Rice Grain Quality Measurement Using Image Processing

Submitted in Partial Fulfillment of the Requirements for the Degree of
Bachelor of Technology
In Computer Science and Engineering

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Certificate of Approval

It is certified that the work contained in the project report entitled, "**Rice Grain Quality Measurement Using Image Processing** ", is under my supervision and guidance for the partial fulfillment of the degree of Bachelor of Technology in Computer Science and Engineering and that this work has not been submitted elsewhere for a degree.

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Signature of External Examiner
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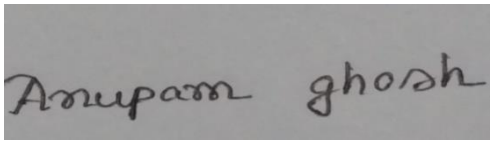
Declaration

We declare that this written submission represents our work in our own words and where others' ideas or words have been included, We have adequately cited and referenced the original sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will cause disciplinary action by the Institute and can also evoke penal action if proper permission has not been taken when needed.



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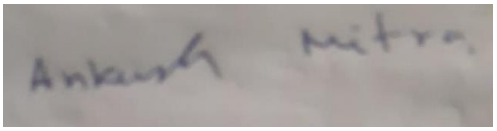

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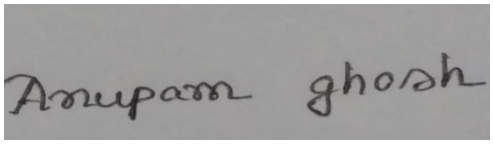
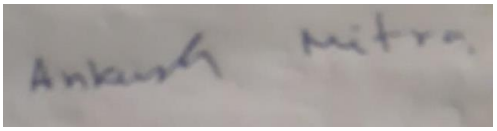
We would like to show our greatest appreciation to Sir **Mr. Mihir Sing**. We cannot thank them enough for their tremendous support and help. Without their encouragement and guidance, this project would not have materialized.

We are grateful for their constant support and help.





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Abstract

Rice (Oryza sativa) is among the most essential food in Indian Culture. 50% of Indian population depends on this grain for their primary food. Upto the report of July 2017, Rice is counted as one of the most consumed food worldwide. So maintaining rice grain quality ,obviously is one of the bold field of research.Traditional methods of Rice grain measurements were done manually(like by humans), which turns out to be time consuming ,not effective and not accurate. But In the era of modern technology we have options to take the help of advanced technology. Through this paper we are going discuss how we can measure the quality of rice grains , by analysing each grain's morphological traits. By this we can see how much proportion of a type of grain is presented in the mixture and we will get to know the amount of impurities(like small stones or pebbles or extremely broken rice) present in the mixture.This is how we can finally get our desired result ,in minimal time but with maximum accuracy.In this paper we are going to propose the methodology for measuring the quality of rice grains effectively, by using Image Processing technique, depending on the rice grain's morphological features.

Keywords- Rice Grain Quality , Image Processing , Morphological Features.

Introduction :

Rice is one of the most produced crop in India and it is also our main food.India has largest area under rice cultivation.Our country is the world's the largest exporter and second-largest producer of rice in the world. Production has been increased from 53.6 million tons in FY 1980 to 120 million tons in FY2020-21.Our country can get a huge profit by exports. So,more we produce,more we gain.Apart from that, improvement of the quality of rice is need to be done at the same time.So,We have to properly inspect the quality of rice. Color,size ,texture ,shape,bulk density etc are the factors which are needed to be considered ,while testing the rice quality .The traditional process of determining rice quality is manual , costly and it takes long time. So,We have to look for a system which can identify rice quality accurately and give correct test result for future use, in various rice samples ,multiple times.Therefore, digital image processing technique helps to test the system, executed previously.By seeing the results of rice grain length ,we can classify whether it is intact,incomplete or damaged ,based on rice grains' size and shape.By studying this topic ,we can make a rice quality detection system for our locally available rice grain(like Basmati rice) based on digital image processing algorithm to analyze rice quality. Here is the flow chart or standard diagram of proposed model :-

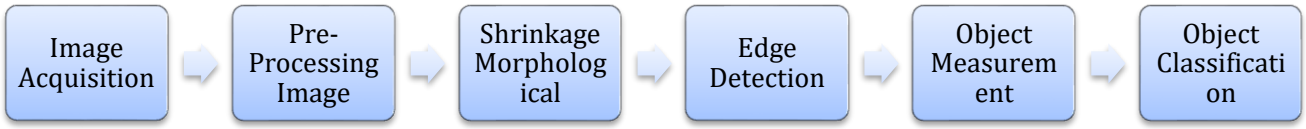

Figure1: Stages of Image Processing

It is an image processing by a digital computer ,which was processed into a rice quality information. Laplacian edge detection is one of the optimal recognition process, which is for detecting the gray scale image boundaries and to reduce the error rate and processing data amount.The main objective is to propose a rice quality detection system, which can assess the rice quality using image processing.

Literature Survey:

Rice grain quality measurement is one of the most interesting feild of research in Agriculture.Varieties of rice grains are present worldwide. Also rice has many morphological, color , textural features,that can be used for differentiation and quality measurement purpose. Herath H., and Eng. de (2016),suggests the method of classifying rice grain of four varieties along with checking the percentage of purity of rice grains ,with the help of image processing techniques on the basis of several features like grain color and shape.

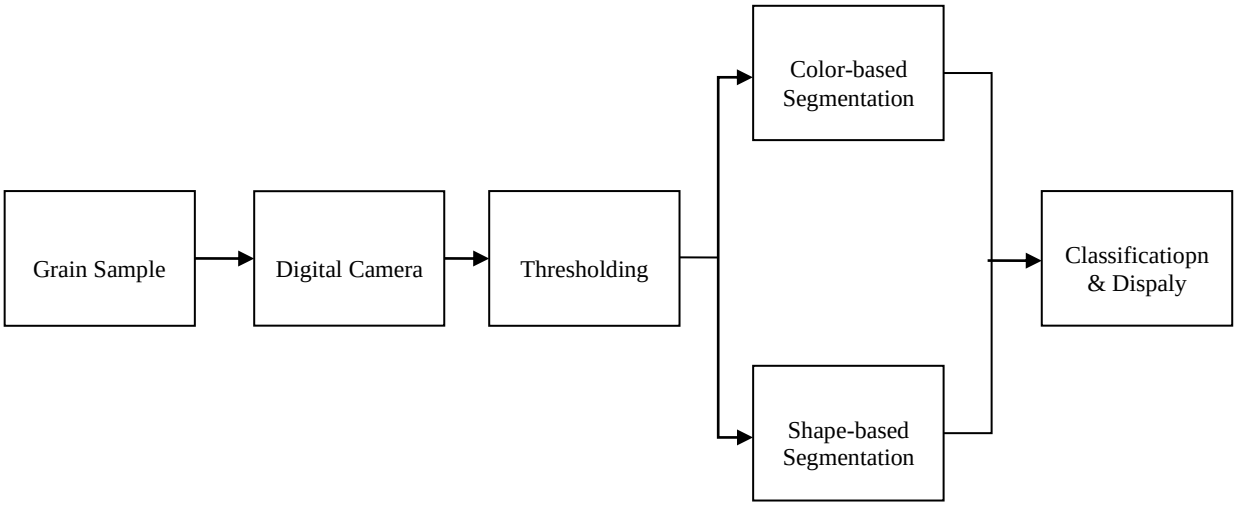

Figure 2: Basic building block for system operation

Fragments of the grain are considered as highly effective, for quality of the rice grain ,in this model.To identify the quality of the grain, machine vision systems are used here .This model deals with the histogram analysis.It consists of three colour channels- Red, Green and Blue (performed in MATLAB) of given input image of rice grain mixture based on grain colors. For this reason Images(pixel size: 2113 X 2177) of two rice samples Rice A and Rice B with four varieties of rice grains (White Basmati, Red Basmati, White Samba and Red Samba) mixture are accuried.

