RICE QUALITY ANALYSIS

PROJECT REPORT

Submitted in fulfilment for the JComponent of

Digital Image Processing (ITE1010)

CAL Course

in

B.Tech. – Information Technology

by

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ABSTRACT

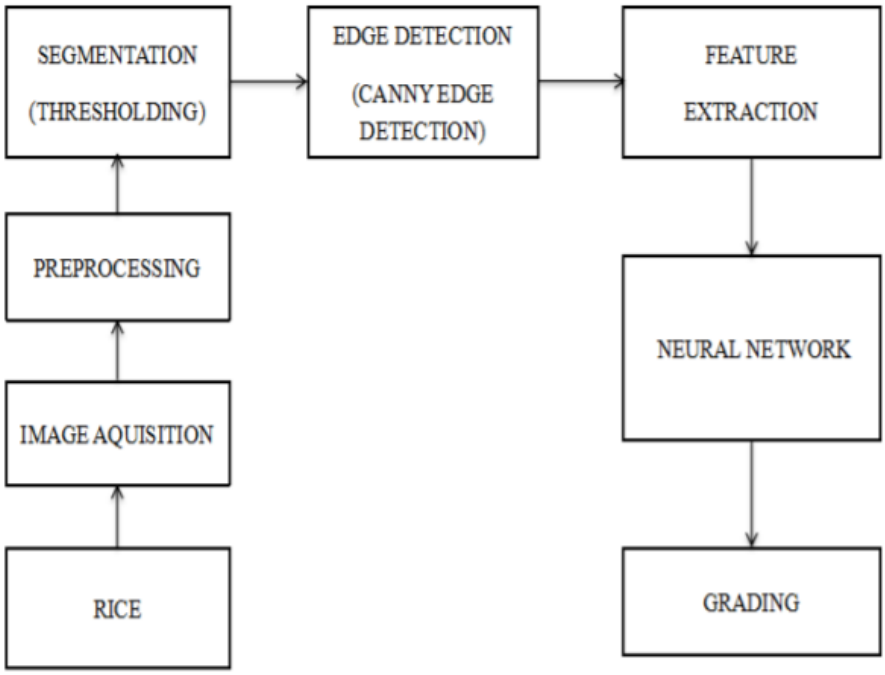
Quality analysis is the only way we get to know how good our food product is, how real it is. Now a days, we encounter a lot of black-market sales. People mix rice with other grades and sell it off. How do we know if our rice is a quality one or not? A normal person would not find any difference when looked through our naked eye. This project is an attempt to understand the quality of rice through image processing techniques and neural networks. This project aims to reduce tedious and time-consuming manual activity when it comes to quality analysis. A model will be implemented for quality analysis using image-processing techniques, Canny edge-detection, Feature-extraction. These features will be presented to the neural network for training the model. The trained network will then be used to identify our rice quality.

Keywords: Rice quality, Image pre-processing, Edge detection, Neural Network.

1. INTRODUCTION

Rice is the primary food of our whole country. Yield is the only characteristic a farmer would have his eyes on when the crops are grown, but quality becomes the only factor for its saleability. They might contain several types of impurities along with the rice like stones or other impurities. The traditional way of quality testing is done by automation process but has heavy workload for men and is a very tedious process. With our country being a highly populated one with rice as its main source of food along with many imports and exports, this quality analysis plays a very crucial role in the market. Visual inspection is the only way right now to assess the quality. This might not always do a very good justice for consumers since quality analysis depends on many factors when it involves human workload like their working stress, or their loyalty for traders or their experience. For example, If the quality of the rice is not tested properly, chalkiness can be seen when rice is of poor quality. Although it has no effect on rice when boiled, it will downgrade the quality of rice. There is a need for a change in this area and image processing fits in very well, reduces workload and helps in classifying rice granules by identifying the attributes from the given image and later when a neural network is applied along, we can know the quality of our rice perfectly with the accuracy, doing justice to consumers, This method reduces tiresome-workload and when proper accuracy is attained through our neural network, it will identify quality of rice more accurately than how accurately a normal person could. This might save a lot of time for food quality testers and get only quality products into the markets without testers' being bribed or doing a tiresome work.

2. GENERAL ARCHITECTURE



3. LITERATURE REVIEW

3.1 REVIEW ON VARIOUS SCHEMES

Mr. V.S.Kolkure, Ms. B.N.Shaikh [1] proposed a better approach for rice quality analysis using neural network and image processing techniques. Their paper focused on feeding the neural network with the feature extracted data from the input image. They did colour extraction as well as morphological features extraction like area, major axis length, minor axis length, aspect ratio. They fed these data to a Probabilistic Neural Network(PNN) which was able to produce output in terms of quality along with identification of unknown grain types.

Wan Putri N. W. M. Tahir, et.al. [2] in their paper on "RICE GRADING USING IMAGE PROCESSING" proposed a different approach to grade rice based on their colour, shape, length. They calculated size of rice for length and RGB colour space for colour and Canny Edge Detection Techniques for shape. They used a Naïve Bayes Classifier, a supervised ML algorithm to classify rice based on their quality. As the output, they produced Rice A,B,C based on their quality from high to low respectively.

Bhavesh B. Prajapati , Sachin Patel [3] proposed an algorithmic approach to grade the quality of rice. They considered Indian Basmati Rice for their research. They identified that quality of rice depends on length, width and chalkiness. Based on these parameters , they calculated the length to width ratio, percentage chalky rice grains, percentage damaged/discoloured rice grains and percentage broken/fragmented rice grains. They check these ratios against standard ones and finally produce an output of whether this rice is within acceptable quality limits or not.

