RICE GRAIN CLASSIFICATION USING IMAGE PROCESSING

REVIEW 3 DOCUMENT

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IMAGE PROCESSING (CSE 4019)

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Abstract – The main aim of this project is about the processing, enhancement and analysis of digital images as a way to determine the quality of different rice samples, thus reducing the time required to do so manually. The evaluation of the rice grains on the basic grain size and shape using image processing edge detection algorithm is used to find the region of boundaries in each grain. We find the endpoints of each grains and after we measure the length and breadth of rice grains. The performance of Image Processing reduces the time of operation.

Keywords - Grading, Rice grain, Quality, Image processing, grain evaluation.

I. INTRODUCTION

Rice is favourable and high consumed cereal grain in Asian countries. It can be easily found all over the world. Many values added products are produced by using rice for human beings. In the rice market, key determinant of milled rice is quality. The quality measurement becomes more important with the import and export trade. Rice samples contain different dispensable objects like paddy, chaff, damaged grains, weed seeds, stones etc. Rice quality is varying according to these impurity content.

The main purpose of the proposed method is, to offer an alternative way for quality control and analysis which reduce the required effort, cost and time. Image processing is significant and advanced technological area where important developments have been made.

In agricultural and farming production quality control and analysis of manufactured goods is vital. Quality of grain is analysed visually by veteran person and technician. But the effect of such measurement is changing in results and prolonged. The excellence and quality also influenced by the mood and atmosphere of technician; so to overcome the shortcoming occurred due to conventional methods advanced technique i.e. Image processing technique is projected, to Maintaining the Integrity of the Specifications.

Image processing manipulates image for performing some operations on targeted image to get an improved and desirable image. And extort some valuable information from input image.

Nowadays, image processing is hastily growing technologies. All types of data have to go through three general phases while using DIP technique which are pre-processing, enhancement, and display, information extraction.

II. EXISTING WORK

[1] In this paper , RGB model was used to extract the spatial features like area, length, perimeter etc. Spectral features like wavelength ,reflectance value was extracted from the HSI model. Both the features were combined to perform feature extraction. Classifiers like kNN, random forest, support vector machines were used for classification.

Merit: Combination of spatial and spectral features results in effective algorithm to identify proper species.

Demerit: Image pre-processing is tough involving both models and cost ineffective

[2] According to this paper, the RGB image is transformed into grayscale and image is pre-processed using filters to remove noise. Image segmentation is done to acquire only the required part of rice image. Feature extraction is done and fed to neural network model

Merit: Neural Network model is very useful for classification of rice.

Demerit: Quality recognition is hard to see.

[3] Main purpose of this paper was to present an image processing-based solution to classify the different varieties of rice and its quality analysis. An approach based on the combination of principal component analysis and canny edge detection was used for the classification.

Quality analysis of rice grain is determined by morphological features of rice grains. These morphological features include eccentricity, major axis length, minor axis length, perimeter, area and size of the grains. Six different varieties of rice were classified and analysed in this paper.

Merit: Proposed system can work well within minimum time and low cost

Demerit: Database creation and training of dataset with multiple morphological features is tedious

[4] In this paper, the main focus is to automate the rice grain classification process by identifying and classifying rice grains individually by including various parameters and four main classes. This approach includes the decision tree, logical regression , random forest classifier and SVM algorithm too and for image collection, they use DSLR camera.

Merit: This can be further expanded to include chalkiness and moisture detection

Demerit: Process involved is more and it is more costly to perform

[7] According to the paper, an optimal image processing-based technique is presented for the characterization and quality analysis of rice grains. Therefore, a White chalky area of grains is detected by the authors by the use of extended maxima operator.

Merit: It only requires deep knowledge in the subject like machine learning techniques.

Demerit: Proposed algorithm’s time complexity is high.

[9] This paper was able to achieve remarkable accuracy as it made use of internal features of the grains in addition to the spatial features .Using fast Fourier transforms and Morphological Features. Also, both spatial and frequency-based features are also used.

Merit: Uses two layers of classification one is naive Bayes tree and second is sequential minimal optimization

Demerit: Images suffer from number of environmental constraints.

[10] This paper uses neural network, pattern recognition and classification for the rice grains. The main aim was to identify the relevant quality category for a given rice sample and based on texture and colour feature extraction are used to measure the quality of a rice sample.