Figure 3: Grains Sample

After that, all the pre-processing operations(to convert into binary images, to perform noise reduction, to reconstruct the image etc) are done in MATLAB. Preprocessing was necessary for removing noise and for getting better result from the algorithm.

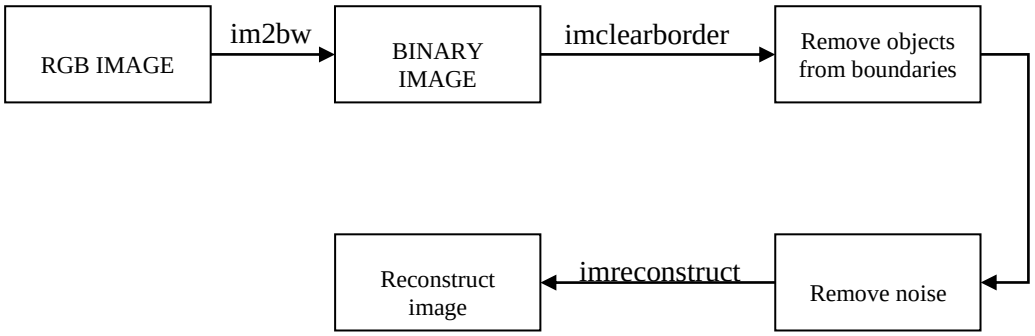

Figure 4: Pre-Processing Operation

Then from the Histogram of the input image rice grains of different colors(basically red and white) are filtered out by comparing the RGB vector value of each grain. In this case ---

- 85<s(x,y,0)<160
  34<s(x,y,1)<144
  15<s(x,y,0)<126
  Combinations were considered as red coloured grain.

- 123<s(x,y,0)<184
  127<s(x,y,1)<189
  128<s(x,y,0)<190
  Combinations were considered as white coloured grain.

  Where s(x,y,n) is the mathematical the representation of colour pixel value.
  R=s(x,y,0) ; G=s(x,y,1) ; B=s(x,y,2)

Some precaution were taken beforehand(grains were manually separated to avoid contact) for better efficiency.Also Black background of input image is taken here for better result. y Tzu. , Chia-Lin., Szu-Yu., Heng-An. and Yan-Fu(2016) in Computers and Electronics in Agriculture Volume 127, September 2016, Pages 716-725, 10.1016/j.compag.2016.07.020, gives the idea about to distinguish 30 varieties rice grains non-destructively by image processing and sparse-representation-based classification (SRC)(machine learning algorithm which is suitable for solving high-dimensional problems and encodes the representative training samples ' characteristics as the atoms in a dictionary). Twelve morphological traits, Nine color traits, Seven textural traits, and Twenty Fourier descriptors(one set of cosine and sine harmonics at various frequencies to encode the outline of an object) are quantified from the 1500 grains, with original samples partition into 10 groups , 9 groups for training and one for testing purpose for distinguishing different grains varieties.This process repeated for 10 time with every group once for testing. Some Morphological traits of the grain ,were -- perimeter, surface area, length of major axis,Haralick ratio etc.

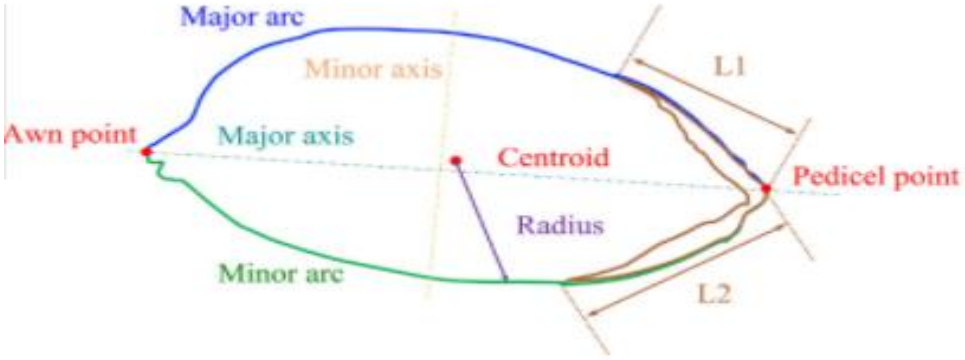

Figure 5: Morphological traits of the grain body and Sterile lemmas

Multifocus image fusion Technology was used for better image quality.

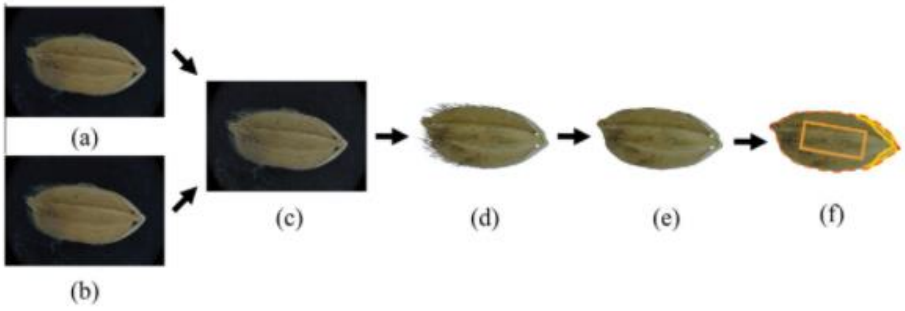

Figure 6: Multifocus Image Fusion and Background Removal. Grain images with the (a) Center and (b) Edge in focus; (c) Image fused from (a) and (b); (d) Foreground image; (e) Brush-eliminated image; and (f) Sterile lemmasand region of interest.

Distribution of color was done by an ellipsoid. This model gives result with the average accuracy of 89.1% and SD of 7.0% compared to average accuracy 92.8% and SD 6.8% of SVM .For some varieties like variety Aswina 330 and R101 , the accuracy is 74.0% because of their resembled appearance. Muhammad., Tayyab., Syed., Sajid(2018) in International Symposium on Recent Advances in Electrical Engineering (RAEE) Islamabad, Pakistan, INSPEC Accession Number: 18638906, pp. 1-6) suggest Principal Component Analysis and Canny Edge Detection which can be used for Classification. Quality analysis is Based on major axis length,minor axis length, eccentricity,perimeter, Area and size of grains.In this paper Six different varieties of rice are classified and discussed . We capture the images with approximate black background.We need to identify those unwanted noises in background by using imopen() function. In order to analyze easily, We need to binarize and segment the image.We use Bwconncomp() function to find connected component in binarized images. The 100 images of each variety of rice grains are fed to train the database.We calculate different morphological feature using regionprop(cc,features).We Classify and analyze the quality by comparing the sample with database . Canny edge detector helps to detect the edges of rice grains.

