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An Efficient Image Processing Methodology to Assess Quality in Food Grains

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***Abstract*—** Agriculture industry is the backbone of any emerging country, in developing countries like India the bulk of the rural population mostly depend on agriculture as their main basis of revenue. Several major crops grown in India are rice, wheat, maize, jowar etc. The primary focus of this paper is to present an efficient method to detect quality of rice grains and also to detect the dissimilar varieties of rice grains via various image processing methodologies. Commercialization of rice grains is mainly dependent on the quality analysis of rice grains which is further based on size of the grain kernel (full, half or broken) and rice varieties are recognized by human inspection. Results of the inspections may change depending on the expertise of inspectors and decisions made by inspectors according to external parameters. Furthermore, the decision making abilities of quality check inspectors are dependent on their personal characteristics such as exhaustion, annoyance, partiality etc. and identification of dissimilar varieties is carried out by applying traditional methods which are erroneous and consumes more time. Digital image processing techniques will help overcome the above issues, which offers quick, economical, and reliable solutions.

***Keywords*—** Agriculture, Grain Kernel, Image processing, Feature extraction, Grain counting, classification of rice grains.

I. INTRODUCTION

Rice is one of the principal crops of India; this country has the largest region under rice farming, as it is one of the major food crops. India is one of the prominent producers of this crop second to china. Contributing for more than 20% of rice production across the world. Being second largest producer of rice in the world, India is administering the use of rice grain criterions to ensure that producers get compensated maximum price for their grains based on its quality. Rice is the most significant grain with respect to human nourishment and caloric intake, contributing more than one fifth of the calories consumed globally by the human's [1].

The quality analysis of rice grains is usually done on the basis of grain length i.e. full, medium and broken length and a feature called chalkiness (white patches inside the grains developed due to prematurity of grain) more the chalkiness lesser the quality. If rice samples consists more than 75 percent of full length grains it is of high quality, between 50-75 medium and below 50 regarded as low quality. Identifying the varieties of grains is usually done by assessing the features of the grain such as grain length, major and minor axis length, aspect ratio, edge to area ratio, compactness ratio, shape, color and texture features such as contrast, correlation and homogeneity [2]. Nowadays, image processing is one of the fast budding technologies. It forms fundamental exploration area within various engineering and computer science disciplines. Image processing fundamentally comprises of methodologies for capturing the image via image acquisition tools, Analyzing, extracting and manipulating the image, Yield in which outcome can be transformed image or report that is based on image analysis. The features required to carry out the analysis can be extracted by using advanced digital image processing methodologies.

The several techniques that are part of Image Processing are as follows:
Image preprocessing: contains a group of methods that are used to develop the visual appearance of an image or to translate the image to a form which is suitable for human or machine understanding.
Image enhancement: the objective is to emphasize certain image features for successive examination or for image display.

Image segmentation: is the procedure that divides an image into its integral parts or objects. The level to which this division is conceded out be subjected to on the problem being solved, i.e., the segmentation should stop when the objects of concern in an application have been isolated.
Feature extraction: This method extracts high-level features needed in order to perform classification of targets. Features

are those items which distinctively label a target, such as size, shape, composition, location etc.

Image classification: It is the process of labeling of a pixel or a group of pixels based on its grey value. Classification is one of the desirable methods used for information extraction.

II. METHODOLOGY

The system architecture for quality analysis and identifying different varieties of rice grains is as shown in figure 2.1. This constitutes of following steps.

- Input image: Images are captured by using flatbed scanning method using scanner at 1200 dpi resolution, rice grains were placed on glass plate and covered with black cloth scanned and saved in jpg format.
- Image pre-processing: Captured images were preprocessed to remove noise by applying background subtraction methods.
- Extract grain length: This feature is extracted for the purpose of quality analysis, the maximum grain length is compared with all other grain lengths and which ever have length more than 3/4th of biggest grain are counted as whole grain.
- Grain counting: Number of whole length grains in the sample is counted on grains extracted in previous step.
- Analysis of grains: if number of whole length grains in the sample is more than 75 percent of total grains then the sample is labeled as high quality, if count is between 50-75 then medium quality and below 50 labeled as low quality.

Features extracted for the purpose of identification are as follows.

