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Analyzing and Recognizing the Quality of Rice Grain using Canny Edge Detection technique

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Abstract-*Nature of grain is vital for the individuals as it straightforwardly impacts the human wellbeing. Subsequently there is incredible need to gauge a nature of grain and recognizing non-quality components. Dissecting the grain test physically is additional tedious and muddled interaction, and having more odds of blunders with the subjectivity of human insight. To accomplish uniform standard quality and exactness, machine vision based strategies are developed. Rice quality is only the blend of physical and compound attributes. Grain size and shape are some actual qualities. The got all actual highlights reviews the rice grains utilizing watchful edge location.*

Keywords: - Grain Quality, Grain images, Image Processing, Canny Edge Detection

1. INTRODUCTION

The fundamental goal of the undertaking is to decide the nature of rice utilizing the advanced procedures dependent on picture preparing. It incorporates order of grains and just as assessment of grain shape by estimating its length-expansiveness proportion. Contrasting with the conventional techniques, it is basic and simple to utilize. The interest for nature of food items we burn-through is expanding step by step. As the education rate is expanding, so is the requirement for nature of food items is expanding. In the current grain-dealing with framework the quality is recognized physically by visual examination which is drawn-out. A programmed assessment technique for the assurance of the nature of rice granules is presented utilizing Canny Edge identification [1] component.

1.1 Existing System

Chemical strategies for the distinguishing proof of rice grain quality. Manual checking of rice grains by a Supervisor. The *result* of this examination is likewise relative, time consuming, having variable outcomes and exorbitant. It requires serious level of exactness to fulfill clients need and not proficient. It destructs the example and dangerous to deal with.

1.2 Proposed System

To defeat constraints of manual examination new and progressed strategy is proposed which is picture preparing method. It gives the solid quality evaluation and minimal effort. Based on the size, the grains are evaluated without any problem. It gives better and exact outcome and least time prerequisite.

2. GRAIN QUALITY ANALYSIS

2.1 Rice Grain Structure

To comprehend rice seed inside and out it is needed to comprehend its biometric properties.

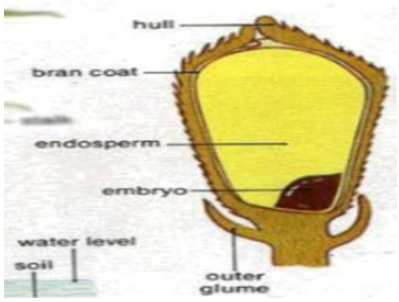


Fig 1: Cross section of rice seed

A portion of rice comprises of a body and a grain coat, the two of which are taken out by cleaning "white" rice. Rice shell, frame or husk: encases the grain coat, the undeveloped organism and the endosperm. Grain Coat (layer): an exceptionally slender layer of separated tissues. The layer contains fiber, nutrient B, protein and fat. The most nutritious piece of rice dwells in this layer. Undeveloped organism: The deepest piece of a rice grain comprises essentially of starch called amylase and amylo gelatin. The combination of these two starches decides the cooking surface of rice.

Seed is a living item that should be developed, gathered, and handled effectively to understand the yield capability of any rice assortment. Great quality seed can expand yields by 5-20%.

Rice seed quality isn't just significant for eating however it is additionally importance for ranch. Development with great quality seeds can give better edit item. For grain quality estimation it is critical to examine the quality boundaries of seeds which are depicted straightaway.

2.2. Grain Quality Parameters [3]:

For any grain seed, there are numerous boundaries which are vital and straightforwardly planned with grain quality. Rice quality is essentially surveyed dependent on actual properties, for example, head rice ID, whiteness, grain size and shape, and premium quality characteristics, for example, shading have additional worth. Underneath referenced boundaries are having abundant importance and can be estimated by picture preparing procedures.