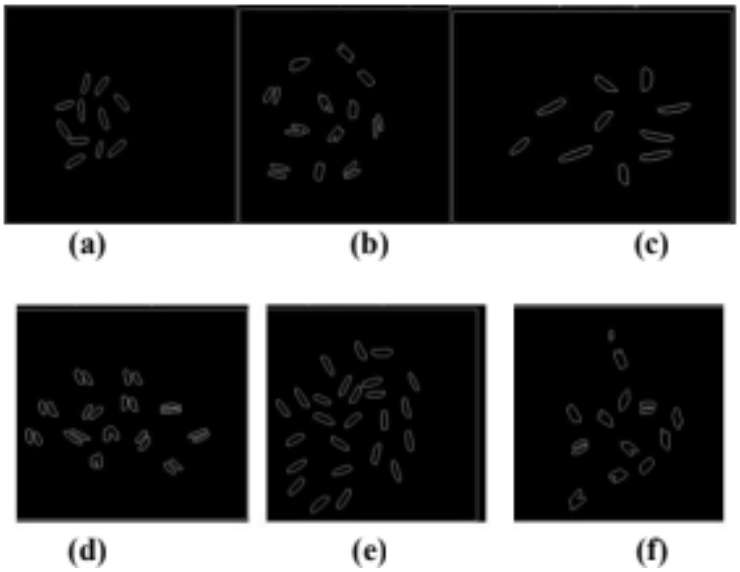

Figure 7: Edge Detected Images (a) sample-1 Kainat Sailla Rice Single Grain (b) sample-2 Kainat Sailla Rice Double Grain (c) sample-3 Super Colonel Rice Single Grain (d) sample-4 Super Colonel Rice Double Grain (e) sample-5 Old Awami Rice Single Grain (f) sample-6 Old Awami Rice Double Grain

Then Eigen values and vectors on the basis of morphological features are calculated .with the help of PCA, different varieties of rice are arranged by comparing the respective image with a database. We get result 92.3% and 89.5% respectively with respective of different quality. Proposed system can work efficiently within minimal time. we use Principal Component Analysis for maximizing the chances of getting the data.Its use is widely seen in Neuro robotics, signal processing , IVP and Pattern recognition etc.It depends On eigen value,decomposition of matrix and covariance of matrix.According to the paper ,first step to implement PCA is that we have to get the data. Then We need to store the data in matrix form.Row number indicates data and Column indicates features. After that we have to standardize the data.Then We have to divide each observation in a column by that column's standard deviation, only if we see that the importance of features is independent of the variance of the features. It is called centered and standardized matrix Z. Next Calculate covariance of Z. Calculate Eigen Vector and Eigen Value. Then Sort the Eigen Vector.After that calculate all the new features. Atlast drop the unimportant feature from new set. Here another important keyword is Canny Edge Detection.It is used optimally to recognize the boundaries.The edges are Built by maxima and minima intensity gradient of function.To perform Canny Edge Detection mehod , we need to following steps. First we have To blur the image to remove the noise .It is known as smoothing. Then Search the gradient and mark the edges where gradient is High .We have to use Non maxima suppression technique to mark the edge. We need to apply double thresholding technique to find potential edge. In this paper five

different varieties of rice grains are taken .Samples are Super Colonel, Khushboo, Basmati, Kainat Sailla, Old Awami.

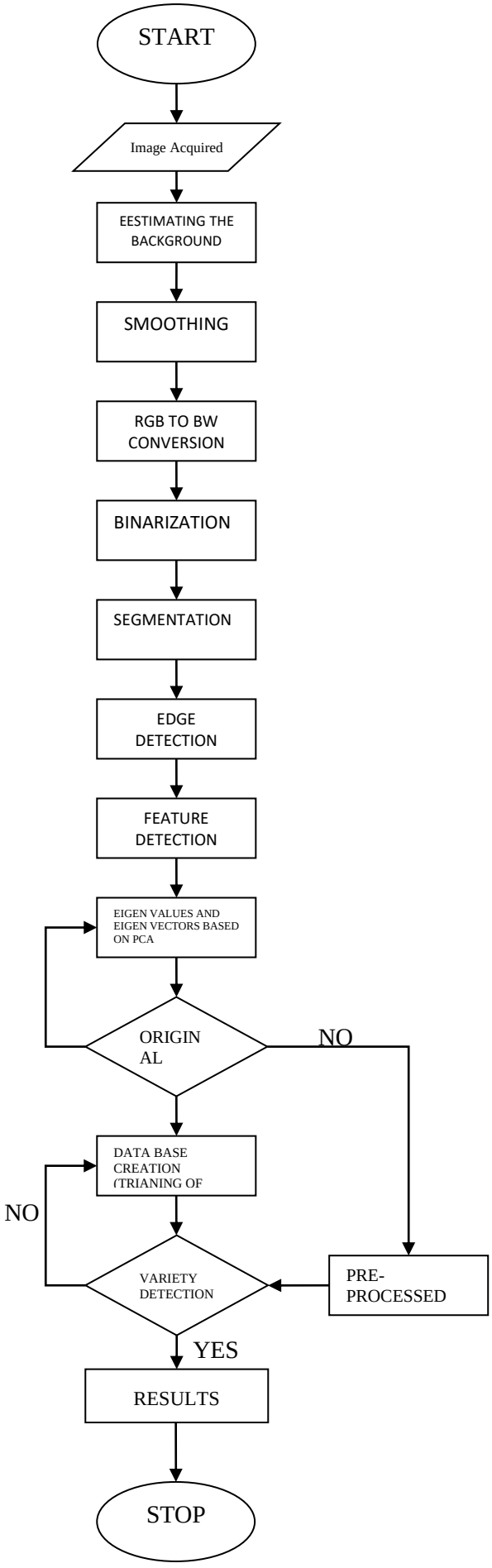
START
Image Acquired
EESTIMATING THE BACKGROUND
SMOOTHING
RGB TO BW CONVERSION
BINARIZATION
SEGMENTATION
EDGE DETECTION
FEATURE DETECTION
EIGEN VALUES AND EIGEN VECTORS BASED ON PCA
ORIGIN AL
NO
DATA BASE CREATION (TRIANING OF
NO
VARIETY DETECTION
PRE-PROCESSED
YES
RESULTS
STOP

Figure 8: Block Diagram of Proposed System

Jan Rei S. , Jun T. , Larah Mae P.(2019) ,in Proceedings of the 2nd International Conference on Computing and Big Data October 2019, ICCBD 2019 Pages 140–144 ,discusses the efficiency of using features extracted from the 3D reconstructed image of a rice grain in classifying different varieties of it.

