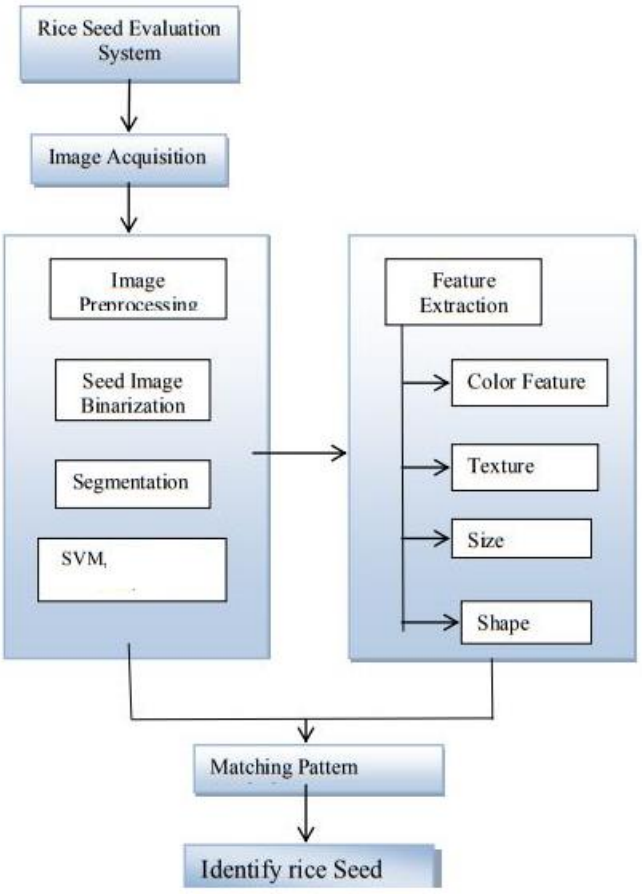

Fig: 1 System Architecture

RGB to Gray **:** Gray scale images are the one which displays only gray shade colors as multiple shades of black and white color. . In gray scale, the intensity of each pixel will be 8 bit and the image will show 256 levels of intensity for each pixel. Similarly in color images the shades will be in the combination of Red, Green and Blue each with 8 bits summing to 24 bits and 16,777,216 levels of intensity. Thus to provide minimum information for each pixel, color images are converted into gray scale. This can be done either by average method or weighted method.

Noise Removal: Removing of unwanted information which is termed as noise from images is also known as smoothing. Here the noise is eliminated or reduced using median filter. Median filter is an example for nonlinear filter and it is extensively used in image processing. It shows a better performance when used over noises like salt and pepper, Gaussian and random noise.

Image Enhancement: This method is used to enhance the peculiarity and standard of the original image before it undergoes processing. Using this, the minute details which are visualized in the original image can be interpreted. Hence this operation' s output will be useful in the feature extraction segment for the analysis of the rice quality.

C. Image Segmentation :

Usually an image may have some region which is not of importance. So segmentation comes here, where the image is divided into many parts and Region of Interest (ROI) is alone considered. This aids to discover the required objects and boundaries in an image. Segmentation is acquired by many techniques like region based segmentation, edge based segmentation, segmentation by clustering and Mask R – CNN. In this proposed work K – means clustering algorithm is used for segmentation. It is a long distance algorithm which is simple and uncomplicated to understand. Here the image is divided into clusters of similar data points and the ' K'

represents number of clusters. The working of this algorithm is shown in the below steps.

Step 1: Initially some k clusters are selected.

Step 2: Every data point is allocated to any of the k clusters randomly.

Step 3: Center of these clusters is determined and

Step 4: Distance between the center of each cluster and every data point is calculated.

Step 5: Based on this distance now the data points are assigned to the nearest cluster.

Step 6: Again the center for newly created cluster is calculated.

Repetition of steps 3 to 6 is done till the center of the cluster remains the same.

IV. RESULTS AND DISCUSSION

In our proposed system we have designed till segmentation process. The following figures represent the output of each module in our project. Fig 2 represents the loading of the program, Fig 3 represents the image acquisition stage, Fig 4 represents the Resized image, Fig 5 represents the gray scale image, Fig 6 represents the noise removed image by filter, Fig 7 represents the enhanced image after noise removal. Finally Fig 8 represents the segmented image which is got as the output using K means clustering.

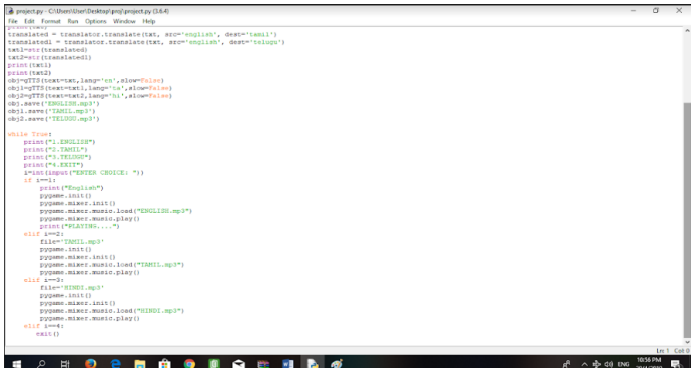

Fig 2: Loading Program

Fig 3**:** Image Acquisition

Fig 4: Resized Image

Fig 5: RBG to Grey scale Image

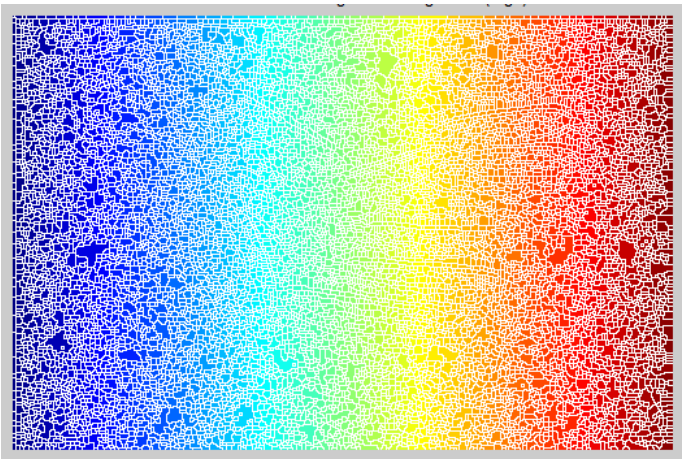

Fig 6: Noise Removal

Fig 7: Enhanced Image

Fig 8: Segmentation

V. CONCLUSION

The main Objective of this paper is to develop an effective model which helps in grading rice grains without labor intensifying work. From the results obtained we can conclude that this system is efficient and cost effective. More data images can be acquired in future for precise evaluation.

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