A. Length and Breadth:

Grain size and shape is a varietal property. Long slim grains ordinarily have more prominent breakage than short, strong grains and thus have a lower processed rice recuperation. The grain measurements likewise direct somewhat the kind of processing gear required. Rice shape and pastiness attributes are vital to assess the rice appearance quality since they are the critical components for rice quality and valuing. In this manner, it is important to have the exact data about rice appearance quality. The length and expansiveness of a rice grain are significant credits that decide the class of the rice. There are three primary classes of rice, in light of grain length: short, medium and long. Regarding width, Arborio styles are for the most part the largest, trailed by short, medium and long. Length and expansiveness of grain are basic boundaries for grain tests characterization. The nature of grain test has a planning with primary boundaries for the most part with length and width. Various associations have their own arrangement rules dependent on size estimation. The analyzer is created which can give various arrangements dependent on association choice. Grains are delegated the short grain, medium grain and long grain. The length and width of a rice grain are significant credits that decide the class of the rice.

In view of ARSO (CD-ARS 464:2012(E)) (ARSO : ARS 464 (English) : Milled Rice Specification 2012) – African Rice Standard Organization, grain seeds are partitioned into head, broken and chip seed. Broken seed is additionally ordered in since a long time ago broken, medium broken and little broken. For CODEX STAN 195-198 (Codex Standard for Rice: CODEX STAN 198 1995) norms the grain seed is arranged in long seed, medium seed and little seed.

B. Aspect Ratio:

Grain shape is the very substantial property of the grain, which is mostly defined by the aspect ratio (length-width ratio). Aspect ratio is basically the ratio of the length of seed to the ratio of the width of the seed.

a) Aspect Ratio = Length of kernel (L) / Breadth of kernel (W)

For any grain sample, generally average value is considered:

b) Aspect Ratio avg = Average length of kernel (L avg) / Average breadth of kernel (B avg)

Aspect ratio generally measured in milli meter. Classification of seeds depends on the aspect ratio i.e. based on seed length/width ratio.

The appearance generally relies upon viewpoint proportion of an item that can be a significant selling variable and influence deals. The presence of a field crop is regularly influenced by collecting rehearses. Staining, climate harm or mechanical harm decreases the visual quality. Mechanical harm likewise influences the capacity qualities; broken grain draws in form and creepy crawly harm. Grain test classification should likewise be possible utilizing a mix of the seed length and the angle proportion. The angle proportion is generally acknowledged to portray the shape and class of the grain assortment. The other significant part of length and width is consistency every one of the grains in a single example should appear to be identical. The examples which have consistency long and width in first look have more exorbitant cost benefits.

C. Texture:

The surface is a significant trademark for each grain types. It characterizes as the normal dull examples. It has some apparent natives which are normal across numerous seeds. Picture surface can be determined dependent on at least one of the properties of fineness, coarseness, perfection, granulation, haphazardness or inconsistency. Rice innovative work programs in Louisiana and Arkansas, in the USA, are endeavoring to distinguish instrumental strategies that correspond well with scores announced by tangible boards for the distinctive textural characters (International rice research foundation 2006).

Surface depicts what we may insight in our mouths when eating rice: starting mouth feel, hardness, adhesiveness, cohesiveness, springiness, flexibility, stickiness and chewiness.

D. Chalkiness [4]:

*C*halkiness is the misty zone in the rice grain. On the off chance that piece of the processed rice bit is obscure as opposed to clear, it is frequently described as "pasty". A pasty grain implies the grains at any rate half of which is smooth white in shading and weak in nature. It is bothersome in pretty much every market. White regions happen in light of contorted starch granules with air spaces between them. Powdery zones cook uniquely in contrast to clear territories, however just an exceptionally astute sense of taste could distinguish them. Broken and parts incorporate bits of rice pieces which are under three fourth of an entire portion. Chalkiness vanishes after cooking and has no impact on taste or fragrance, anyway it minimizes processed rice.