Harpreet Kaur and et.al. [4] in their paper classified rice and graded them using a Multi-class SVM classifier. They also suggested that the length, chalkiness are basic rice quality grading parameters from which they calculated the type of rice in terms of bold, round, slender based on length and purity analysis based on the chalkiness. Later they gave these parameters for SVM classifier and produced an output in terms of premiere, A, B, C based on their quality.

Nikhade Pratibha and et.al. [5] on their paper for analysis and identification of rice quality used a Feed Forward Neural Network to classify the quality of rice. They fed the NN with area, perimeter, major axis length and minor axis length which they extracted from the rice granules image in the feature extraction step. They considered these as the primary parameters for classifying rice. In their output, the NN was able to detect percentage of rice belonging to different categories that are mixed together also. They were able to detect stones from the input image too.

3.2 COMPARATIVE STUDY ON VARIOUS SUBTITLES

(Year, Authors)	Methodology or Techniques used	Advantages	Issues	Metrics used
Title: Identification and Quality Testing of Rice Grains Using Image Processing and Neural network. **Authors:**V.S.Kolkure, B.N.Shaikh **Year:**2017	Image Acquisition, pre-processing, segmentation, feature extraction, PNN training and testing	They extracted morphologic al as well as colour features from the rice granules to detect rice quality as well as other objects in rice.	Their used model, PNN is comparatively slower than many other neural models like BPN. Their model also requires more memory space.	Accuracy of the system.
Title: Rice Grading using Image Processing. **Authors:** Wan Putri, Hussin, Htike, Naing. **Year:**2015	Image Acquisition, Pre-processing, Feature extraction, Statics analysis using Naïve Bayes Classifier.	They identified that colour, shape and length are major parameters in identifying quality of rice and trained their model with 60 images and later tested with 40 images.	They said that their classifier fails to identify if the image is not captured properly in terms of dimension, brightness etc. I suspect their accuracy being so low says that they haven't considered all important parameters during feature extraction phase or Naïve Bayes doesn't fit our problem domain.	Accuracy of the system. Their model had 46.6% accuracy after training with 285 images.
Title: Algorithmic approach to quality analysis of Indian basmati rice using digital image processing. **Authors:** Prajapati, B. B., Patel, S.	Image Acquisition, Binarization, Feature Extraction.	They developed an algorithm that calculates length to width ratio, percentage	Their result can only say whether given rice granule image is of acceptable quality or not. It can't say the	They used standard values to check against calculated values as metrics to

Year: 2013		chalky rice grains etc. and checks these ratios against standard values and provides a result. The standard ratio idea is brilliant.	grade of the rice.	determine rice quality.
Title: Classification and grading rice using multi-class SVM. **Authors:** Kaur H, Singh B. **Year:**2013	Scanning the Rice grain sample, Image smoothening , Image Segmentation, Image Binarization, Calculation of chalk Volume, Analysis of Shape of Rice Grains, Analysis of purity of Rice Grain, Classification Module	They classified the rice kernel by examining the Shape, Chalkiness and Percentage of Broken (Head Rice, Broken and Brewers) kernels. The SVM classify accurately more than 86%.	None. Instead, their approach can be used to develop an online rice quality grader.	Accuracy. Their system has an accuracy of more than 86%.
Title: Analysis and Identification of Rice Granules Using Image Processing and Neural Network. **Authors:** Pratibha N, Hemlata M, Krunali M, Khot S. T. **Year:**2017	Image acquisition and smoothing, segmentation and thresholding, edge detection, feature extraction, training and testing NN.	They identified area, perimeter, major axis length and minor axis length to be the important parameters in grading rice. They were able to detect various quality type percentages and stones from same image itself.	None. Their Feed forward neural network was able to understand complex relations easily helping the output to even produce percentage of stones found in the given input image.	They have mentioned the percentages of rice grades from one image. They haven't given any values to support their NN to work fine but mentioned that they used accuracy as primary metric.

3.3 OVERVIEW OF THE REVIEW

In the paper in [1], they extracted colour features alongside morphological features to understand the image features better.

In the paper in [2], they trained their neural network with almost 60 images. They considered colour, shape and length to play an important role in grading a rice based on it's quality.