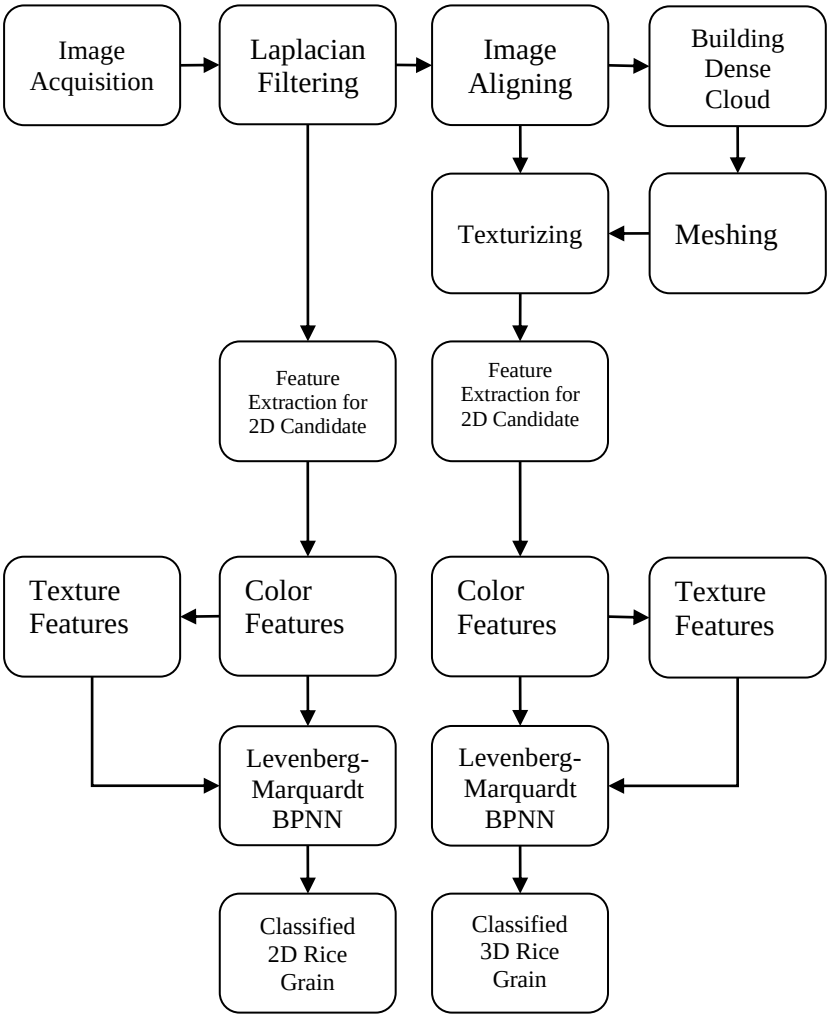

Figure 9: Conceptual Framework

The sample consists of 250 rice grains belonging to five varietal groups of rice in the Philippines. In order to capture the image We set up camera on the platform in eye level.The platform was rotated with the help of Arduino.The researcher captured video frame in order to store the video frames in jpeg format.The Data was captured

through Video and The images that has been divided into 80 images were filtered to show optimized images in order to reconstruct images.

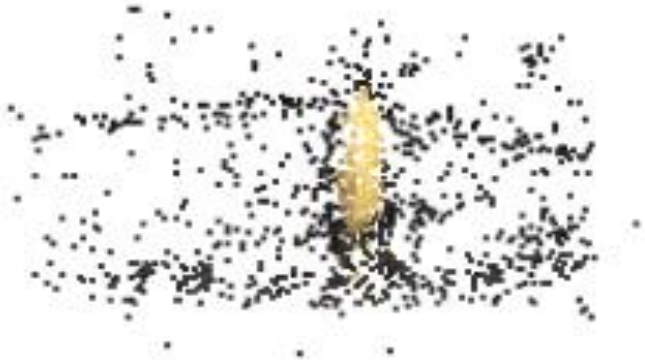

Figure 10: Cloud Point Figure

The preprocessed data were passed to Agisoft which helps to reconstruct the 3d images. After the reconstruction, 18 color features and 21 texture features were collected from the image. After this, 32 features were selected for this study.In order to calculate Hue,Saturation and Intensity,We use RGB band in shown below:-

$$H = \begin{cases} \theta, & if\ B \le G \\ 360 - \theta, & if\ B > G \end{cases}$$

$$where\ \ \theta = \cos^{-1}\left\{\frac{(1/2)[(R-G)+(R-B)]}{[(R-G)^2+(R-B)(G-B)]^{1/2}}\right\}$$

$$S = 1 - \frac{3}{(R+G+B)}\{\min\ (R,G,B)\}$$

$$I = \frac{(R+G+B)}{3}$$

And texture feature is to identify distinction between images. BPNN architecture is used to classify the rice grain's varietal type using MATLAB. It is the brief overeview of this paper.The following rice varietal types were used in the study: NSIC rc216, NSIC rc300, NSIC rc222, NSIC rc160, and NSIC rc218 sr.With these approach the researchers get result 74%, 82.4%, 66.8%, and 62% in accuracy method (The table 2) respectively. Then We compute F measure and see that the accuracy level of 2D dataset with 32 features is higher than the accuracy of 3D data set with 39 features. We can see that NSIC218 has the F-measure based on all the datasets used, which gives 87%, 90%, 92%, 88% on respective datasets.The following F-measures of NSIC160 are : 73%, 78%, 55%, and 54% . The following F-measures of NSIC216 are: 78%, 83%, 57%, and 58% . The following F-measures of NSIC222 are: 71%,

82%, 70%, and 60% .The poorest performance of NSIC300 with the following F-measures are: 54%, 76%, 59%, and 47% . The red color channel made the noticeable correlation in order to predict the various types among all these features.In this paper,there is lots of improvement. Accuracy can be increased by reconstructing 3d images with the help of 3D scanners or proper calibration of the camera and object.The accuracacy is also dependent on lighting and image capturing.

RICE VARIETY	2D 39 FEATURES			2D 32 FEATURES			3D 39 FEATURES			3D 32 FEATURES		
	P	*R*	*F*	*P*	*R*	*F*	*P*	*R*	*F*	*P*	*R*	*F*
NSIC 160	79.10%	68.00%	73.13%	80.90%	76.00%	78.37%	60.5%	52.0%	55.9%	65.70%	46.00%	54.11%
NSIC 216	68.10%	94.00%	78.98%	85.40%	82.00%	83.67%	50.8%	66.0%	57.4%	51.60%	66.00%	57.92%
NSIC 218	81.00%	94.00%	87.02%	87.00%	94.00%	90.36%	90.4%	94.0%	92.2%	81.40%	96.00%	88.10%
NSIC 222	72.90%	70.00%	71.42%	87.00%	80.00%	83.35%	76.2%	64.0%	69.6%	67.50%	48.00%	60.00%
NSIC 300	68.80%	44.00%	53.67%	72.70%	80.00%	76.18%	60.4%	58.0%	59.2%	46.20%	68.00%	47.08%

Table 1: Confusion Matrix

	Precision	Recall	F- Measure
39 Extracted Features On 2D Dataset	**73.98%**	**74.0%**	74.0%
32 Extracted Features On 2D Dataset	**82.60%**	**82.4%**	82.4%

39 Extracted Features On 3D Dataset	**67.70%**	**66.8%**	66.8%
39 Extracted Features On 3D Dataset	**62.48%**	**62.0%**	62.0%

Table 2: The Accuracy of the Method

Nikhade., More.,, Manekar., and S. T.(2017), in International Journal of Electronics and Communication Engineering, ISSN 0974-2166 Volume 10, Number 1 , pp. 25-33 ,tried to analyse the Quality of rice based on major axis length, minor axis length, perimeter,area through neural network and digital image processing.

