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RICE QUALITY ANALYSIS USING IMAGE PROCESSINGTECHNIQUES

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Abstract

Inagricultural industries grain quality evaluation is very big challenge. Quality control is veryimportant in food industry because after harvesting, based on quality parameters food products areclassified and graded into different grades. Grain quality evaluation is done manually but it isrelative, time consuming, may be varying results and costly. To overcome these limitations andshortcoming image processing techniques is the alternative solution can be used for grain qualityanalysis. Rice quality is nothing but the combination of physical and chemical characteristics. Grainsize and shape, chalkiness, whiteness, milling degree, bulk density and moisture content are somephysical characteristics while amylase content, gelatinization temperature and gel consistency arechemical characteristics of rice. The paper presents a solution of grading and evaluation of ricegrains on the basis of grain size and shape using image processing techniques. Specifically edgedetection algorithm is used to find out the region of boundaries of each grain. In this technique wefind the endpoints of each grain and after using caliper we can measure the length and breadth ofrice.This method requires minimum timeand it islow incost.

I. INTRODUCTION

The agricultural industry is oldest and most widespread industry in the world. Traditionallyquality of food products is defined from its physical and chemical characteristics by humansensorypanel[2].Physicalparameterincludesgrainsizeandshape,moisturecontent,chalkiness, whiteness, milling degree and bulk density. Moisture content is nothing but the watercontent in the grain. For better storage purpose moisture content should be in between 12-14%.Different methods are used for moisture analysis like standard moisture meter and hot air ovenmethod. Chalkiness is the white spot present in the rice endosperm. Chalky grain is defined ashalf of the grain is white in color and brittle in nature. Because of its brittle nature chalky grainsbreak during milling so it affect on milling degree of rice. On the basis of chalkiness rice grainsare classified as white belly, white center and white back. Chalky rice reduces the palatability

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ofcookingproductssopresenceofchalkinessmorethan20%isavoidedinworldsmarket.Magnifyinggla ss and photographic enlargerusedforchalkinessdetection.

Manual methods used for the measurement of grain size and shape are also discussed in the samesection. Section III talks about the method proposed for calculating parameters like length,breadth and length-breadth ratio. Section IV discusses the evaluation for the quality of rice grainsbased on image processing and analysis. It also includes results based on quality analysis forlength, breadth and length-breadth ratio. Section V provides the conclusion of the proposedmethod.

1.1ProblemStatement

In agricultural industry quality analysis of product is very important. Quality of grain seeds isanalyzedvisually by experienced technician.

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A. Ricequalityandclassification

Grainqualityisveryimportantfactorinwholeworld.Forthepurposeofimportorexportofanyfoodgrains, itsqualityanalysisshouldbedone.Forexportationpurpose,whileanalyzingqualityofgrainstherearesomestandarddatabasewhichhastobesatisfiedbyeachverityofgrain.Butmanytimesqualityisanalyzedbymanuallywhichincludesmanydisadvantagesandshortcomings, so to overcome these problems new and developed techniques are to be designed.Thetraditionalmethodsusedforgrainsizeandshapemeasurementaredialmicrometer,grainshapetesterandgraphicalmethod,butthesemethodsareverytimeconsuming.Indialmicrometerandgrainshapetesterwecanmeasurelengthandbreadthofsinglegrainsatatime.Theoutcomeofthisanalysisisalsorelative,timeconsuming,havingvariableresultsandcostly.Soitrequireshighdegreeofaccuracytosatisfycustomersneedandtoovercomelimitationsofmanualinspectionnewandadvancedmethodisproposed whichisimageprocessingtechniques.

B. *Imageacquisitionandprocessing*

Image is captured using a color camera. The image should be 640 X 380 pixels in size, which isshown in Fig.1. The captured image stored in the desktop using USB cable. After storing theimageon desktop imageprocessing algorithms areappliedon it.