Merit: An efficient method is proposed for classification of food grains which require limited features and thus overcoming the disadvantages like tediousness and time.

Demerit: Noticing the precise quality is difficult.

[12] This paper elucidates the need to identify artificial rice from the normal edible rice types and along with that, they propose to find the type and quality of rice using automates systems, CCD camera and various image processing techniques.

Merit: Accurate and faster classification of rice, this method can be done also to classify cereals, pulses and grain given time.

Demerit: Cameras don’t give 100% accuracy in the captured images, the nutrition part cannot be found just by using sensor and camera.

III. PROPOSED METHODS

The image processing technique is used for counting the number of rice seeds and classifies them on the basis of length, breadth and length - breadth ratio. Length is the average length of rice grain while breadth is the average breadth of rice grain and length-breadth ratio is calculated as:

L/B = [(Average length of rice grain)/(average breadth of rice)]*10.

3.1 Image pre-processing:

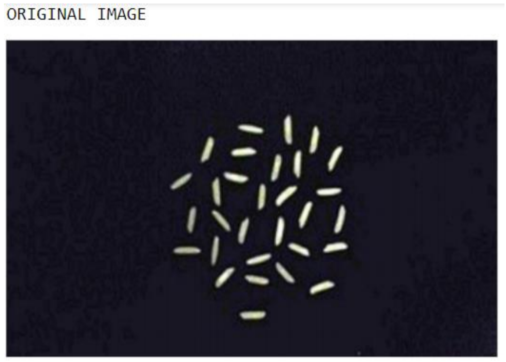


Fig 3.1: The original image taken for image pre-processing

Filter is applied to remove noise which occurs during the acquisition of image. Filter also sharpens the image.

Threshold algorithm is used to segment the rice grains from the black background.

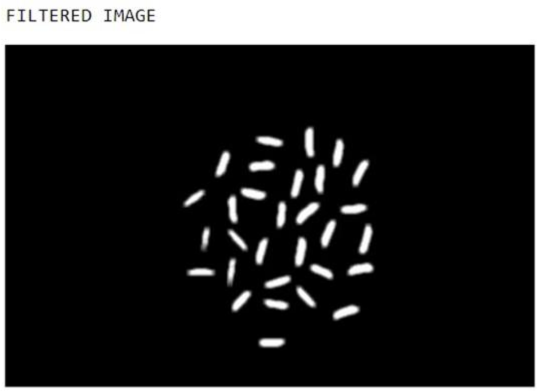


Fig 3.2: Filtered image after pre-processing which includes conversion of original image to gray and then binary and at last filtered image as it is shown

3.2 Shrinkage morphological operation :

Erosion is applied to separate the touching features of rice grains without losing the integrity of single feature.

Dilation process follows erosion process. The goal of dilation is to grow the eroded features to their original shape without re-joining the separated features.

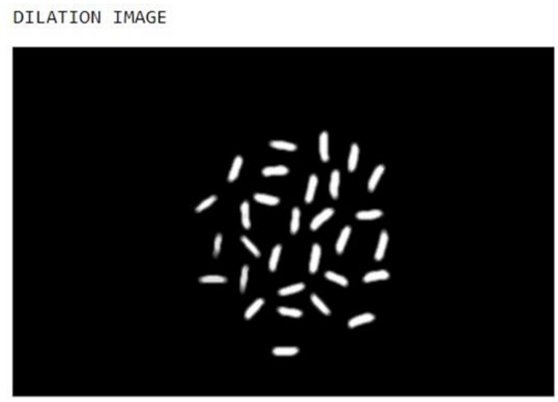


Fig 3.3 : The image obtained after both erosion and dilation(opening)

3.3 Edge detection:

Edge detection helps to find out the region of boundaries of rice grains. We use canny algorithm to detect the edges.

Fig 3.4: Image obtained after using Canny edge Detection algorithm

3.4 Object measurement:

Measurement indicates the count of rice grains. After getting the count of rice grains, edge detection algorithms applied on the image and outcome of the applied algorithm is we get endpoint values of each grain.