E. Whiteness:

In processing, the brightening and cleaning enormously influence the whiteness of the grain. During brightening, the silver skin and the grain layer of the earthy coloured rice are taken out. Cleaning subsequent to brightening is completed to improve the presence of the white rice. During cleaning, a portion of the grain particles adhere to the outside of the rice which cleans and gives a shinier appearance. Fig.2 shows the distinctive processing degree rate in rice grain while processing m measure

Fig2: Milling degree

F. Breakage and Cracking:

Overexposure of develop paddy to fluctuating temperature and dampness conditions prompts the improvement of crevices and breaks in an individual piece. Breaks in the bit are the main factor adding to rice breakage during processing. This outcome in diminishes processed rice recuperation and head rice yields. In certain seasons, breaking of the rice grain is a huge issue. Most breaking happens in the field and is by all accounts identified with changes in grain dampness or to

dampness cycles after the rice develops. Pasty grains are gentler than clear grains and are bound to break during processing. Harsh treatment of grain during harvest tasks and during drying and preparing will likewise make the grain break. Breaking diminishes head rice yield in light of the fact that broke grains regularly break during processing. Grains that are broken however stay unblemished during processing are considered outwardly unwanted.

G. Adulteration:

Adulteration implies the presence of unfamiliar matter or non-quality components in grain test. Unfamiliar matter incorporates dust, stones, pieces of earth, debris, stems or straw and some other debasement. Different grains incorporate those which are not the real grain. Lower quality grain is likewise utilized as a corruption. Debasement can cause genuine sicknesses whenever overwhelmed by day by day food varieties. At times lower quality grain is blended in with great quality grain to improve cost from the client. While picking grain item, this sort of debasement should be distinguished.

H. Yield:

Yield is the most observable trademark to ranchers while the harvest is in the ground, yet when the result of the harvest, the processed rice, arrives at the market, quality turns into the critical determinant of its deal capacity.

Head rice yield (HRY) is one of the essential factors that right now decide the authority market evaluation of rice. Head rice, or the entire parts in an all-around processed rice test, is characterized by the USD a Federal Grain Inspection Service (1999) as, "Solid pieces of rice and broken bits of rice, which are in any event three–fourths of a whole bit. "HRY is the weight level of an unpleasant rice test that stays as head rice after complete processing. Head rice is by and large worth twice however much the wrecked portion classes of brewers, second heads, and screenings. Hence, HRY fundamentally decides the financial estimation of rice since it is a pointer of the processing nature of a rice parcel. End–clients of rice follow through on premium costs for head rice and ordinarily determine greatest resistances of rate broken parts for some random deal. As a result of the significance of HRY as a pointer of rice quality.

I. Weight:

Grain weight gives data about the size and thickness of the grain. Grains of various thickness plant in an unexpected way, and are probably going to hold dampness contrastingly and cook in an unexpected way. Uniform grain weight is significant for steady grain quality.

3. TECHNICAL TERMS FOR GRAIN QUALITY ANALYSIS

1. Rice means non-glutinous and glutinous rice (Oryzasativa L.) in whatever form.

2. Paddy or rough rice means rice that is not yet de husked. Paddy or rough rice is a similar term for paddy, or rice retaining its husk after threshing. Under-milled grain means grain whose bran portion is not completely removed during polishing or which has substantial bran streaks left on it.

3. Brown rice [5] or husked rice means paddy from which the husk has been removed.

4. Green grains mean kernels, whole or broken, which are greenish in color.

5. Cargo rice (Loonzain rice, Brown rice, Husked rice) means rice that is de husked only.

6. White rice means rice that is obtained by removing bran from cargo non-glutinous rice.

7. Whole kernels mean rice kernels that are in the whole condition without any broken part.

8. Head rice means broken kernels whose lengths are more than those of broken but have not reached the length of the whole kernel. Milled rice with length greater or equal to three-quarters of the average length of the whole kernel.

9. Broken means broken kernels which don't reach the length of Head rice. This includes splits kernels that retain the area less than 80% of the whole kernel.

10. Red kernels mean rice kernels that have red bran covering the kernels wholly or partly.

11. Yellow kernels mean rice kernels that have some parts of the kernels turn yellow obviously.

12. Chalky kernels mean non-glutinous rice kernels that have an opaque area like chalk covering the kernels as from 50% onward. Damaged kernels mean kernels that are previously damaged as can be seen by the naked eyes due to moisture, heat fungi, insects or other.