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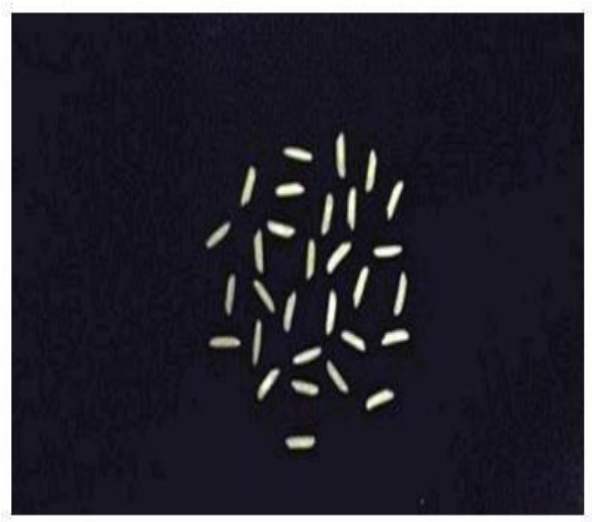

3.LiteratureSurvey

[1] Gradingofricegrainsbyimageprocessing.

The purpose of this paper is grading of rice grains by image processing technique. Commerciallythegradingofriceisdoneaccordingtothesizeofthegrainkernel(full,halforbroken).Thef ood grain types and their quality are rapidly assessed through visual inspection by humaninspectors.Thedecisionmakingcapabilitiesofhuman-inspectorsaresubjectedtoexternalinfluencessuchasfatigue,vengeance,biasetc.withthe helpof image processingwecanovercome that. By image processing we can also identify any broken grains mixed . Here wediscussthevarious procedures used toobtain thepercentagequality ofricegrains.

[2] Non-destructive Quality Analysis of Indian Gujarat-17 Oryza Sativa SSP Indica (Rice) UsingImageProcessing.

The Agricultural industry on the whole is ancient so far. Quality assessment of grains is a verybig challenge since time immemorial. The paper presents a solution for quality evaluation andgradingofRiceindustryusingcomputervisionandimageprocessing.Inthispaperbasicproblemofric eindustryforqualityassessmentisdefinedwhichistraditionallydonemanuallyby human inspector.

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Machine vision provides one alternative for an automated, non-destructiveandcost-effectivetechnique.WiththehelpofproposedmethodforsolutionofqualityassessmentviacomputervisionimageanalysisandprocessingthereisahighdegreeofqualityachievedascomparedtohumanvisioninspectionThispaperproposesanewmethodforcountingthenumberofOryzasativaL(riceseeds)withlongseedsaswellasmallseedsusingimageprocessingwithahighdegreeofqualityandthenquantifiesthesameforthericeseedsbasedoncombinedmeasurements..

[3]PhysicalQualityofSelectedRiceVerities.

Experimentwasconductedtoknowthephysicalqualitiesof41ricevarieties.ThericevarietieswereprocuredfromTirunelveli,MaduraiandVirudhunagardistrict.Length,Breadth,Bulkdensityand1000grainsweightweredetermined.Thegrainlengthvaried from0.33to0.43cm,breadth0.13to0.20cm,1000grainsweight14.0to18.5gandbulkdensity0.701to0.868(g/ml).FromthisexperimentthericevarietiesKarnatakaponni,CR,Ambai16,Ambai

(Tirunelveli),ASD19,CR1009(Madurai)andCR1andCulture.F(Virudhunagar)providedmorebulkdensityand1000grainsweight.

[4]ImageProcessingTechniquesforGrading&ClassificationofRice.

Arelatively faster computer vision system has been discussed to analyze and sort rice kernels. Aseries of measurements were done using image processing techniques on three varieties of IndianricenamelyMarkfedSupreme,MarkfedGolden(exportquality),HafedBasmati.Area,perimeter,maximumlength,maximumwidth,compactnessandelongationweremeasured.Further, separating the rice varieties by their shape difference was examined. The computervision system developed has been able to sort rice into sound, cracked, chalky, broken anddamagedkernels with anaccuracyranging from90-95%.

[5]QualityEvaluationofRiceGrainsUsingMorphologicalMethods.