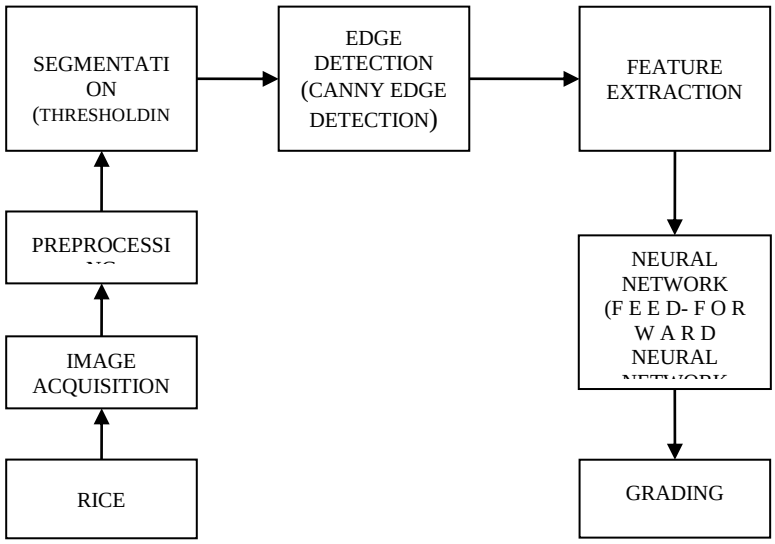

Figure 11: Block Diagram

The sample is Basmati Rice and a camera is used to acquire and capture the images of rice granules of different sizes . We fix the camera at certain distance between the lens and the sample table with uniform black background. The uniform intensity of light is given enough.In image acquisition We set up PC web camera under Uniform light set up. Through image acquisition and smoothing, the noises in the background are removed and through segmentation and thresholding, We are differentiating the granules from the background and extracting a binary image, which is used further for decision making process.In smoothing ,We use median filter

to preserve the edges of images during noise removal.After smoothing,We have to create Binary Image .We need the help of Segmentation.Here We use threshold as segementation technique. It is completely based on absorption of light to show features of their regions clearly. Here another important keyword is Canny Edge Detection. It is used optimally to recognize the boundaries. The edges are Built by maxima and minima intensity gradient of function.These are the following steps in Canny Edge Detection:-First We have to blur the image to remove the noise .It is known as smoothing. Second Search for the gradient and mark the edges where gradient is high. Then We have to use Non maxima suppression technique to mark the edge. In last step ,We need to apply double thresholding technique to find potential edge. Through canny edge detector, we can extract feature and this features are fed into neural network. The rice granules are graded depending on the size of grains present in the sample. After that we get the following result, 55% long grain as Grade 1, 33.33%small grain as Grade 2, 11.11% of stones
This Grading System is designed to make hard work simple.

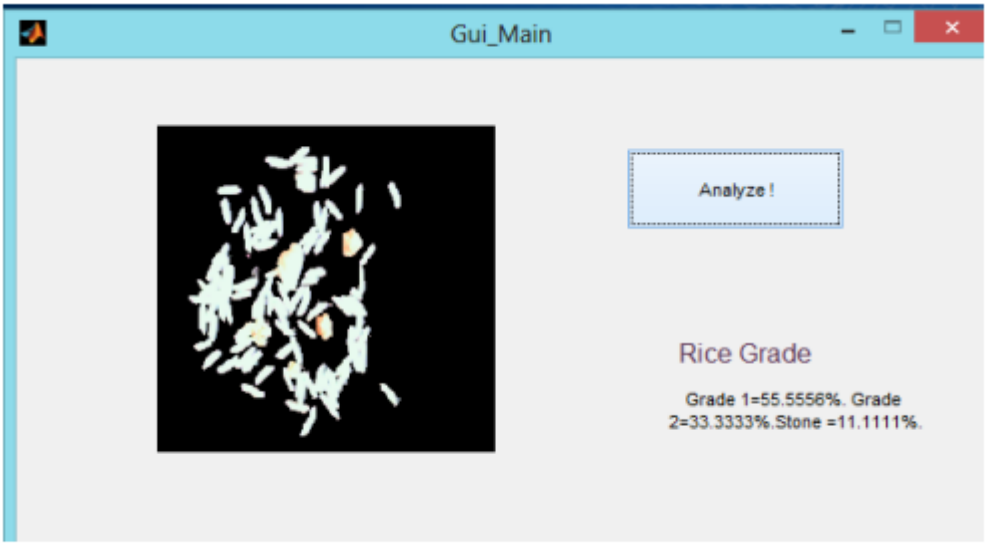

Figure 12: Result

Sudhanva., Sreedath., N Arunachalam(2017) in Proceedings Volume 10341, Ninth International Conference on Machine Vision (ICMV 2016); 1034126 , approached to calculate geometrical parameters out of the images of both scattered and heaped rice grains where the boundaries of rice grains, are not properly recognized.

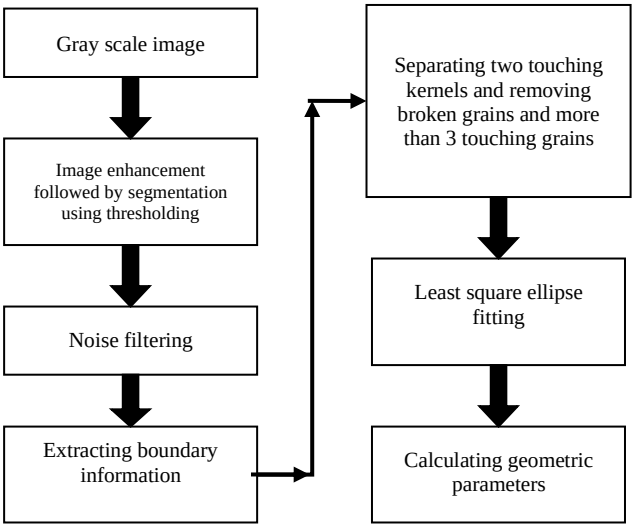

Figure 13 :Flowchart showing the methodology adopted.

One methodology on the basis of convexity is proposed to differentiate rice grains, which are touching in the scattered rice grain images and also geometrical parameters associated with them.

$$convexity = \left(y_j - m * x_j - c\right) * \frac{(y_{center} - m * x_{center} - c)}{|(y_{center} - m * x_{center} - c)|}$$

And in case of heaped arrangement we need to introduce Pixel-Distance Contribution Function which helps to obtain points inside rice grains as well as the boundary points of rice grains.

$$PDCF = \sum_{i,i \neq i_c} \sum_{j,j \neq j_c} \frac{I(i,j)}{D(i,j)}$$

We have to fit these points with the help of an ellipse's equation to calculate their breadths and length. The methodolgy are applicable on images of heaped and scattered rice grains of different varieties. It has been shown that each variety gives a distinct result.

y Muhamad. and Sidiq.(2021), proposed the idea of identifying rice grains, based on several physical features like the grain shape and size, moisture content, whiteness, and bulk density.This study describes a solution for evaluating rice grains based on shape and size using digital image processing. The algorithm in this study categorises "small broken" rice into four types: small, broken, large broken and head rice.