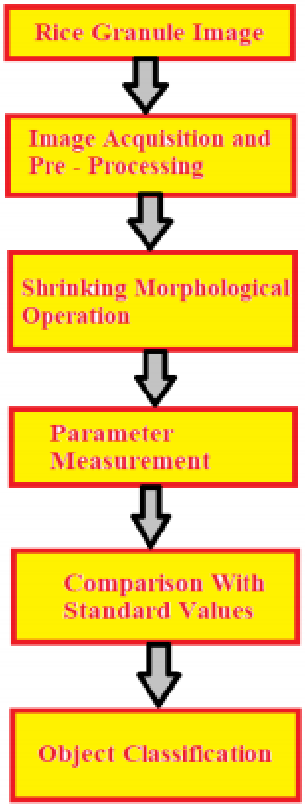
We use calliper to join the endpoints and measure the value of length and breadth of each grain. After getting the value of length and breadth we can calculate length-breadth ratio.

3.5 Object classification:

Classification requires all standard, measured and calculated results. The standard database for rice size and shape measurement is referred from laboratory manual on rice grain quality, Directorate of Rice Research, Rajendra Nagar, Hyderabad given below:

Long Slender (LS)	Length >= 6mm, L/B Ratio>=3mm
Short Slender (SS)	Length< 6mm, L/B Ratio>=3mm
Medium Slender (MS)	Length >= 6mm, 2.5 <L/B Ratio<3mm
Long Bold (LB)	Length >= 6mm, L/B Ratio<3mm
Short Bold (SB)	Length < 6mm, L/B Ratio<3mm

IV.SYSTEM ARCHITECHTURE



V. RESULTS AND DISCUSSION

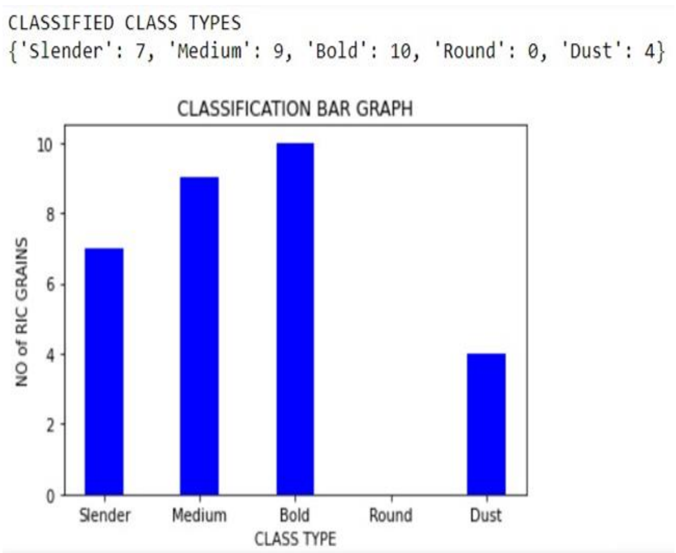


Fig 5.1 : The bar graph obtained after classification which list rice grains based on the calculated ratio and table

5.1 Comparison with Existing Work:

In this project, we are classifying the rice grain sample taken into various categories and also analysing its quality based on its aspect ratio, so it is not possible to compare with other works.

Existing works only detect the rice grains, or calculate number of rice grains in the given sample but our work helps to analyse the quality of rice sample and classify them into particular category.

5.2 Overall Discussion:

Quality of grains in the samples should be nearly 100% accurate and it should be suitable to grade large quality of grains efficiently, which otherwise will consume lot of time in manual analysis, this feature will be able to save lot of time & human effort.

VI. CONCLUSION

The image analysis algorithms are applied on image in which rice grains are randomly placed and spread in one layer. If the error occurs like touching kernels shrinkage operation works efficiently for separating the connecting part from point touching kernels. 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. We have successfully executed all the steps proposed .

Last two steps include calculating the size of the grains and then classifying them according to the Table provided.

VII. FUTURE WORK

The project can be improved by improving the training set and running in advanced systems which is out of scope currently. We also improve the classification part by improving the accuracy.