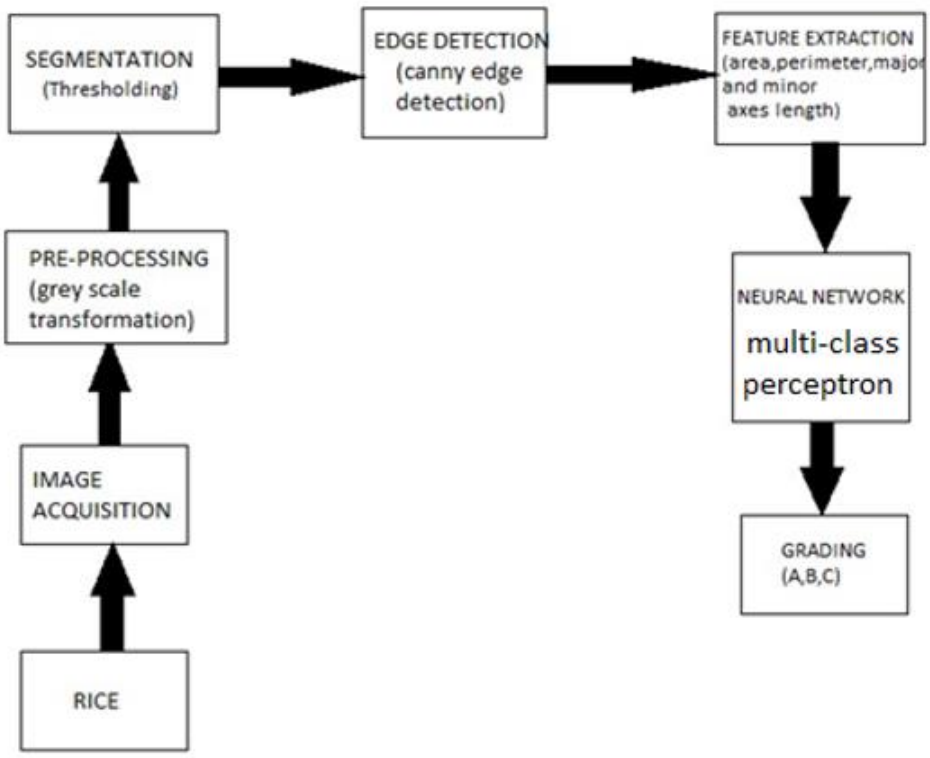
In the paper in [3], they calculated various ratios and verified them against the standard ones to decide whether the rice quality is acceptable or not.

In the paper in [4], despite the common parameters, they gave importance to broken kernels and calculated their percentage as well since they also play a major role in deciding quality of rice. But in usual cases, area and perimeter suppresses these differences. They were able to provide an accuracy of 86% through their SVM model.

In the paper in [5], they used feed forward neural network which understands all the hidden complex relationships from the parameters, and they were able to calculate percentages of different grades that have been mixed and sold in one grade.

4. SYSTEM DESIGN

4.1 FLOW CHART



4.2 DETAILED DESCRIPTION OF MODULES

- **IMAGE ACQUISITION**

Image Acquisition is the first step in image processing. Acquisition of basmati rice granules is done using mobile camera in uniform lighting setup.

- **IMAGE PRE-PROCESSING**

Grey-Scale Transformation

RGB image is converted to grey-scale image to make it feasible for further processing techniques.

- **SEGMENTATION**

The next step is to segment an image. Segmentation is the process of partitioning a digital image into multiple segments. In simpler words, the goal of segmentation is to simplify or change the representation of an image into something that is more meaningful and easier to analyse. There are various techniques to attain segmentation, such as: region segmentation, thresholding, clustering-based etc.

Our goal is to extract the rice granules from the background. We need maximum variance between our object and background. Thresholding fits better for our work.

Thresholding

It is the method of image segmentation. From a grey scale image thresholding can create a binary image. This technique is done to separate the regions in an image with respect to the objects, which is to be analyzed. The separation of region is based on the variation of intensity between the object pixels and the background pixels.

In our work to perform thresholding, Ostu's thresholding technique is implemented. After properly separating the necessary pixels, we can set them with a determined value to identify them (i.e. we will assign them a value of 0(black)for background and 255(white) for objects).

- **EDGE DETECTION**

It is an image processing technique that is used to find the boundaries of the objects within an image. It works by recognizing discontinuities in colour, grey level, textures etc.

Canny Edge Detection

The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images and suppresses noise simultaneously.

Canny edge detection is an optimal detector which gives optimal filtered image. The edges in the image are marked only once and false edges are not created due to the noise in the image because this method has good detection and localization with minimal response. This detector has the ability to detect weak edges. Canny edge detector

distinguishes the edges by locating the local maxima and minima of the gradient of the intensity function. The advantage of Canny edge detection is that the detected edges are thick. This occurs if the edge is with one pixel thick. Canny edge detector first blurs the images slightly and then applies an algorithm that thins the edges to one-pixel effectively.

- **FEATURE EXTRACTION**

Feature extraction is the process of extracting necessary information from the segmented image. For our project, the main morphological features to be extracted from the image are area, perimeter, major-axis length, minor-axis length. These features are extracted using contour detection.

Area: This refers to the number of pixels in the region.

The algorithm calculated the number of pixels inside including the seed boundary (mm2/pixel).

Perimeter: This refers to the boundary pixels in every granule.

Major axis length: It was the distance between the end points of the longest line that could be drawn through the seed. The major axis endpoints were found by computing the pixel distance between every combination of border pixel in the seed boundary.

Minor axis length: It was the distance between the end points of the longest line that could be drawn through the seed while maintaining perpendicularity with the major axis.

These extracted features are later fed to an algorithm based classifier as input parameters for getting the results.

- **GRADING USING NN**

Neural network is used for the classification based on the extracted features from the rice samples. Multiclass perceptrons provide a natural extension to the multi-class problem. Instead of just having one neuron in the output layer, with binary output, one could have N binary neurons leading to multi-class classification. In practice, the last layer of a neural network is usually a softmax function layer, which is the algebraic simplification of N logistic classifiers, normalized per class by the sum of the N-1 other logistic classifiers.

An output of Grade A or Grade B or Grade C will be provided in the result along with the accuracy of the trained model.

5. SOFTWARE REQUIREMENT SPECIFICATIONS

SOFTWARE USED	DESCRIPTION
MATLAB	**Matlab has been used to pre-process the image and extract features from the image**
PYTHON	**Python has been used to train an MLP model and test it with features extracted from the image obtained from Matlab.**

6. EXPERIMENTAL RESULTS & DISCUSSION

I was able to classify every granule in the image into their respective grades after extracting features from the image and training it with multi-layer perceptron model.