	FAO scale(mm) for Milled rice	USDA worker'scale (mm) for brown rice	IRTP-IRRI scale (mm) for brown rice
Length class (80% of sample or more)			
Extra Long	7.0 and over	-	Over 7.50
Long	6.0-6.99	6.6-7.5	6.61-7.50
Medium	5.0-5.99	5.5-6.6	5.51-6.60
Short	Less than 5.0	Less than 5.5	Less than 5.51
Shape class (80% of sample or more)			
Slender (long)	Over 3.0	Over 3.0	Over 3.0
Medium	-	2.1-3.0	2.1-3.0
Bold	2.0-3.0	Less than 2.1	1.1-2.1
Round	Less than 2.0	-	Less than 1.1

Table 3: Rice Grain Characteristics

OpenCV (Open Source Computer Vision Library) is used to support the creation of a digital image-processing system. There are 6 stages in running the image acquisition, image pre-processing, morphological shrinkage, edge detection, object measurement and object classification process. Digital image processing uses image input in several formats such as JPEG, PNG, JPG,The threshold algorithm is used to differentiate rice grain objects from the object's background in preprocessing image.Shrinkage Morphological Operation Image is for separating the tactile features of the rice grain without damaging the wholeness of a single feature.Then ,edge detection is carried out to help to determine the grain boundaries of rice .Object Measurement Image is to detect the rice grain count and after edge detection and caliper measuring technique we measure length and width value of grain and calculate the grain ratio.we compare those values with the database of the International Rice Research Institute regarding grain size characteristics of rice based on grain length and width.The digital image processing technique using the canny edge detection algorithm can calculate and identify the rice grain's quality based on the shape of the rice grains in a digital image format.

Cyril L. Macalalad, Edwin R. Arboleda, Adonis A. Andilab and Rhowel M. Dellosa (2019) in August 2019 ,International Journal of Scientific & Technology Research 8(8):1446-1450 ,suggests the idea of classifying rice grains using fuzzy logic algorithm and KNN classification technique.

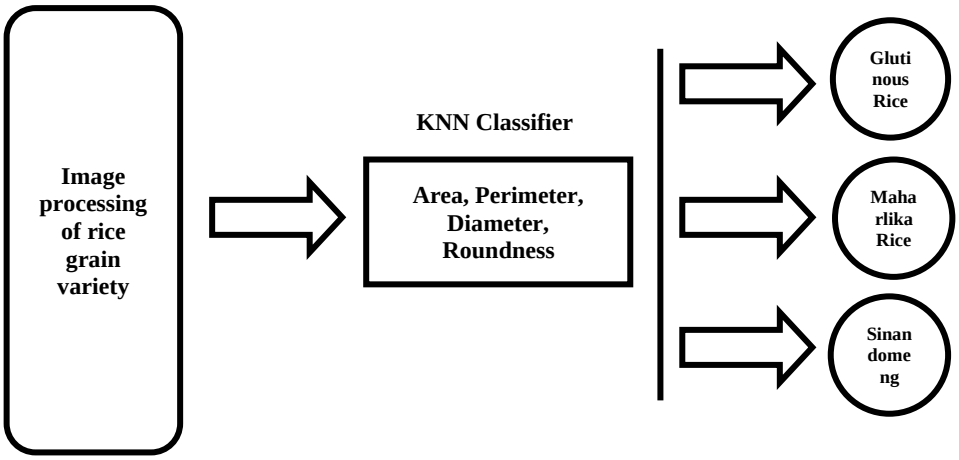

Figure 14: Representation of Features

In Fuzzy logic , classes of objects are related with unsharp boundaries where membership is a matter of degree. The main idea of using fuzzy logic in this project, is to classify the Three different varieties of sample rice grain. Sample used here are -------- Glutinous rice, Sinandomeng rice and Maharlika rice of Philippine market. Another important term , KNN or K Nearest Neighbor Classifier is a type of method ,which is used to classify objects on the basis of the examples of closest training sample's in the given feature space. Here the Euclidean distance between any two points P and Q i.e. P (p1, p2, pn) and Q (q1, q2, qn) was calculated using the following given equation

$$d(P,Q) = \sum_{i=1}^{n} (Pi - Qi)^2$$

For this, Sample images were captured using 13 Megapixel Camera of ASUS Zenfone 3 Max , with white background at 1.4x zoom (total 180 samples , 60 for each taken). It is known as Image Acquisition. Then Image Processing was done after acquisition , to remove all noises and to extract the morphological features. Next Image Segmentation is performed. This is the process of separation of a digital image into multiple segments like pixel sets.Segementation is used in this paper for converting the representation of the image into meaningful one. After that Fuzzy Logic Classifier is applied . Then KNN classifier method is used. Classification Model application is the next and last process. , This mainly consists of three setps-

Feature extraction from images, Getting data sets, and Classification of the gathered data sets. Some of the Morphological features and values, as per the paper, is here ,shown below---

Rice Grain Variety	Morphological Features			
	Area	Equivalent	Perimeter	Roundness
Glutinous Rice	250-650	18-28	90-175	19-55
Maharlika Rice	230 to 930	15 to 35	110 to 310	5 to 60
Sinandomeng Rice	400 to 900	20 to 40	110 to 210	15 to 65

Table 4: RANGES OF MORPHOLOGICAL FEATURES OF RICE GRAINS

Here used KNN classifier has good accuracy value for each variety like for Glutinous rice variety, the average accuracy score is 83.33% as per the paper result and is the most among other two varieties . Thae Nu Wah, Pann Ei San, Thandar Hlaing Department of Electronic Engineering, Technological University ,(June,2018) in The 11th National Conference on Science and Engineering, Myanmar , suggested the idea of using real field feature and KNN classifier.Sample used in this model is—Paw-San Rice of Myanmar, including 3 classes – Class A, Class B, Class C. Class-A contains 0-5% broken kernels , whereas Class-B contains above 10% broken Kernels. Rest are considered as Class-C for which broken kernel is above 20% . Main Eye catching feature of this rice is it's percentage of broken rice grain. Minimizing consumed time and cost is the main objective of this paper.

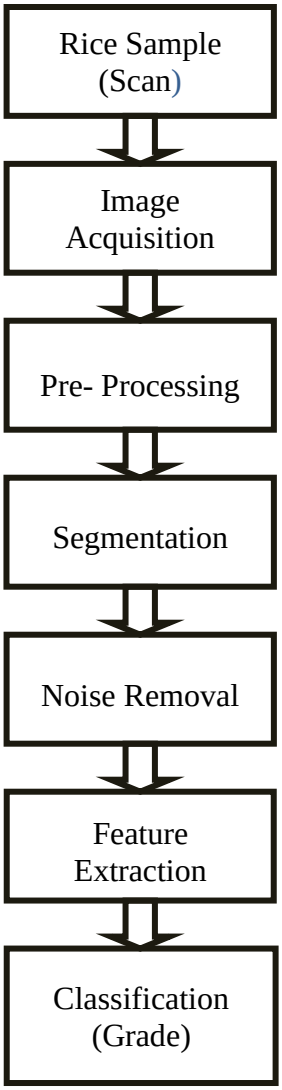

Figure 15: Block diagram of Classification and Grading

First step of the algorithm , used in this paper is Scanning and Image Acquisition. It is collection of kernels of rice grain were done for classification and grading purpose with resolution of 200 dpi with USB interface to a PC.Black sheet is used for reducing the effect of reflection. Next is Image Pre-processing. RGB to Gray scale image conversation of input image is done here in this process. Then Image Segmentation. Global Threshold based on Segmentation is used in this paper. For calculating needed threshold value, We follow Otsu method. This process's optimum gray threshold value, according to the paper, was normally 0.4471. After that Noise Removal is done . For this, MATLAB function bwareaopen is used for getting smooth image. Next is Feature extraction . In very last, Object Classification is done. In this step we need to take the help of KNN classifier. For each class of Paw-San rice, 30 tests are conducted. The Accuracy for Class-A comes as 100% for