13. Undeveloped kernels mean kernels that do not develop normally as should be and are flat without starch.

14. Immature kernels mean rice kernels that are light green, obtained from immature paddy.

15. Other seeds mean seeds of other plants other than rice kernels.

16. Foreign matter means other matter than rice. This includes rice husk and bran detached from rice kernels.

17. Milling degree means the degree to which the rice is milled.

4. GRAIN QUALITY

4.1 Quality of Rice

Quality can be characterized as the joined highlights and attributes of an item or administration to fulfill expressed or inferred needs. Grain quality is a blend of numerous variables like smell (fragrance), size, cooking attributes, shading, healthy benefit and percent entire grains.

It is the norm of horticultural items which offers purchasers the chance to buy precisely what they need (US Grains 2016). The nature of rice isn't in every case simple to characterize as it relies upon the buyer and the planned end utilization of the grain. All buyers need the best quality item that they can bear. The interest from the shopper for better quality rice has expanded. As of late the pattern has changed to consolidate favored quality attributes that increment the all out financial estimation of rice. Grain quality isn't only reliant on the assortment of rice, however the quality likewise relies upon the yield creation climate, gathering, preparing and processing frameworks. The quality attributes of paddy and processed rice can be considered independently. These properties are assuming a significant part in rice quality, promoting and trading. Rice quality is a blend of physical and compound attributes which are needed for a particular use by a particular client (IRRI 2017)

4.2 Importance of Rice Quality

Nature of grain is critical for people as it straightforwardly impacts the human wellbeing. Henceforth there is an incredible need to gauge a nature of grain and distinguishing contaminated/non-quality components. Grain quality can have distinctive significance to various individuals relying on the kind of grain or seed and its proposed use. A few significant components influence grain quality, including phenotypic articulation, ecological conditions, reaping and dealing with hardware, drying frameworks, stockpiling the board practices and transportation strategies (Grain and Seed examination - ASDInc - PANalytical 2017). Lower quality grain in every day food can cause genuine infection. At times the lower quality grain is blended in with great quality grain to get a more exorbitant cost. The item produced using this sort of blend can prompt low quality food varieties. This sort of corruption should be recognized while the determination of grain.

Purchaser inclinations (e.g., an inclination for a specific smell or whiteness of grain) influence what individuals purchase thus influence market costs. In this manner it requires distinctive sort of grain analyser which can give investigation to fulfill the market needs. (Rice Knowledge Bank - IRRI 2016).

5. SYSTEM ANALYSIS

A. Proposed Algorithm:

Input: Original Color Image

Output: Classified food grains parameters along with Quality

Algorithm:

- Acquire the food grain image.
- Enhance image to remove noise.
- Identify Patces and Do the image segmentation.

- Extract the morphological features.
- Measure the geometrical features.
- Classify the grains based on aspect ratio obtained.

BLOCK DIAGRAM:[2]

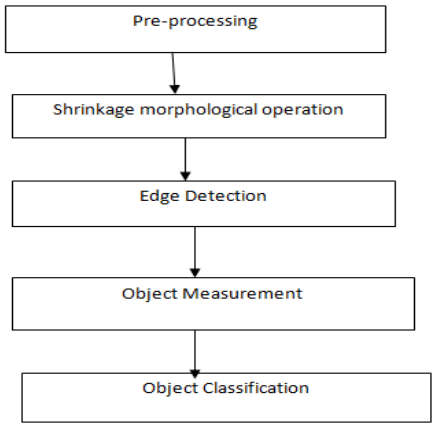


Fig 3: Block diagram [1]