The model was tested using K-Fold technique which basically divides the data-set into as many parts as we specify (in our case 10) and assumes k-1 as training sets and one part as testing set and checks the model for k times. This technique proves to be the most proper way of testing our model's accuracy. And with this, our model has 89.7% accuracy with RMSE about 7%.

6.1 SOURCE CODE

feature_extract.m

```
clc;
clear all;
close all;
k=imread('rice.JPG');
a=rgb2gray(k);
radius=1;
b=fspecial('disk',1);
c=imfilter(a,b,'replicate');
level=graythresh(c);
d=imbinarize(c,level);
figure,imshow(k),figure,imshow(a),figure,imshow(c),figure,imshow(d);
e=edge(d,'canny');


labeledimg=bwlabel(e,8);
imshow(labeledimg);
coloredlabels=label2rgb(labeledimg,'hsv','k','shuffle');
imshow(coloredlabels);
blobmeasurements=regionprops('struct',labeledimg,'all');
numofblobs=size(blobmeasurements,1);
figure,imshow(k);
hold on;
```

```
boundaries = bwboundaries(d);
numofboundaries=size(boundaries,1);
for l=1:numofboundaries
    thisboundary=boundaries{l};
    plot(thisboundary(:,2),thisboundary(:,1),'g','LineWidth',2);
end
hold off;
textFontSize = 14;  % Used to control size of "blob number" labels put atop
the image.
labelShiftX = -7;   % Used to align the labels in the centers of the coins.
blobECD = zeros(1, numofblobs);
fprintf(1,'Blob #    Area   Perimeter Major-Axis-Length   Minor-Axis Length
\n');
% Loop over all blobs printing their measurements to the command window.
for x = 1 : numofblobs           % Loop through all blobs.
      blobArea = blobmeasurements(x).Area;          % Get area.
      blobPerimeter = blobmeasurements(x).Perimeter;             % Get
perimeter.
      blobCentroid = blobmeasurements(x).Centroid;% Get centroid one at a
time
      blobmajor=blobmeasurements(x).MajorAxisLength;
        blobminor=blobmeasurements(x).MinorAxisLength;
      fprintf(1,'# %2d %11.1f %8.1f %8.1f     %8.1f\n', x, blobArea,
blobPerimeter,blobmajor,blobminor);
      % Put the "blob number" labels on the "boundaries" grayscale image.
      text(blobCentroid(1) + labelShiftX, blobCentroid(2), num2str(x),
'FontSize', textFontSize, 'FontWeight', 'Bold');
end
```

ip_classifer.ipynb

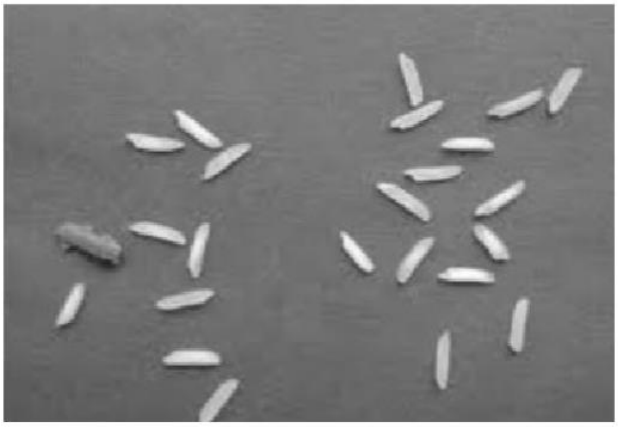
```
# importing necessary libraries
from sklearn import datasets
from sklearn.metrics import confusion_matrix
from sklearn.model_selection import train_test_split
import pandas as pd
# loading the dataset
from google.colab import files
uploaded=files.upload()
print(uploaded.keys())
data = pd.read_csv(list(uploaded.keys())[0],sep=",")
data = data.fillna(data.mean())
data.info()
data.head()
#separating input parameters and output parameters
X = values[:,0:4]
Y = values[:,4]

from sklearn.preprocessing import LabelEncoder
from keras.utils import np_utils

encoder = LabelEncoder()
```

```
encoder.fit(Y)
encoded_Y = encoder.transform(Y)
print(encoded_Y)
# convert integers to dummy variables (i.e. one hot encoded)
dummy_y = np_utils.to_categorical(encoded_Y)
dummy_y
# define baseline model
def baseline_model():
  # create model
  model = Sequential()
  model.add(Dense(8, input_dim=4, activation='relu'))
  model.add(Dense(3, activation='softmax'))
  # Compile model
  model.compile(loss='categorical_crossentropy', optimizer='adam', m
etrics=['accuracy'])
  return model

# loading the test dataset attributes retrieved from feature extract
ion of image through matlab
from google.colab import files
uploaded=files.upload()
print(uploaded.keys())
testdata = pd.read_csv(list(uploaded.keys())[0],sep=",")
testdata = testdata.fillna(data.mean())
testdata.info()
testdata.head()
testdata.shape
testX=testdata.values[:25,1:]
testX #run the model to get grades of rice granules.

from keras.wrappers.scikit_learn import KerasClassifier
from sklearn.model_selection import KFold
from sklearn.model_selection import cross_val_score
from keras.models import Sequential
from keras.layers import Dense


estimator = KerasClassifier(build_fn=baseline_model, epochs=200, bat
ch_size=5, verbose=0)
estimator.fit(X,dummy_y)
predictions=estimator.predict(testX)
print(predictions)
print(encoder.inverse_transform(predictions))
kfold = KFold(n_splits=10, shuffle=True)
results = cross_val_score(estimator, X, dummy_y, cv=kfold)
#calculate accuracy of the model
print("Accuracy: %.2f%% (%.2f%%)" % (results.mean()*100, results.std
()*100))
```