Class-B 93% and for Class-C 83%. Komal ,Ganesh Kumar Sethi,Rajesh Kumar Bawa(2020),in Volume 64, Issue 2, 2020 Journal of Scientific Research discusses the idea of quality measurements of rice depends on parameter like rice colour,rice shape, size, damaged or broken kernels. According to this paper , color and morphological feature will result in great accuracy ,along with textural features.This paper describes Rice grading as the sorting process and assigning them into proper Classes or Grades. For this ,first Image Acquisition is done.Used hardware in this step are camera or scanner under un-constrained or constrained environment. Then Image Pre-processing. Noise and impurities of rice grains are removed in this step. Next is Image Segmentation. Sample image decomposition is done here to transform it into analyzable object. Next is Feature Extraction and the last step is Classification or Grading. This Classification or Grading is the deciding phase of rice grain quality analysis.

Comparative Study:

Researchers	Food Type	No. of Samples	Used Features	Techniques	Accuracy / Results
Herath H.M.K.K.M.B and Eng. de Mel W.R (2016)	Rice Grain	Sample Of 4 varieties ((White Basmati, Red Basmati, White Samba and Red Samba)	Color	Histogram analysis Of Input Image Using MATLAB	Accuracy: 100% (With Proper Precation Taken)
Tzu-Yi Kuo , Chia-Lin Chung, Szu-Yu Chen, Heng-An Lin, Yan-Fu Kuo (2016)	Rice Grain	Sample Of 30 varieties	Morphological Traits No: 12,Color Traits No: 9,Textural Traits No: 7, And Fourier Descriptors No: 20	Image Processing and Sparse-Representation-based Classification	Accuracy: 89.1%, SD: 7.0%
Muhammad Junaid Asif, Tayyab Shahbaz, Dr. Syed Tahir Hussain Rizvi, Sajid Iqbal (2018)	Rice Grain	Sample Of 6 varieties (Each Consisting Of 100 images)	Major Axis Length, Minor Axis Length, Eccentricity,Perimeter, Area And Size Of Grains	Image Processing with the help of Principle Component Analysis	Accuracy: 92.3% and 89.5%(for two different cases)
Jan Rei S. Buenaventura, Jun T. Kobayashi, Larah Mae P. Valles (2019)	Rice Grain	250 Rice Grains (belonging to five (5) varietal groups of rice)	32 features (color features and texture features)	Image Processing by Multi-View 3d	Accuracy: 92%
Nikhade Pratibha, More Hemlata, Manekar Krunali and Prof. S. T. Khot (2017)	Rice Grain	Basmati Rice	Major Axis Length,Minor Axis Length, Perimeter,Area	Image Processing and Neural Network	NR
Sudhanva Bhat, Sreedath Panat, N Arunachalam (2017)	Rice Grain	Sample Of 5 varieties (Basmathi, Idly, Samba, Ponni and Ponni raw)	Geometrical parameters (Length and Breadth)	Image Processing (convexity calculation, Pixel-Distance Contribution Function (PDCF), least square ellipsefitting,geometrical parameters)	Accuracy of the methodology can be enhanced by designing a setup with optimum lighting and camera

					specifications
Muhamad Cahyo Ardi Prabowo and Sidiq Syamsul Hidayat (2021)	Rice Grain	C4 Raja rice	Morphological (Length and Breadth)	Digital Image-Processing Using Opencv (Open Source Computer Vision Library)	Specific Information Is Obtained About The Quality Of Rice Grains. However, This Study Still Has Limitations On Digital Image Processing With Adjacent Objects
Cyril L. Macalalad, Edwin R. Arboleda, Adonis A. Andilab and Rhowel M. Dellosa (2019)	Rice Grain	180 samples of Glutinous rice, Sinandomeng rice and Maharlika rice (60 samples for each type)	Morphological features like area, diameter ,perimeter ,roundness.	Image Processing with Fuzzy logic algorithm and KNN classification technique.	For Glutinous rice variety, the average accuracy score is 83.33%(most among three varieties)
Thae Nu Wah, Pann Ei San, Thandar Hlaing Department of Electronic Engineering, Technological University (Thanlyin)(2018)	Rice Grain	Sample of Paw-San Rice of Myanmar, including 3 classes – Class-A, Class-B, Class-C.	Morphological features of Broken Paw-San rice.	Image Processing using MATLAB and KNN classifier	Accuracy for Class-A comes as 100%, for Class-B 93%, for Class-C 83%(after performing 30 tests).
Komal ,Ganesh Kumar Sethi,Rajesh Kumar Bawa(2020)	Rice Grain	Rice Grains(Specifically not mentioned)	Morphological features	Image Processing	No Specified Results

Table 5: Comparative Study Table

Problem Definition :

In this paper, We are going to discuss Rice Grains Quality Measurement Using Image Processing Technology . Traditional method of rice grain quality measurement was difficult , complex and time consuming. In Order to get better accuracy in minimal time , our proposed method work better than the traditional method . For Pre-processing Thresholding Algorithm and for Edge detection Laplacian Edge Detection method is going to be used.

Proposed Methodology:

Python is a type of interpreted ,object oriented, high level programming language , which can be used to integrate systems (made by humans) for the purpose of reading and working on , by various computer devices . By this way we can work effectively in terms of supporting digitization. In this proposed paper we are going to discuss about rice grain quality measurement through using programming language python. We will take the help of OpenCV library in python (one open-source library for Computer vision, Image Processing, and Machine Learning) to implement the idea of Image Processing Technology.

Image processing is a method by which we can convert an image to digital aspect and can perform some operation on it.We do this on the input to get enhanced image or to extract necessary informations .Generally,in this technology inputs are like images or video frames and outputs are like images or some features associated with input images or video frames. Morphological or Colour traits can be very useful in this Digital image processing technology.In our proposed paper ,we will use morphological traits like length and width or we can say major axis length and minor axis length to determine the quality of rice grains.For this we will take the help of Laplacian Edge Detection technique . We can count the total number of rice grains by this technique and after this we can classify them on the basis of their length/width ratio.Here is the formula we are going to use

L/W = [(Average length of rice grain/ Average width of rice grain)]*100

- Image Acquisition :

  Image Acqusition, in Image Processing is generally the method of retrieving an image from a source where mainly hardware systems like cameras, sensors are used. In general ,Image Acquisition is pure hardware

Dependent process, where light energy , reflected from the imaged object is transformed into electrons and will spread over the whole internal sensor chip. Here Cells of one 2-D array is called photosite. This contains amount of charges that further converts into digital form through Analog to Digital Converter.This is the very first and most important stage of image processing and images acquired in stages are normally unprocessed.