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In this paper we present an automatic evaluation method for the determination of the quality ofmilledrice.Amongthemilledricesamplesthequantityofbrokenkernelsaredeterminedwiththe help of shape descriptors, and geometric features. Grains are said to be broken kernels whoselengths are 75% of the grain size. This proposed method gives good results in evaluation of ricequality.

In this paper we proposed a morphological processing based method for classification of brokenrice grains. This method is computationally efficient and improved method compared to allpreviousmethods.Hencewesuggestthatthisisanefficientmethod.Toperformthericeclassification whether broken or not by the proposed method is faster and simple. In future, weare planning to implement a classification method for chalkyness of rice and can be extended toothergranules likewheatand Barley.

[6] Classification&GradingRiceusingMulti-ClassSVM.

This paper proposes machine algorithm to grade (Premium, Grade A, Grade B and Grade C) therice kernels using Multi-Class SVM. Maximum Variance method was applied to extract the ricekernels from background, then, after the chalk has been extracted from rice. Rice Grain Chalkvolume is defined as the opaque volume in the rice grain. The procedure to calculate the chalkyvolumeofriceis as follows:

- The number of connected regions in the image is obtained after the segmented binaryimageof riceiscounted.
- Thendothelabelingofricegrains.
- Computethebestchalky segmentationthreshold.
- Processtheconnectedregionofricewiththresholdtosegmentthechalkyricegrain.
- Computethe boundary valuesofeachobject with helpof Harris CornerAlgorithm.
- ComputetheConvexHullusingthecornerpointsandwewillbewithvolumeofchalkyricekernel.

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This study shows the use of support vector machine in classifying and grading the rice grain. Byimproving the speed classification systems, we would focus on online quality measurement withthistechnique in the future.

[7] "Grain Quality Evaluation and Organoleptic Analysis of Aromatic Rice Varieties of Goa,India.

Rice grain quality characteristics such as physical (hulling, length andbreadth (L/B), grainclassification, chalkiness, chalk index), chemical (alkali spreading value (ASV), amylose content(AC), gel consistency (GC), aroma), cooking (volume expansion, elongation ratio (ER), wateruptake) and organoleptic-tests based on consumer preferences like appearance, cohesiveness,tenderness on touching, chewing, taste, aroma, elongation and overall acceptability were studiedfor fourteen aromatic rice varieties. The higher hulling percentage was recorded in 'Ek-Kadi'(82.46%)and'Ghansal' (80.96%).

The paper has concentrated on the physical, chemical, cooking characteristics and organoleptictest with consumer preferences of traditionally cultivated scented and basmati rice varieties.Amongthevarietiesstudiedtraditionallycultivatedaromaticrice'Ek-Kadi'and'Ghansal'showed maximum hulling percentage. The AC, ASV and GC were excellent in 'Girga', 'Ek-Kadi', 'Mugadh Sugandh', 'Pusa Basmati-1' and 'Pusa Sugandh-3'. The study revealed that therice varieties viz. 'Basmati local', 'Jiresal', 'Kotimirsal', 'Pusa Basmati-1', 'Pusa Sugandh-2','PusaSugandh-3','PusaSugandh-5','Kasturi'and'Vasumati'withbestcookingqualitycharacteristicsandconsumer's preference.

II. WRITE DOWN YOUR STUDIES AND FINDINGS(PROPOSED WORK)

MaterialsandMethods

NI Lab view software is used to implement image processing algorithms for the analysis of grainquality.Visionandmotiontoolboxisusedtoimplementanddesignimageprocessingalgorithms. Color camera is used to capture image and using USB cable captured image can bestored in desktop. Then after that using lab view image processing algorithms are designed toevaluate

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quality of rice grains. The flow of image processing algorithm is shown in fig. 2 whichconsistsof somebasicsteps

Fig.2 FlowDiagramforImageProcessing Algorithm

A. Imagepre-processing

We capture image using color camera which is saved in the three dimensional RGB (red, green,blue)colorspace.ThecapturedimageacquiredindesktopusingUSBcablewhichisshowninfig 3. Filter is applied to remove noise which occurs during the acquisition of image. Filter alsosharpens the image. Threshold algorithm is used to segment the rice grains from the blackbackground. Using color extractor color image get converted into gray image which is shown infig4.Fig.