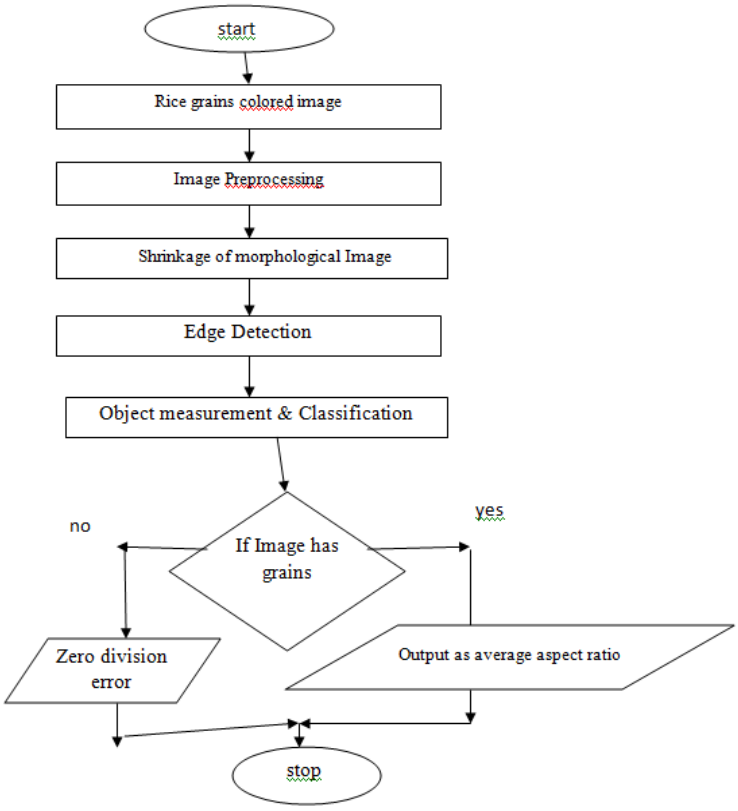


Fig 4: Flow Chart

6. MODULE DESCRIPTION:

In Fig 3, the principal pre-handling step, picture enrollment happens and commotion is taken out from the image by utilizing filter. Shrinkage [6] calculation utilized for sectioning the contacting pieces which is second step. In third step we perform edge recognition to discover the area of limits. In fourth step rice seed estimation is done and in a similar advance length, expansiveness and length-broadness is also measured. In the fifth step of the calculation rice is ordered by its size and shape.

a. Colored Original picture:

The Captured pictures were put away in JPEG/JPG/PNG design. The Images of rice grains were caught by utilizing digitalized camera. Least 16MP goal is kept up while taking the snaps. We keep a uniform foundation which is dark in shading. The grains are spread on a dark sheet arbitrarily.

b. Picture pre-preparing:

Channel is applied to eliminate commotion which happens during the obtaining of picture. Channel also sharpens the picture. Edge calculation is utilized to fragment the rice grains from the black background.

c. Shrinkage morphological activity:

This activity manages two sub cycle:

• Erosion: It is applied to isolate the contacting highlights of rice grains without losing the uprightness of single component.

• Dilation: This cycle follows disintegration measure. The objective of enlargement is to develop the dissolved highlights to their unique shape without re-joining the isolated highlights.

d. Edge-Detection

Edge discovery assists with discovering the area of limits of rice grains. We utilize shrewd algorithm to distinguish the edges.

• Canny edge identification calculation:

It is a various advance calculation that can identify edges with commotion suppressed simultaneously. Smooth the picture with a Gaussian channel to diminish commotion and undesirable subtleties and surfaces. It is procedure to remove helpful primary data from various vision objects and significantly diminish the measure of information to be prepared. It has been generally applied in different PC vision frameworks. The overall rules for edge discovery include:

•Detection of edge with low blunder rate, which implies that the discovery ought to precisely get however many edges appeared
in the picture as could be expected under the circumstances.

•The edge point identified from the administrator ought to precisely limit on the focal point of the edge.

•A given edge in the picture should just be stamped once and where conceivable picture clamor ought not make bogus edges.

e. Article estimation:

Estimation shows the check of rice grains. In the wake of getting the tally of rice grains, edge location calculations applied on the picture and result of the applied calculation is we get end point estimations of each grain. We use caliper to join the end focuses and measure the value of length and broadness of each grain. Subsequent to getting the estimation of length and broadness we can calculate length-expansiveness proportion by utilizing the beneath recipe.