6.2 SCREENSHOTS WITH EXPLANATION

1. **Firstly, we import the image of rice for which we need to calculate grades. Let's call this test_data.**

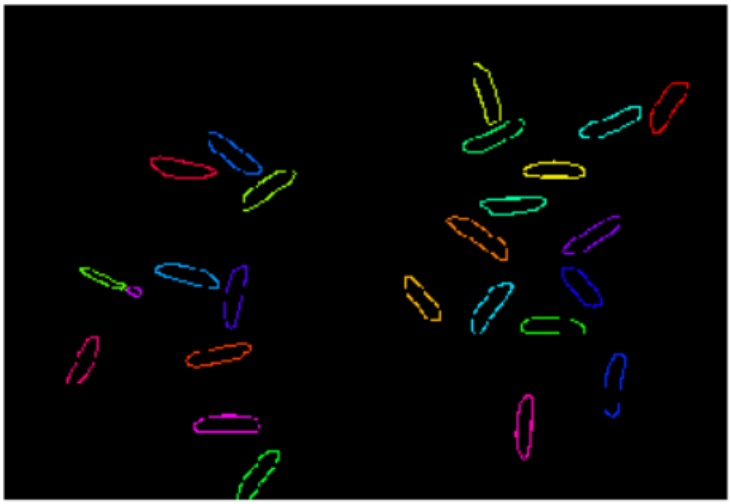
2. **Converting the RGB image to Gray-scale.**



3. **Applying Thresholding to the Gray-scale image to convert it to a binary image so as to focus on granule particles leaving the background. (Here, OSTU'S thresholding technique is applied).**

4. **Applying Canny Edge Detection algorithm to detect edges of the granules.**

(showing it in hsv color)



5. **Applying feature extraction now on the identified granule edges. We extract Area,perimeter,major axis length and minor axis length from the image as discussed.**
   (marking the detected grain with numbers for convenience)

6. Extracted features from the granules in the image.

Blob #	Area	Perimeter	Major-Axis-Length	Minor-Axis Length
# 1	66.0	62.6	35.0	13.8
# 2	61.0	56.8	31.0	6.7
# 3	21.0	17.1	8.5	6.4
# 4	84.0	76.4	43.7	13.9
# 5	83.0	76.4	43.6	13.6
# 6	77.0	76.3	43.0	13.0
# 7	105.0	76.6	38.7	15.6
# 8	88.0	76.2	41.9	15.0
# 9	78.0	75.2	41.7	14.0
# 10	75.0	127.2	36.4	15.0
# 11	86.0	74.0	40.2	14.6
# 12	78.0	65.0	35.1	13.8
# 13	91.0	83.0	45.9	14.9
# 14	83.0	76.0	42.4	13.3
# 15	87.0	74.0	41.0	15.1
# 16	82.0	75.3	41.9	15.0
# 17	88.0	75.5	40.9	13.8
# 18	87.0	73.9	40.2	13.2
# 19	87.0	74.2	40.3	14.1
# 20	87.0	71.2	37.6	13.2
# 21	82.0	76.0	42.8	13.3
# 22	73.0	63.7	33.3	16.0
# 23	85.0	76.0	43.1	13.6
# 24	80.0	73.5	41.6	14.3
# 25	78.0	71.9	39.1	16.9

7. **Later we trained a Multi-layer perceptron model with various images of various grades of rice whose features were obtained through the above discussed technique.**

NO. OF INPUT LAYERS : 4 (area,perimeter, major axis length, minor axis length)

NO. OF OUTPUT LAYERS : 3 (grades : A,B,C)

NO. OF HIDDEN LAYERS : 8

```
model.add(Dense(8, input_dim=4, activation='relu'))
model.add(Dense(3, activation='softmax'))
```

8. **The dataset consists of about 200 granules' details and their corresponding classified grade.**

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 224 entries, 0 to 223
Data columns (total 5 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   Area                224 non-null    int64
 1   Perimeter           224 non-null    float64
 2   Major-Axis-Length   224 non-null    float64
 3   Minor-Axis Length   224 non-null    float64
 4   grade               224 non-null    object
dtypes: float64(3), int64(1), object(1)
memory usage: 8.9+ KB
```

	Area	Perimeter	Major-Axis-Length	Minor-Axis Length	grade
0	77	68.2	35.6	19.6	B
1	83	72.4	37.0	23.2	B
2	81	70.9	37.0	21.3	B
3	81	74.4	40.5	20.3	B
4	79	69.5	37.2	19.5	B

9. **Later, the features extracted from the given rice image are loaded into this model as test_data after training. The result of grades obtained from the model :**

```
estimator = KerasClassifier(build_fn=baseline_model, epochs=200, batch_size=5, verbose=0)
estimator.fit(X,dummy_y)
predictions=estimator.predict(testX)
print(predictions)
print(encoder.inverse_transform(predictions))
kfold = KFold(n_splits=10, shuffle=True)
results = cross_val_score(estimator, X, dummy_y, cv=kfold)
print("Accuracy: %.2f%% (%.2f%%)" % (results.mean()*100, results.std()*100))
```