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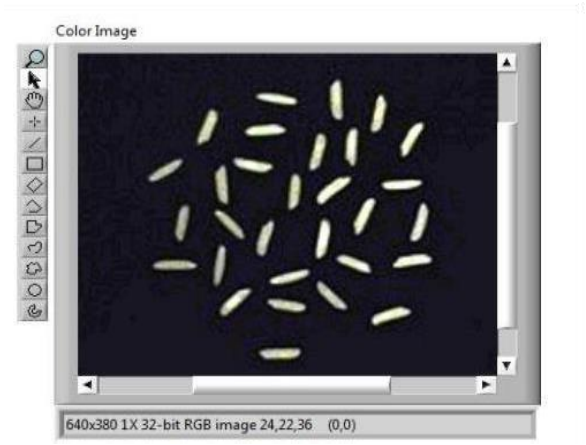

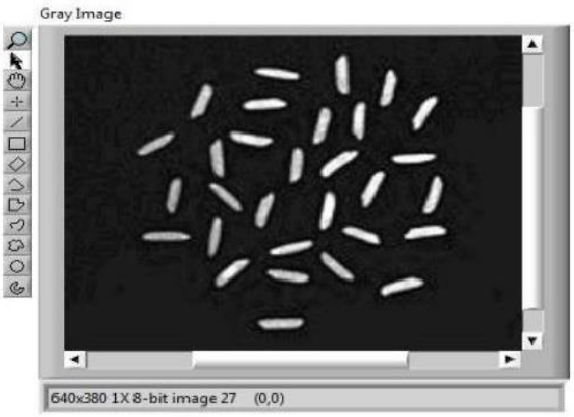

Fig.3ColorImage *Fig. 4 Gray Image*

B. Shrinkagemorphologicaloperation

Rice grains are randomly spread on black background. It can be seen in fig.1 that grains are notpointinginthespecificdirection.Incaseoftouchinggrainswecanclassifythemusingmorphological operation. Touching grains are divided into two types as point touching and linetouching. Morphological operation consists of the combination of dilation and erosion. In visionandmotion toolbox,different typesof morphologicaloperation areavailablewhichareas;

i. **AutoM**:Automedian,

ii. **Close**:Dilationfollowedbyanerosion,

iii. **Dilate**:Dilation(oppositeoferosion),

iv. **Erode**:Erosionthateliminatesisolatedbackgroundpixels,

v. **Open**:Erosion followed bydilation,

vi. **Pclose:**Asuccessionof sevenclosingsandopenings,

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vii. Popen: Asuccessionofsevenopeningsandclosings.

C. Edgedetection

Edge detection helps to find out the region of boundaries of rice grains as shown in fig. 5. Therearesixmethodsareavailableforedgedetectioninvisionand motiontoolboxlikedifferentiatiogradient, perwitt, Roberts, sigma and sobel. The method specifies the type of edge detection filtertobe used. Weused sobel method foredgedetection in proposedmethodology.

Fig.5EdgeDetectionOperation onRiceGrains

D. Objectmeasurement

Measurement indicates the count of rice grains which is shown in fig. 6, which shows thecounting of each grainwith number indicated in red margin. After getting the count of ricegrains, edge detection algorithms applied on the image and outcome of the applied algorithm

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iswe get endpoint values of each grain. We use caliper to join the endpoints and measure the valueof length and breadth of eachgrain. After getting the value of lengthand breadth we cancalculatelength-breadthratio.