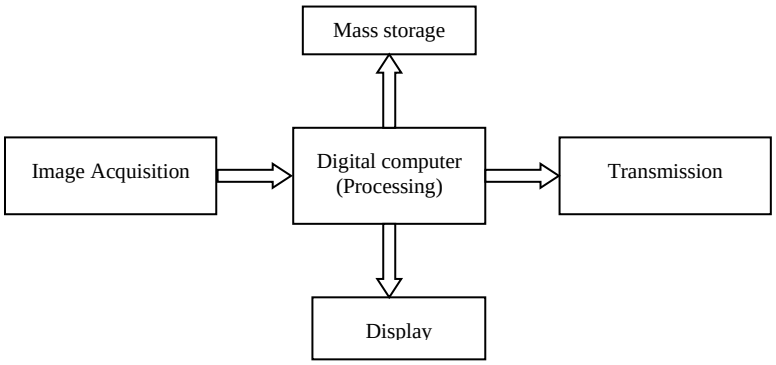

Figure 16: Image Processing

Our main purpose of Image Acquisition is to convert an Image (Real World Data) into an array of numerical data that we could later elaborate on a computer. This process is done for converting image or video into manageable entity.The whole process image acquisition is done in three steps_____

I. An optical system , mainly focuses on the energy.
II. Energy, which will be reflected from the interested object.
III. Finally a sensor (for measuring total energy amount).

We can take input images in various formats like JPEG,JPG,PNG etc.
For achieving Image Acquisition, we just need proper hardware devices.For example , if X-ray image is required , a camera(film) which is perceptive to X-ray, will be needed. If Infrared image is wanted , camera perceptive to infrared radiation, will be required. For normal images , visual spectrum sensitive camera, is required. For our model, Input photos of rice grains are to be taken with black background for better identification of grains and better accuracy.In this model we are going to use locally available rice grains(like Basmati rice).We will take the pictures of grains using digitals camera or smartphone camera.

- Image Pre-Processing :

Pre-Processing is a process of performing some operations with the images at the lowest level of abstraction.This stage removes noise from the image and improve the image quality and also image sharpening. Algorithm used here to differentiate rice grains from object's background is Threshold algorithm.

Thresholding can be in the following methods

- Histogram Shape Based Method
- Object Attribute Based Method
- Entropy Based Method
- Local Method
- Spatial Method

In this model , we are going to use Automatic Thresholding type, which is the simplest form of thresholding.Here , steps are simple

a) Selection of initial threshold value is done(normally the mean 8-bit value of the given image)
b) Original image will be converted into two categories based on the following rule
    - Black background for pixel values less than equals to initial threshold value.
    - White foreground for pixel values greater than initial threshold value.

Figure 17: Original Image

Figure 18: Thresholding Image

- Shrinkage Morphological Operation:

  Basic idea of morphological filter is shrink and let grow process. Shrink refers to use median filter to culminate the large structures and to remove the small structures and grow refers to remaining structures which are grown back by the same previous amount.

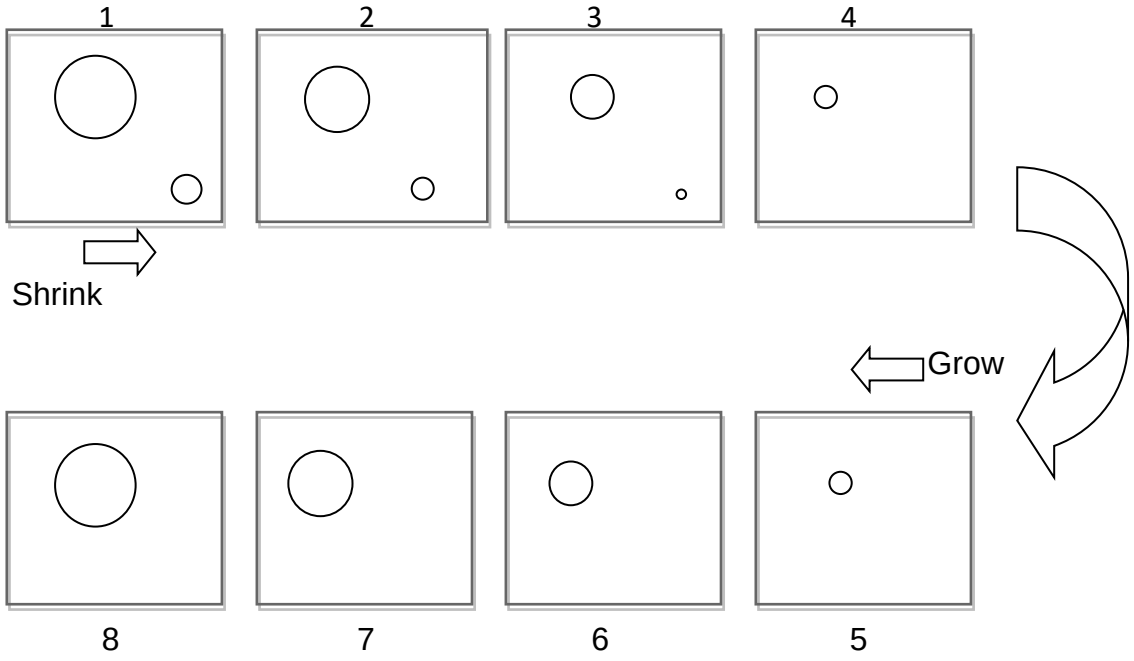

Figure 19: Shrink and Grow process

Operator used here are

- Erosion : It is a morphological operator used for shrink process.
- Dilation: It is morphological process used for the grow process

This process of erosion is used to separate tactile features of the rice grain without losing any portion of any single feature. After that the dilation follows.Aim of dilation process is to grow eroded features into their original form, excluding the separated features of erosion process.

- Edge Detection :

In Image processing , Edge Detection method is used for identifying points in an image with discontinuities(like sharp changes in image brightness). These points are known as edges of the image.This process is carried out for determining rice grain boundaries . The method here is Laplacian Edge Detection Method. Here is the characteristics of Laplacian Edge Detection Method

a) This compares second derivatives of an image.By this edge detection operation we can measure the rate at which 1st derivative change in a single pass.
b) No. of kernel used in this method is one.
c) It can be contained with negative values in a cross pattern manner.

As this method might detect noises as edges, it is better required, to smoothen input image before applying Laplacian filter.

- Object Measurement :

This stage is to count total numbers of rice grains in the sample input image. Also we can get our required morphological trait value(value of rice grain length or major axis length and value of rice grain width or minor axis length). This can be done with the help of edge detection method.All these data can be stored in excel .

- Object Classification :

  In this Oject classification stage, rice grain quality measurements is going to be done. We can do it by classifying each rice grain. We are going to classify them four groups--- Long, Medium, Small,Impurities(like small stone or extremely broken rice).
  This Classification can be done L/W ratio of equation. For this we would require those data which we will get from previous stage.

Conclusion:

This project can help to recognize the quality of rice grain based on shape of rice grain.But we need to keep in mind that this image analysis applying to the rice testing is randomly placed in one layer with black background.We can get the data on the number of rice recognized in digital images to calculate the L/W ratio of the each grain detected. Propose approach can work well with minimal cost in short span of time.But this has limitations too.We may not get correct result on digital image processing with adjacent objects.In future,We have to implement code based on this approach .

Future Scope :

In this we proposed our main algorithm or main steps , we are going to follow. Here is the plan for our future work

a) Collecting Sample input for Image Acquisition .

b) Implementing the Coding Solution for our proposed model.

c) Analysising all the results and recording them in proper place.

Through this proposed method ,we can easily determine the quality of rice grains.

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