```
[0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
['A' 'A' 'C' 'A' 'A' 'A' 'A' 'A' 'A' 'A' 'A' 'A' 'A' 'A' 'A' 'A' 'A' 'A'
 'A' 'A' 'A' 'A' 'A' 'A' 'A' 'A']
Accuracy: 89.70% (7.85%)
```

10. **We can observe that our model's accuracy is about 89% with RMSE about 7%**

7. REFERENCES

[1] Kolkure, V. S., & Shaikh, B. N. (2017). Identification and quality testing of rice grains using image processing and neural network. *International Journal of Recent Trends in Engineering & Research*, *3*(01), 130-135.

[2] Tahir, W. P. N., Hussin, N., Htike, Z. Z., & Naing, W. Y. N. (2015). Rice grading using image processing. *ARPN Journal of Engineering and Applied Sciences*, *10*(21), 1-9.

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[5] Pratibha, N., Hemlata, M., Krunali, M., & Khot, S. T. (2017). Analysis and Identification of Rice Granules Using Image Processing and Neural Network. *Dept. of Electronics and Telecommunication, Bharati Vidyapeeth's College of Engineering for Women*.

ANNEXURE

Analysis and Identification of Rice Granules Using Image Processing and Neural Network

Nikhade Pratibha, More Hemlata, Manekar Krunali and Prof. S. T. Khot

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Bharati Vidyapeeth's College of Engineering for Women, Pune, India.

Abstract

The quality of food grains is referred to the every aspect of the profit of supply and marketing. The varietals purity is one of the factors whose inspection is more difficult and more complicated than that of other factors. This evaluation process is, however, tedious and time consuming. The farmers are affected by this manual activity. A model of quality grade testing and identification is built which is based on features such as the major axis, minor axis, parameters and area with image processing and neural network technology. Investigation is made on basmati rice by image processing and Neural Network which is implemented based on the features extracted from rice granule. Images are acquired for rice using Web cam. Image Pre-processing techniques, Ostu's Thresholding, Canny edge detection, Feature extraction are performed on the acquired image using image processing method through MATLAB. The features are presented to the neural network for training purposes. The trained network is then used to identify the unknown impurities and its quality.

Keywords: Grain quality, image processing, neural Network, Ostu's Thresholding, Canny Edge Detection.

I. INTRODUCTION

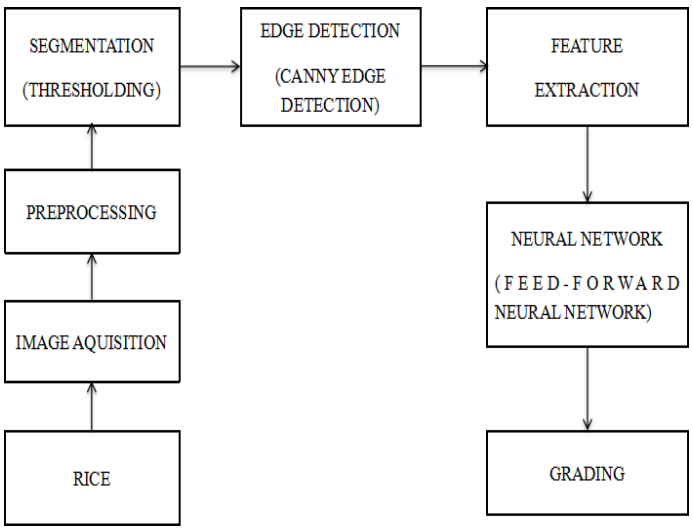
Grains are the prime crop for our country to increase the agricultural income. Also, yield is the most noticeable characteristic to farmers while the crop is in the ground, but when the milled rice reaches the market, quality becomes the key determinant of its sale-ability. These grains consist of several impurities like stones, weed seeds, chaff, and damaged seeds etc. The automation level of testing quality of grain is low and most work is done by manpower. The workload is so mass that it will lead to

workers fatigue and need them to have sample testing experience. And it also makes the testing more costly and long to be made. With the development of import and export trade this contradiction is more and more outstanding. During grain handling operations, types of grain and their quality is required at several stages before the next operation can be determined and performed. In the present grain handling system, grain type and quality are rapidly assessed by visual inspection. This analysis process is, however, tedious and time consuming. There is no convenient method to identify these inferior quality grains in the market. Therefore, this has become a serious issue for the consumer. The farmers are affected by this manual activity. Therefore, it is required to explore the possibility of using technology for a suitable solution. The accuracy of quality checking by using manual method is varied from person to person and it also depends on working stress, persuasion and loyalty for traders and also the knowledge and experience of inspectors are required to accurately perform this evaluation process.