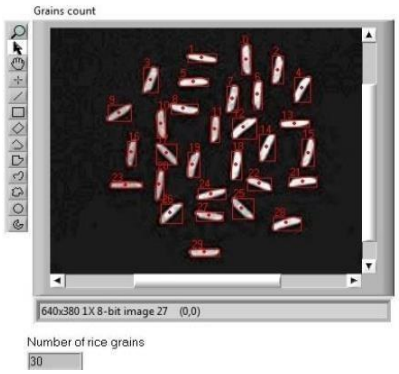

Fig.6 Numberof Rice Grains

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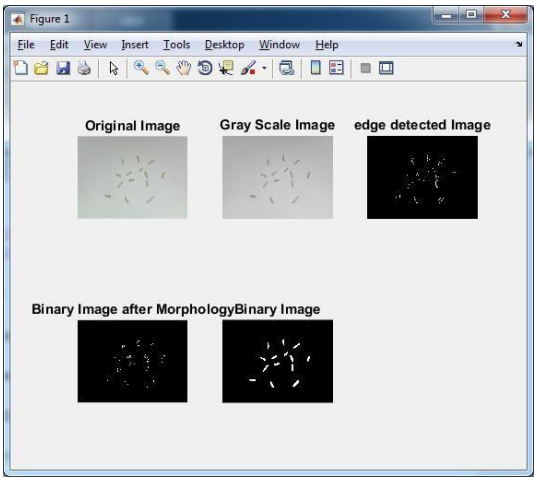
4. RESULTS AND DISCUSSION

Theresultswhichoccurred byimplementingimageprocessingalgorithmsareshownintablebelow.



Theresultsindicatelength-breadthratioofeachgrain.

total_rice_grains=14s

tats = 14x1

structarraywithfields:MajorAxisLengthMinorAxisLengthst

ats =

MajorAxisLength	MinorAxisLength
37.8773108489759	10.9971808858253
40.8416777778177	11.4961620815603

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50.5769746131946	11.1848030297915
37.4512803207583	11.312872631238
45.6546316303521	12.747717373013
36.249116310571	12.504844898772
32.9781589084845	12.3509806110583
39.6877990372274	11.0483507516756
33.2582801368029	11.989429885581
45.4276731195893	14.3824069010019
41.8969287257561	11.9889658882612
57.7431744225651	14.1911303690681
46.5905606271234	11.3124821556389
40.248131199208	11.971225919999

L_B_Ratio

=3.44427460475777

7

3.552635869959341

4.521936995982794

3.310501367914719

3.581396597872747

2.898805751211720

2.670084258650530

3.592192167795558

2.773966773582844

3.158558468848812

3.494624066515926

4.068962296930620

4.118509093417624

3.362072645540007

Rice Grain Number 1 is of type slender

.Rice Grain Number 2 is of type slender

.Rice Grain Number 3 is of type slender

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.Rice Grain Number 4 is of type slender

.Rice Grain Number 5 is of type slender

.Rice Grain Number 6 is of type medium

.Rice Grain Number 7 is of type medium

.Rice Grain Number 8 is of type slender

.Rice Grain Number 9 is of type medium

.RiceGrainNumber10isoftypeslender.RiceGrainNumber11isoftypeslender.RiceGrainNumber12isoftypeslender.RiceGrainNumber13isoftypeslender.RiceGrainNumber14isoftypeslender.

Theimageanalysisalgorithms areappliedon imagein which ricegrains arerandomly placed and spread in one layer. If the error occurs like touching kernels shrinkage operation worksefficiently for separating the connecting part from point touching kernels. Edge detection isperformedtofind outtheregion ofboundaries andendpointsof each grain.

5.CONCLUSION

In this study, the image processing algorithms are developed to segment and identify rice grains.From the obtained results, it can be concluded that the use of image processing algorithm is anefficient method to analyze grains quality by its size. The main benefit of proposed method is itrequires minimum time; cost is less and gives better results compared with manual results ortraditionalmethods.

For quality analysis, maximum numbers of parameters are to be measured by image processingtechniques. Expansion on this work can target to design such a system which can

classify ricegrains on the basis of each parameter which can used to enhance the quality of rice. The cost ofsuchsystem should beless and minimizetimerequirement for qualityanalysis.

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