L/B = (avg length of rice)/(avg expansiveness of rice) *100

f. Article grouping:

Order requires all norm, estimated and determined results. The standard data set for rice size and shape estimation is alluded from lab manual on rice grain quality, Directorate of Rice Research, Rajendranagar, Hyderabad is appeared in table

no 5.1. The grouping of rice grains according to the standard information base is appeared in after tables. Table1 shows classification of rice grains based on length and length-broadness proportion.

Table -1: Classification table [1][2]

Shape of Grain	Measurements
Long Slender(LS)	Length 6mm and above, L/B ratio 3 and above
Short Slender(SS)	long Slender(LS Length less than 6mm, L/B ratio 3 and above
Medium Slender(MS)	Length less than 6mm, L/B ratio 2.5 to 3.0
Long Bold(LB)	Length 6mm and above, L/B ratio less than 3
Short Bold(SB)	Length less than 6mm, L/B ratio less than 2.5

7. SYSTEM DESIGN

7.1. Data Flow Diagram:

(DFD) is a way of representing a flow of data of process or a system. The DFD also provides information about the outputs and inputs of each entity and the process itself. A data flow diagram has no control flow; there are no decision rules and no loops. Specific operations based on the data can be represented by flowchart

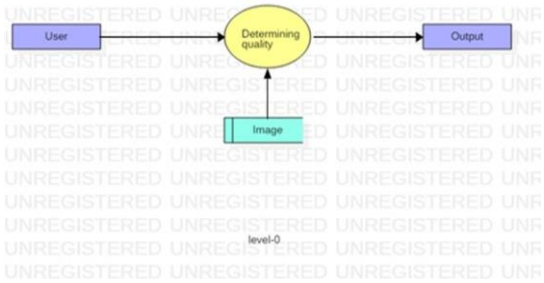


Fig 5: Data Flow diagram (Level 0)

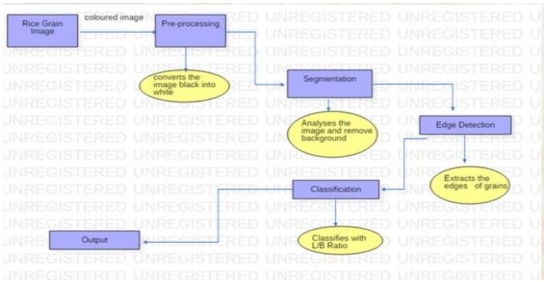


Fig 6: Data Flow diagram (Level 1)

8. RESULTS

The paper is based on structure analysis so the output is in the form of structure parameters. As soon as the code runs, output gives the parameters of the rice grains along with the classified property name. Along with text output an image output also generated as original image, binary image, filtered image, eroded image, Dilated image, edge detection image.

INPUT:

The input image should follow some conditions in order to avoid ambiguity.

The grains should be arranged properly.

The background should be black color in order to detect the edges and parameters of the grains

