Chapter 4

PROBLEM DEFINITION

4.1 Introduction

During grain handling operations, data on grain type and grain quality is required at several stages before the following course of operation can be resolved and performed. In the present grain-handling framework, grain sorting and quality are quickly surveyed by visual investigation. This assessment procedure is repetitive and tedious. The decision making capabilities of a grain inspector can be seriously affected by his/her physical condition such as fatigue and eyesight, mental state caused by biases and work pressure, and working conditions such as improper lighting, climate etc. Thus, these undertakings require mechanization and create imaging frameworks that can be useful to recognize rice grain images.

4.2 Problem Definition

In a rice plant industry the blend of brown rice and unhusked is moved into the separator, where the rice is being isolated from the outside materials. Amid the de-stoning process and cleaning of rice there are a few components which have prompted to raise the subject of quality. As appeared in Figure 4.1 the blue highlighted circles are long rice seeds correspondingly the red hued ones are too little. These both sorts of rice or foreign elements corrupt the genuine ordinary rice which is highlighted by green circles as normal seeds. The sample of rice seeds also contain adulterated grain particles degrading the quality of image. These foreign elements essentially comprise of long seed, stones, and small seeds as in figure
4.2 (a)-(c). Here we propose another strategy for finding the grade of Oryza Sativa in light of its quality utilizing computer vision non-destructive technique taking into account neural network for analysis. In this segment the suggested approach for quality assessment is being recommended. Here we characterize quality in view of the arrangement utilizing neural system strategy by extracting the features in form of geometric data of rice seed.

![Rice sample with Large, Normal and Small Seeds](image)

Figure 4.1: Rice sample with Large, Normal and Small Seeds

(a) Normal Seed  (b) Small Seed  (c) Large Seed

![Various Categories of Rice Sample](image)

Figure 4.2: Various Categories of Rice Sample
4.3 Materials and Methods

Here we are attempting to propose the quality assessment plan alongside the arrangement of different varietal Indian rice accessible in Gujarat region to be specific like Gujarat-17, Ponia, Chhapi, Masoori, Parimal, Jirasar, Kamod and so on are taken. In this segment the proposed calculation for quality assessment is being recommended. Here we characterize quality in light of the neural network.

4.3.1 System Description

In general it is observed that major work in rice mill industry is done by the technicians or labourers (layman) who are not well equipped of the knowledge to operate a complex system. Our proposed system is simple and easy to operate. A schematic diagram of the proposed framework is in Figure 4.3. Here In our proposed framework there is a camera which is mounted on the highest point of the box as pointed out by point 3 in Figure 4.3(a). The camera is having 12 super pixels quality with 8X optical zoom. The images being clicked by camera of rice seed samples are further stored for processing. The camera with a USB 2.0 link was connected to laptop for further processing of images. To avoid issue of luminance and for good nature

![Diagram](image-url)

Figure 4.3: Proposed system for capturing the sample of rice
of image, we have used two tubes at point number 4 and 5 as appeared in the Figure 4.3(b). Light sources were set symmetrically and each of the specimens were taken at consistent camera settings, i.e., exposure time, saturation and gamma. The images so obtained were processed for background subtraction. Later on these images were taken for pre and post processing operations for extracting the required features. We likewise used butter paper for uniform conveyance of light on the tray as seen at point number 6. In our framework box two doors are made for the sake of settling everything properly rice tray and camera position at point number 1 and 2. The base of tray was made up of butter paper for proper luminance.

4.3.2 Suggested Process Technique

Image Processing techniques have been quiet use full for evaluation of food products in recent years. Recent advancements show the incorporation of charge coupled gadget camera for acquisition of image. As appeared in figure 4.4 the recommended strategy comprises primarily

![Diagram of process technique](image)

**Figure 4.4:** Proposed process technique for assessment of sample of rice

of five stages: Data Acquisition, Pre-Processing, Image Handling, Image Description and Classification. Information Acquisition stage contains spreading of rice seeds consistently of every specimen without overlapping of rice seeds and image procurement from the imaging framework. In Pre-Processing stage we have converted RGB image to grey scale image as colour has very little significance in assessment of rice. Image processing stage contains image division leading to edge detection. Once the image is converted from RGB to grey scale then the output
image is further processed for edge detection as the goal is to extract the geometrical features of the seeds. Characterization stage includes reviewing and question acknowledgment. For preparing our chosen classifier neural system we appointed evaluations to all rice seed as little, typical and expansive. Furthermore, at that point from prepared dataset we can distinguish rice seeds of obscure specimen.

4.3.3 Suggested Operating Procedure

Hence the workflow for the quality assessment of sample of rice can be processed as shown in algorithm 4.1.

Algorithm 4.1: Operating procedure for suggested method

1. Select the ROI of the rice seeds
2. Convert RGB to grey scale image.
3. Apply edge detection algorithm
4. Extract geometric properties of rice seeds
5. Extract the threshold ranges of geometrical features of rice varieties based on image enhancement using histogram analysis
6. Compute the threshold values of rice seeds based on histogram
7. Train the Artificial Neural Network for classifying Normal, Long and Small rice seeds.
8. Testing the unknown rice seeds for counting Normal, Long and Small rice seeds.
9. Graphical User Interface of framework was developed for evaluating the quality of rice.