II. MATERIALS AND METHODOLOGY

The samples of Basmati rice grains were collected from store and a camera is used to acquire and record the images of rice granules of different sizes. The camera is mounted on a stand which provides vertical movement. When the camera is fixed at certain distance between the lens and the sample table with uniform background. The background is black. The uniform intensity of light is provided on the sample table. Inside the field of view, the grains were arranged in random orientation and position. Acquired Image stored in jpeg format and parameters were extracted from the image for further analysis. With the parameters interpreted we will establish a Neural Network system using Back propagation algorithm for grading of rice granule.

III. BLOCK DIAGRAM



IV. IMAGE ANALYSIS

It is the process of differentiating the granules from the background and extracting quantitative information, which is used further for decision making process.

A. Image Acquisition and Smoothing:

Image Acquisition is the first step in image processing. Acquisition is done by using PC web cam Camera under uniform lighting setup. Smoothing is done using Median Filters. Median filter is used for pre-processing, because it preserves the edges of the image during noise removal. Median filtering is extensively used in digital imaging since it conserves the ends of the image during noise exclusion. Salt and pepper noise are which with, median filters are predominantly effectual. Using median filter the noise in the input gray color image is removed.

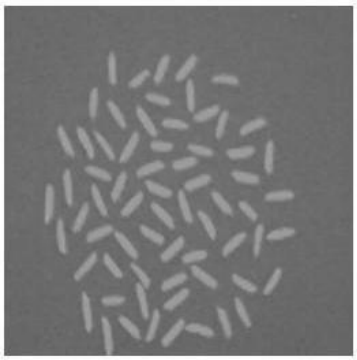


Fig.1. Smoothing Image

B. Segmentation:

The subsequent step is to segment an image, which is one of the imperative stages in image analysis. Segmentation is attained by three techniques such as Edge segmentation, Region segmentation and Thresholding.

C. Thresholding:

It is the method of image segmentation. From a grey scale image, thresholding can create a binary image. Threshold is to separate the regions in an image with respect to the objects, which is to be analyzed. The separation of region is based on the variation of intensity between the object pixels and the background pixels. In our work to perform thresholding, ostu's thresholding technique is implemented. After properly separating the necessary

pixels, we can set them with a determined value to identify them (i.e. we can assign them a value of 0(black), 255(white) or any value that suits our needs).

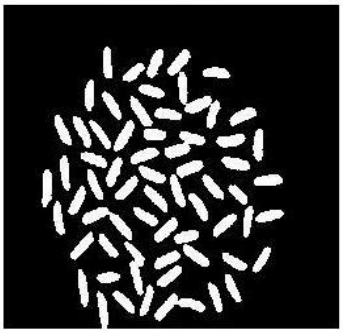


Fig.2. Threshold Image

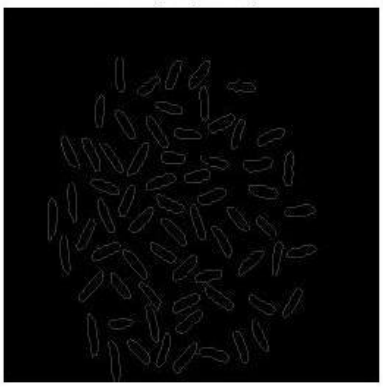
D. Edge Detection:

Edge detection is based on recognition of edges by diverse edge operators. Discontinuities in color, Grey level, texture, etc. are detected by edge operators.

Canny Edge Detection:

Canny edge detection is an optimal detector which gives optimal filtered image. The Grey scale image edges are detected by this optimal detection technique. The edges in the image are marked only once and false edges are not created due to the noise in the image because this method has good detection and localization with minimal response. This detector has the ability to detect weak edges. Canny edge detector distinguishes the edges by locating the local maxima and minima of the gradient of the intensity function. The advantage of Canny edge detection is that the detected edges are thick. This occurs if the edge is with one pixel thick. Canny edge detector gives a solution to the problem first it blur the images slightly and then applies an algorithm that thins the edges to one-pixel effectively.

Fig.3. Canny Edge Detection

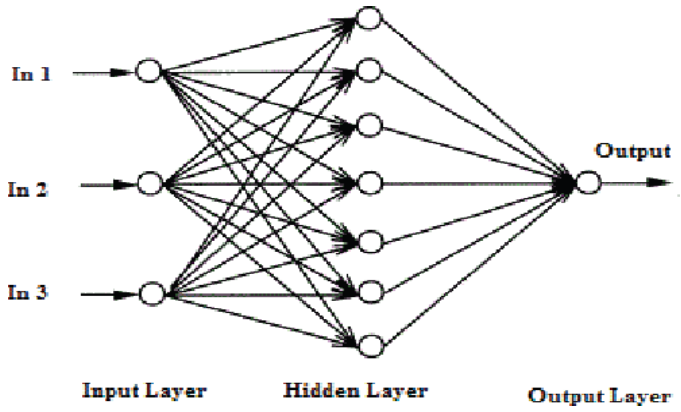


F. Features Extraction:

Extraction of quantitative information from segmented images is deal with Feature Extraction. Object recognition and classifications is done based on various algorithms of morphological features. Some of the morphological features for classification purposes contain redundant, noisy and irrelevant information. The features which extracted from images of rice granules is Perimeter, Area, Minor-axis Length and Major-axis Length using Contour detection. The collected data is given to Neural Network system for grading of rice granules.

V. GRADING USING NEURAL NETWORK

The collected data is given to the Neural Network Pattern Recognition system for grading of rice granules.



- Extracting patterns and detecting trends are complex to be noticed by either humans or other computer techniques.
- Neural network is used for the classification based on the extracted features from the rice samples.
- The neural network is built with three neurons in input layer, seven neurons in the hidden layer and one neuron in the output layer.
- The network which used for classification is back propagation algorithm.
- During the training, neural network weights are initiated with random values.
- The weights are stored during the end of training.
- When the training completed, the network tested to calculate the accuracy with stored weights.

VI. ALGORITHM

Input: Original Color Image

Output: Classified food grains along with Quality

Step1: Acquire the food grain images.

Step2: Enhance image to remove noise

Step3: Identify Patches and Do the image segmentation.

Step4: Extract Color and morphological features.

Step5: Use these features to recognize and classify the food grain image samples using Neural network

VII. RESULT

Quality evaluation of rice seeds is performed via image processing. Calculations of perimeter, minor axis length, area, major axis length are done for a given sample. The rice granules are graded depending on the size of grains present in the sample.

- 55% of long grains are graded as grade 1.
- 33.33% of small grains are graded as grade 2.
- 11.11% of stones are present in sample.

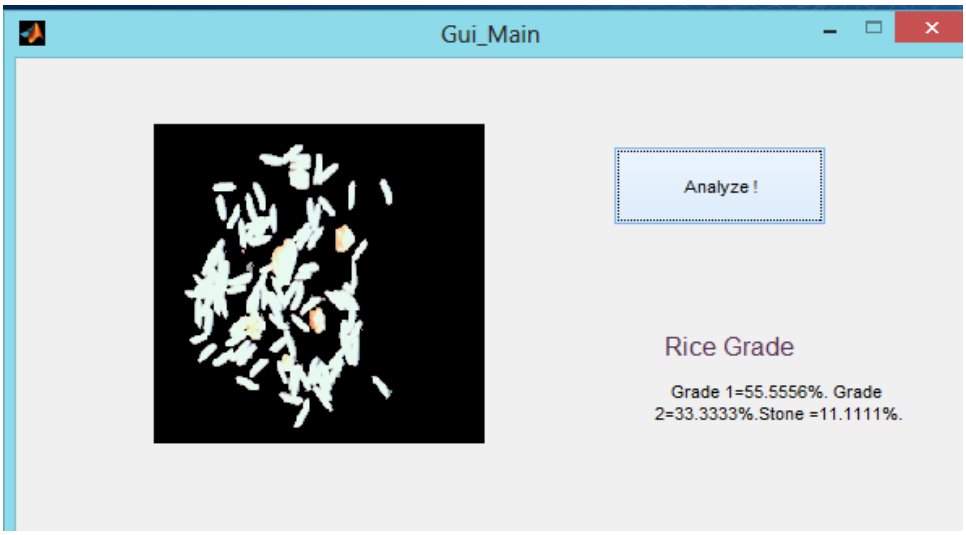


TABLE I: ANALYSING SEVERAL GRAINS IN ONE SAMPLE

Sr.No.	Area	Major-axis	Minor-axis	Perimeter
1	129	26.45215568	6.474056681	56.28427125
2	116	22.61338124	6.753313574	48.870.05769
3	125	23.09343348	7.051399628	48.52691193
4	129	27.18976437	6.241474347	57.45584412
5	108	21.15132969	6.705329553	46.28427125
6	115	28.46547094	5.36493914	57.3137085
7	115	24.29226898	6.269345856	49.35533906
8	120	21.60775281	7.291891729	48.04163056
9	102	29.25358896	4.581519015	56.48528137
10	113	24.94454879	6.011378942	52.87005769
11	109	24.96749463	5.718731565	51.3137085
12	115	20.14895685	7.4728345060	44.97056275

The rice granules are graded depending on the size of grains present in the sample.

- 100% of long grains are graded as grade 1.
- 0% of small grains are graded as grade 2.

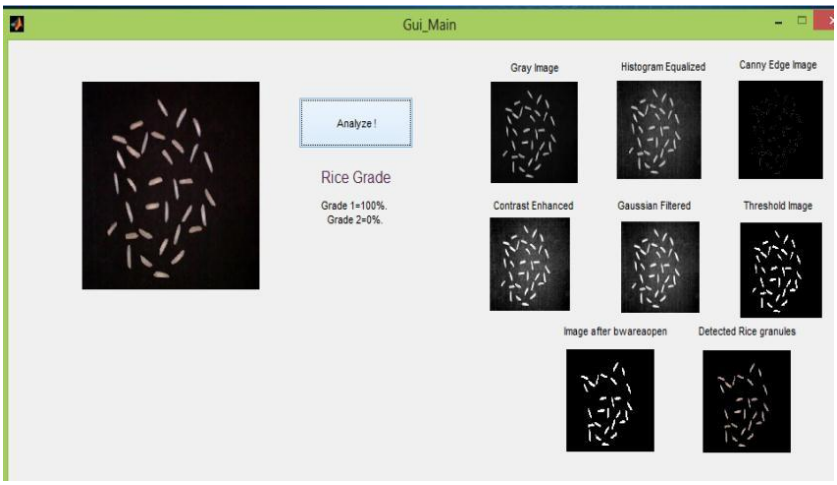


TABLE II
ANALYSING SEVERAL GRAINS IN ONE SAMPLE

Sr. No.	Area	Major-Axis	Minor-Axis	Perimeter
1	109	21.27274431	6.731781567	46.38477631
2	171	31.44453235	7.233455645	68.76955262
3	139	28.26205889	6.516883231	58.97056275
4	245	25.55930446	12.34474398	61.9411255
5	1257	87.52459029	27.8875262	285.1787156
6	127	22.64991562	7.377160346	50.04163056
7	288	37.72154801	10.77883982	95.74011537
8	1241	72.47722805	27.65020717	272.1492783
9	122	25.51442466	6.410072105	53.3137085
10	1419	81.21597842	31.39301005	328.9777054
11	133	22.45174055	7.765079172	50.28427125
12	103	17.12139522	8.963775079	56.627417
13	124	20.47362601	12.2480396	73.35533906
14	291	24.45989512	16.08607454	79.01219331
15	179	31.14552939	7.720417384	64.97056275

VII. CONCLUSION

The grading system is developed for easing the labor intensive work and creates consistency in the quality of product. There are several inferior quality grains arriving at the market day by day. This system is helpful for categorization grades of granules using Neural Network Pattern Recognition Tool. This system is based on features extraction from rice granules. Features which extracted from image of rice granules are Area, perimeter, major axis, minor axis.

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