If possible the representation of the data found can be made even more easy to comprehend by including various other pictorial formats

VIII . ACKNOWLEDGMENT

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APPENDIX:

Libraries:

```
import pandas as pd
import numpy as np
import cv2
from PIL import Image
from IPython.display import display,Image
import matplotlib.pyplot as plt
```

Classification Block:

```
def get_classification(ratio):
    ratio =round(ratio,1)
    toret=""
    if(ratio>=3 and ratio<3.5):
        toret="Slender"
    elif(ratio>=2.1 and ratio<3):
        toret="Medium"
    elif(ratio>=1.1 and ratio<2.1):
        toret="Bold"
    elif(ratio>0.9 and ratio<=1):
        toret="Round"
    else:
        toret="Dust"
    return toret
```

Preprocessing:

```
def update_image():
    path="rice.png"
    img1 = cv2.imread(path,0)
    img2=cv2.cvtColor(np.array(img1), cv2.COLOR_RGB2BGR)
    img=cv2.cvtColor(img2,cv2.COLOR_BGR2GRAY)

#convert into binary
    ret,binary = cv2.threshold(img,160,255,cv2.THRESH_BINARY)

#simple averaging filter
    kernel = np.ones((4,4),np.float32)/9
    dst = cv2.filter2D(binary,-1,kernel)

#erosion
    kernel2 = cv2.getStructuringElement(cv2.MORPH_ELLIPSE,(3,3))
    erosion = cv2.erode(dst,kernel2,iterations = 1)

#dilation
    dilation = cv2.dilate(erosion,kernel2,iterations = 1)
```

Edge detection and classification:

```
#edge detection
    edges = cv2.Canny(dilation,100,200)


### Size detection
    contours, hierarchy = cv2.findContours(erosion, cv2.RETR_EXTERNAL, cv2.CHAIN_APPROX_SIMPLE)
    classification1 = {"Slender":0, "Medium":0, "Bold":0, "Round":0, "Dust":0}
    avg1 = {"Slender":0, "Medium":0, "Bold":0, "Round":0, "Dust":0}
    total_ar1=0
    for cnt in contours:
        x,y,w,h = cv2.boundingRect(cnt)
        aspect_ratio = float(w)/h
        if(aspect_ratio<1):
            aspect_ratio=1/aspect_ratio;
        classification1[get_classification(aspect_ratio)] += 1
        if get_classification(aspect_ratio) != "Dust":
            total_ar1+=aspect_ratio
        if get_classification(aspect_ratio) != "Dust":
            avg1[get_classification(aspect_ratio)] += aspect_ratio
    avg_ar1=total_ar1/len(contours)
    if classification1['Slender']!=0:
        avg1['Slender'] = avg1['Slender']/classification1['Slender']
    if classification1['Medium']!=0:
        avg1['Medium'] = avg1['Medium']/classification1['Medium']
    if classification1['Bold']!=0:
        avg1['Bold'] = avg1['Bold']/classification1['Bold']
    if classification1['Round']!=0:
        avg1['Round'] = avg1['Round']/classification1['Round']
    cv2.imwrite("img1.jpg", img)
```

```
    cv2.imwrite("binary1.jpg", binary)
    cv2.imwrite("dst1.jpg", dst)
    cv2.imwrite("erosion1.jpg", erosion)
    cv2.imwrite("dilation1.jpg", dilation)
    cv2.imwrite("edges1.jpg", edges)
    print("ORIGINAL IMAGE")
    display(Image(filename="rice.png"))
    print("GRAY IMAGE")
    display(Image(filename="img1.jpg"))
    print(" BINARY IMAGE")
    display(Image(filename="binary1.jpg"))
    print("FILTERED IMAGE")
    display(Image(filename="dst1.jpg"))
    print("ERODED IMAGE")
    display(Image(filename="erosion1.jpg"))
    print("DILATION IMAGE")
    display(Image(filename="dilation1.jpg"))
    print("EDGE DETECTION IMAGE")
    display(Image(filename="edges1.jpg"))

    return classification1,avg1,avg_ar1

classification,avg,avgr=update_image()
```

Plotting Graph:

```
print("\n")
print("CLASSIFIED CLASS TYPES")
print(classification)
plt.bar(list(classification.keys()),list(classification.values()),color ='blue',width = 0.4)
plt.xlabel("CLASS TYPE")
plt.ylabel("NO of RICE GRAINS")
plt.title("CLASSIFICATION BAR GRAPH")
plt.show()
```