4.4 Samples of Varietal Rice Available in Gujarat Region

With the end goal of our research work we have taken few varietal rice samples commonly available in Gujarat state. We have taken 15 samples of all Non Basmati Indian rice assortments and every sample contains roughly 50 rice seeds. Here in Figure 4.5 K_{15} indicates 15^th sample out of 15 samples of Kamod rice same way G_{7} stands for 7^th sample out of 15 samples of Gujarat 17 rice, J_{1} for 1^st sample out of 15 samples of Jirasar rice, P_{14} sample stands for 14^th of 15 samples of Parimal rice, M_{11} for 11^th sample out of 15 samples of Masoori rice, C_{12} for 12^th sample out of 15 samples of Chhapi rice, PO_{12} stands for 12^th sample out of 15 samples
of Ponja rice. At first spread the given sample on the dark paper then capture the image of various varietal rice sample of Oryza Sativa SSP Indica with the assistance of 12MP camera as appeared in figure 4.6 (a)-(h). These images are further converted to grey scale image as shown in figure 4.7 (a)-(h) in light of the fact that the colour information is not of significance for investigation. Different samples of every assortments are being taken for the assessment reason and every specimen contains estimated 50 rice seeds. Parametric investigation is done on every specimen and the same is utilized for quality assessment of that assortment. Geometric components are separated from all specimens of Indian rice assortments. Preparing dataset is set up for 15 samples of every seven assortments of Oryza Sativa SSP Indica. Reviewing of rice seeds is done taking into account the estimations of geometric components.

Figure 4.5: Varietal rice samples collected for analysis
(a) Parimal

(b) Chhapi

(c) Basmati

(d) Gujarat 17

(e) Ponia

(f) Masoori
Figure 4.6: (a)-(h) Images of different varietal rice
4.5 Edge Detection

Thresholding is utilized to change over the fragmented image to a binary image. The final output of a binary image is 1 (White regions) for all pixels of edges and 0 (Black regions) for all other pixels. The recognizable proof of seeds inside an image can be an extremely troublesome task through image. One approach to improve the issue is to distinguish edges so we are focusing on the edge location as it is a standout amongst the most normally utilized operations as a part of image analysis, and there are many methods for improving and identifying edges. This implies if the edges in an image can be recognized precisely, the majority of the seeds can
be found and essential properties, for example, area, perimeter, and shape can be measured. In investigation of machined products, part identification, object acknowledgment, estimation of size, shape, orientation and so forth edge identification is a key procedure.

There are two sorts of edge indicators. Template and optimal based edge detectors which are described in Table 4.1. Optimal edge detector gives better results compared to normal template based detectors. Canny edge detector uses the Gaussian curve to approximate the edges and it operates on the derivative of the Gaussian in first as well as in second order, as it is considered to be the good approach for approximation. Unfortunately to detect the edge in the image, it is necessary to go for better approximation of edge. We have used Shen Castan's Infinite Symmetric Exponential filter for detection of edges in our case.

### 4.5.1 ISEF Edge Detection

The edge can be identified by any edge detection system still Shen Castan Infinite Symmetric Exponential Filter based edge detector is an optimal edge detector likewise canny edge detector which gives optimal filtered image. To begin with the entire image will be separated by the recursive ISEF channel in X direction and in Y direction, which can be actualized utilizing the accompanying equations. Recursion in X direction:

\[
y_1[i, j] = \frac{1 - b}{1 + b} I[i, j] + b y_1[i, j - 1], j = 1...N, i = 1..M
\]  
(4.1)

\[
y_2[i, j] = b \frac{1 - b}{1 + b} I[i, j] + b y_1[i, j + 1], j = N...1, i = 1..M
\]  
(4.2)

\[
r[i, j] = y_1[i, j] + y_2[i, j + 1]
\]  
(4.3)
Recursion in Y direction:

\[
y_1[i, j] = \frac{(1-b)}{(1+b)} I[i, j] + b y_1[i-1, j], i = 1...M, j = 1..N \tag{4.4}
\]

\[
y_2[i, j] = b \frac{(1-b)}{(1+b)} I[i, j] + b y_1[i+1, j], i = M...1, j = 1..N \tag{4.5}
\]

\[
y[i, j] = y_1[i, j] + y_2[i, j] \tag{4.6}
\]

\[b = \text{Thinning Factor } 0 < b < 1\] The Palladian image can be approximated by subtracting

**Algorithm 4.2: Steps for ISEF**

1. Smear ISEF Filter in X direction
2. Smear ISEF Filter in Y direction
3. Smear Binary Palladian technique
4. Smear non maxima suppression
5. Calculate the gradient
6. Smear Hysteresis thresholding based on histogram

the filtered image from the original image. At the location of an edge pixel there will be zero intersection in the second derivative of the filtered image. The first derivative of the image function should have an extreme at the position corresponding to the edge in image and so the second derivative should be zero at the same position. Non maxima suppression is applied for thinning purpose as it is used in canny for false zero crossing. The gradient at the edge pixel is either maximum or minimum.

(a) Recursive Filter in X direction (b) Recursive Filter in Y direction
Figure 4.8: (a)-(g) Results of ISEF edge detector of one sample

Presently gradient applied image has been diminished, and is prepared for the thresholding.
The simple thresholding can have standard single out cut-off however Shen-Castan proposes to utilize Hysteresis thresholding. Spurious reaction to the single edge caused by noise usually creates a streaking problem that is very common in edge detection. The output of an edge detector is usually thresholded, to finalize which edges are important and which are not means the breaking up of the edge contour caused by the operator fluctuating above and below the threshold. Thin edges can be removed with hysteresis. The ISEF algorithm is explained in table 4.3 and the corresponding results so obtained for a sample of rice seeds are explained in figure 4.8 (a) to (g). On the similar basis the edges so detected by each varietal rice varieties is shown in figure 4.9 (a) to (h).
Figure 4.9: (a)-(h) Results of ISEF edge detector of various rice samples