Fig 9 Rice grain image

OUTPUT: Merge output

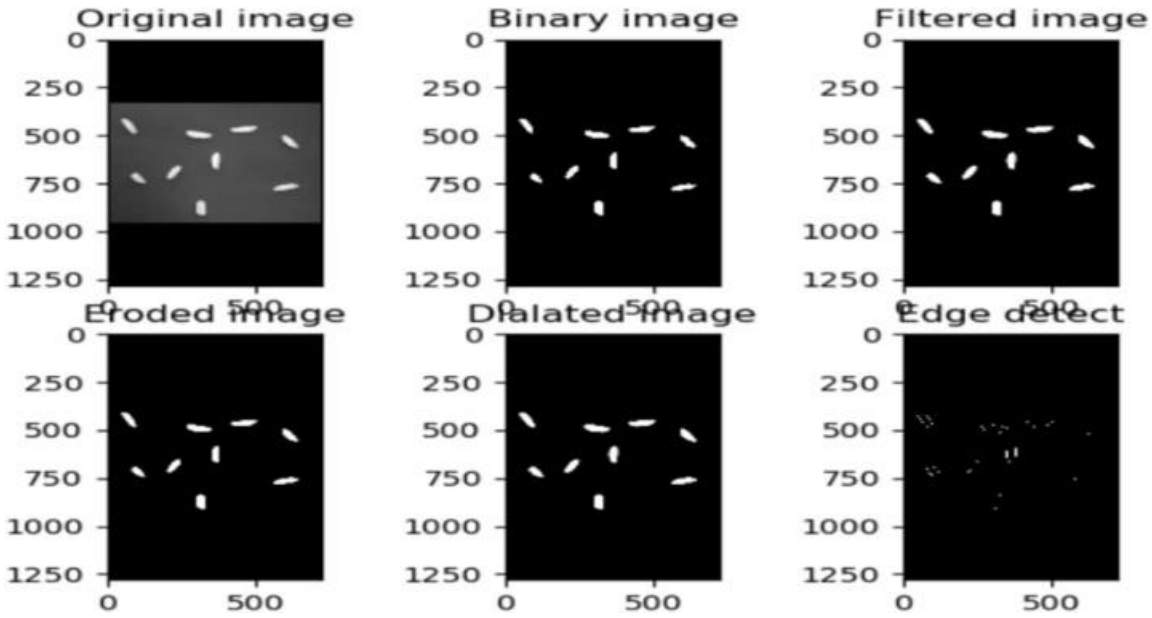


Fig 10: Output

The image describes the conversions which are done while the image goes on while running the code. The image goes on state to state, those are displayed on the image.

Text output:

The text output describes the parameters of rice grains like length-breadth ratio for each grain and also average aspect ratio which is the average of all length breadth ratios obtained.

For the Fig 9 the text output is as follows:

No. of rice grains= 9

2.44 (Medium)

2.24 (Medium)

1.15 (Bold)

1.49 (Bold)

2.93 (Medium)

1.26 (Bold)

2.15 (Medium)

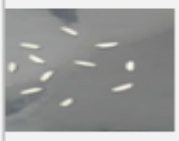
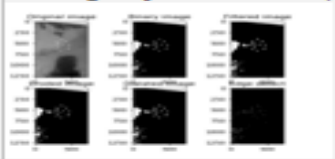
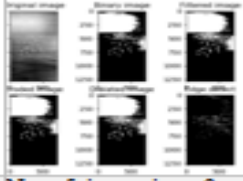
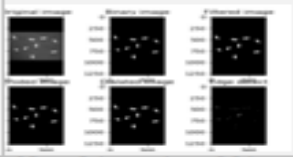
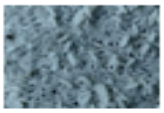
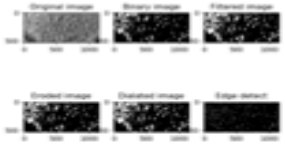
2.43 (Medium)

1.65 (Bold)

Average Aspect Ratio= 1.97 (Bold)

9. TESTCASES

Table 2 Test Cases

S.No.	Description	Input	Output
1	age of rice grains with the improper background		No. of rice grains= 87 Average Aspect Ratio= 1.47 (Bold) 
2	age of rice grains with the improper clumsy background.		No. of rice grains= 100 Average Aspect Ratio= 2.79 (Medium) 
3	age of rice grains with perfect background which got perfect output		No. of rice grains= 9 verage Aspect Ratio= 1.97 (Bold) 
4	Image with improper arrangement of the rice grains		No. of rice grains= 254 Average Aspect Ratio= 1.48 (Bold) 
5	Image with no the rice grain.		No. of rice grains= 0 ZeroDivisionError: division by zero

10. CONCLUSION AND FUTURE WORK

The image analysis algorithms are applied on image in which rice grains are randomly placed and spread in one layer. Edge detection is performed to find out the region of boundaries and endpoints of each grain; and then after that using calliper length and breadth can be measured. After getting the values for length and breadth, length-breadth ratio is to be calculated. In this study, the image processing algorithms are developed to segment and identify rice grains. use of image processing algorithm is an efficient method to analyse grains quality by its size. The main benefit of proposed method is it requires minimum time; cost is less and gives better results compared with manual results or traditional methods.

In futute, the idea can be used for any kind of Grain Detection, Scanner Enhanced Detection, Grain Colour Advancements, Cameras Enhanced Detection.

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