- Average Length (La): absolute length of a grain is acquired by finding per pixel length of an image which can be found by calibration. Lm is calculated from the image by computing the Euclidean distance between the two most distant points on the edge of the rice grain.
- Area: The area a grain is obtained by finding total number of pixels enclosed by boundary of a rice grain object.
- Aspect Ratio (Ra): It is the ratio between the shortest (dmin) to the longest (dmax) diameters: Ra = dmin / dmax.
- Shape factors (Sf): Is defined as: Sf = drmsd / dmean.Where dmean is the mean diameter of the grain with root mean- square deviation (drmsd): drmsd = Sqrt (((dmax - dmean)2 + (dmean - dmin)2) / 2).
- Compactness Ratio (Rj): this feature is used to find the shape of a grain, it assigns the values from 0-1 means elongated to compact respectively.
- Edge-to-area ratio: Re = (E / A), the value of E is the sum of detected edge pixels from the canny edge operation, as detected within the area region each connected component.

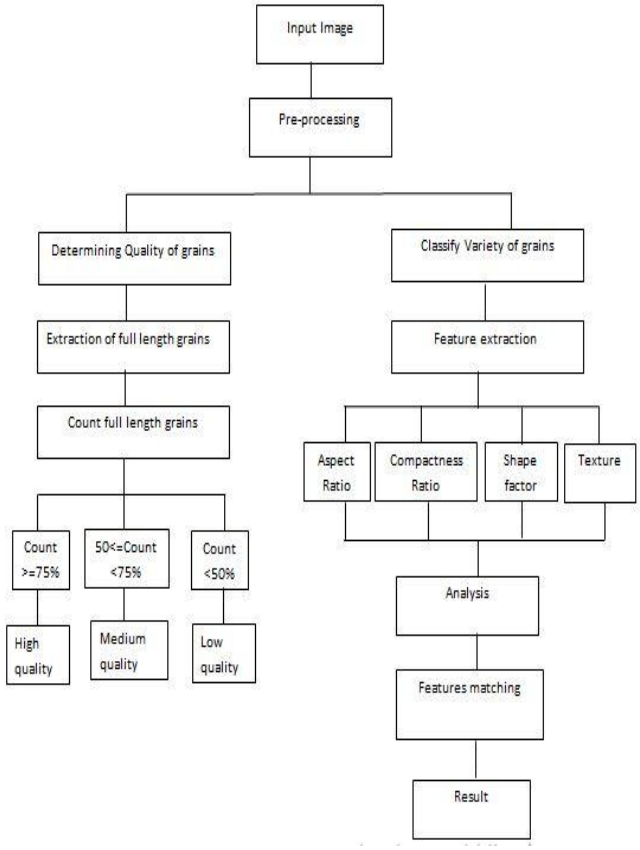

Fig 2.1 System architecture for quality analysis and identification of grain varieties.

- Features may be recorded for individual grains. Then the mean and standard deviations per sample can be determined.

III. RESULTS

Extracted properties of the grains such as area, aspect ratio, compactness ratio and texture features for all the sample images etc... And on the collected values we applied statistical features such as mean, mode and median to identify the range of values a variety of grain takes. Then based on the range we classified the grains hierarchically and feature matching was done with the standard values. We had collected 125 sample images by the process of flatbed scanning for the problem of quality analysis and we were able to identify the quality of all samples with 100% accuracy when compared with results obtained by manual counting method (i.e grains in the sample were counted manually by a person by separating full, medium, broken grains and count of full length grains was noted along with total number of grains in individual sample). For the problem of identifying the variety of a grain the sample images with only full length grains were chosen, covering 25 different varieties of rice grains and features extraction was

done on every individual grain by applying bounding boxes then mean, mode and median were found collectively for the whole sample. Based on the extracted features grains were classified hierarchically and feature matching was performed for all the samples to identify variety of grain sample. Out of 25 different varieties chosen were able to identify 19 varieties accurately.

IV. CONCLUSION

Successfully recognized 19 varieties were 64 Ration, Egg rice, Gamsale, Ganga Kaveri, Ankur sona, Sri Ram Sona, Jaya dosa, Kampli sona, Mamul sona raw, Mamul sona, Mangalore boiled, Nellur sona new, Prakash sona, Rajmudi, Salem, Sona masoori end quality, Sona masoori steam fine, Basmati, Mangalore rice. Due to overlapping of the extracted features we could not recognize 6 rice varieties such as Sona, Nellur sona, Malebennur sona, Sona raw, Sona raw and Kampli sona.

V. FUTURE ENHANCEMENT

Extension on this work may target identification of rice based on more specific guideline requirements for certain rice varieties, such as Basmati, Gamsale, Selam, Sona etc. Also the use of surface texture and intensity features can be explored for the identification of white area in milled rice, a factor in defining grain chalkiness which is used as a factor in determining cooking quality of rice and there is a need to identify some more attributes using which all rice varieties can be distinguished and recognized.

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