

Image Processing for Grain Quality Monitoring

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ABSTRACT:

Food is an essential element for supporting life and providing nourishment. Nevertheless, contaminants like stones, damaged seeds, and broken granules are frequently found in food and can have a negative impact on the content and quality of the food. Wheat and rice are two staples consumed by a majority of the world's population, making it important to ensure their quality. A system that can assess food quality has been offered as a solution to this problem. The classification of the grains is then determined by their color, shape, chalkiness and size, using a Probabilistic Neural Network (PNN) classifier to categorise them as good, bad, or medium quality.

KEYWORDS: Image Processing, Grain Quality, Neural Network.

i. INTRODUCTION

A basic requirement of existence is food. Everyone needs food to survive. Hence, having meals every day is a fundamental requirement that should be of high calibre. While India is the world's top producer of wheat and rice (agricultural), the food that the population consumes is of poor

quality. For optimum nutrition, food quality is crucial, thus there shouldn't be any contaminated food grains on the market today. These grains contain a variety of contaminants, including stones, cracked seeds, and fractured granules. The composition and quality of food are impacted by the presence of contaminants. Food is a fundamental need for life. To exist, everyone requires food. So, eating every day is a key need that should be of the highest calibre. India is the world's leading producer of wheat and rice (from an agricultural standpoint), yet the quality of the food that the people eat is subpar. Food quality is essential for maximum nutrition, thus there shouldn't be any tainted food grains available right now. These grains come with a number of impurities such as stones, cracked seeds, and crushed granules. Contaminants have an influence on the content and quality of food.

- Quality issue
- Automation in quality assessment

In this work, we used wheat and rice grains to assess the grain quality. According to training, our system categorises food into three categories: category1, category2, category3, category4, category5.

ii. STATE OF ART

M. Berman et.al reported that with the Development of computer image processing technology, by combining the image acquisition devices, the grain size measurement based on image processing technology is of feasibility and practice in the field of materials, medicine, chemical industry, construction and soon. Meanwhile, many researches on cereal grain have been made. M.Berman. Explains the 38 kinds of wheat flour yield deviations correctly by extracting the grain size, axial length of the maximum and minimum size, elliptical area and Quality [1]. According to the national standard of the People's Republic of China, the characteristics of rice shape and chalkiness are critical for assessing the rice appearance quality because they are determining factors for rice quality and price. As a result, a precise understanding of rice quality and appearance is required. Rice grains are measured for length, breadth, and length-to-width ratio to evaluate grain morphology. The length and width of rice grains are now measured by inspectors using either a ruler or a micro-particle meter (a kind of caliper). This manual method is inefficient because 10 rice grains must be checked for every variety according to the requirement [2]. N.S. Visen et.al were done a research to develop and optimize a technique for discrimination of various types of grains by extracting the morphological, texture, and color based features using images of single kernel and compare the classification accuracies using back propagation and specialist probabilistic neural network classifier [3]. Wan et al. (2002) developed an automated inspection device and an image processing unit to categorise rice grains as sound, cracked, chalky, immature, dead, broken, damaged, and off-type. Their system outperforms the human inspection method [4]. Abedullah, et.al claimed that one

of Rice is the largest and most widely consumed cereal grain in Pakistan and the entire world. It is also most important for the human nutrition caloric intake. It generally provides 130 calories per 100 grams with 1% calcium, iron and 3% magnesium. It is the seed of grass species *Oryza sativa* (Asian rice) *glaberrima* (African rice) [5]. Guiping Wu et.al reported that using the image processing method to detect the broken rice rate [6], Found that the result has good correlation with the manual method which demonstrated the feasibility of the method; Peng Jia et al make a research on the grain counting methods based on Matlab image technology. It makes up for the shortcoming of manual method and photoelectric method, but it is still confined to grain counting [7]. According to a report, Changling Sun et al. used wheat grain to assess quality. The stereo vision approach was used to determine the length, width, and thickness of the grain, as well as the presence or absence of creases in a sample of wheat grains. In terms of the grain, a crevice is essentially a line or a dark area. The process of stereo vision essentially involves obtaining 3D information from digital photographs [8]. Neelamegam.P et.al they assessed the rice's quality using an image processing technique, they started. They suggested a method based on neural networks to classify the Grains [9]. Vinita Shah et.al proposed an approach that used multi-layer feed-forward neural networks and image processing to attain great levels of accuracy. This methodology is used to count both large and small seeds and to determine the characteristics of the rice grain [10].

iii. PROPOSED SYSTEM

The experiment for the proposed system includes the PNN procedure, therefore the probabilistic neural network method is described step-by-step. The following are the steps of the algorithm:

Algorithm

- Step 1: Image acquisition
- Step 2: Image enhancement
- Step 3: Segmentation
- Step 4: masking
- Step 5: Classification

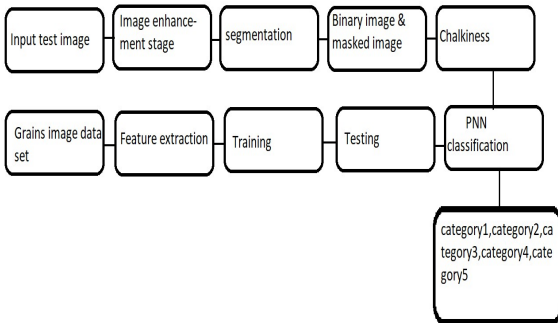


FIG 3.1: Proposed Architecture of Food Grain Public Distribution System.

Image acquisition:

Digital imaging, also known as digital image capture, is the process of creating a presentation of an object's visual characteristics, such as a real-world scene or the interior of an object. It is usually assumed that the phrase includes or implies the processing, compression, storage, printing, and presentation of such photos. Before processing, the quality and information content of the original data are improved through the process of image enhancement. FCC, spatial filtering, density slicing, and contrast enhancement are examples of common approaches. Stretching or enhancing the contrast is achieved by performing a linear transformation, which increases the initial range of grey levels. The linear features that are present naturally, such as faults, shear zones, and lineaments, are enhanced by spatial filtering. With density slicing, the continuous grey tone range is transformed into a sequence of different color or symbol to represent various features is known as image improvement.

Segmentation:

Segmentation is nothing but partitioning of an image.

Masking:

Picture masking is a non-destructive image modification technique that uses tools from programmes like Photoshop. The technique is used to expose some details while hiding others in an image. This method makes the mask flexible and adaptable as an image editing tool by allowing you to subsequently update and modify it as needed.

Chalkiness:

The steps in a chalkiness analysis involve glume removal and milling, followed by naked-eye observation and an area-based estimate of the chalky rice rate. The predicted area rate between the chalkiness region and the milled rice area in an image was used to determine the degree of chalkiness.

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iv. METHODOLOGY

A technique for clustering pixel color data to separate the characteristics in photographs of maize kernels is provided. Red, green, and blue (RGB) pixel value inputs to a probabilistic neural network were used to identify features for hard starch and soft starch as well as for blue-eye mould, germ damage, sound germ, and shadow in sound germ. It is taught how to arrange data in order to get an example set for adjusting the weights of a probabilistic neural

network (PNN) and optimising a global smoothing factor. The 14,427 available exemplars (RGB pixel values sampled from previously gathered photos) were divided into three groups: 12,912 were setted for the network validation, and 778 were utilized to optimise the PNN smoothing parameter, made popular by D.F. Specht (1988, 1990, 1996). The PNN effectively functions as a look-up table for the general issue with clearly separable data, responding to new input patterns in a manner similar to that of training patterns that are closest to the new input feature space.

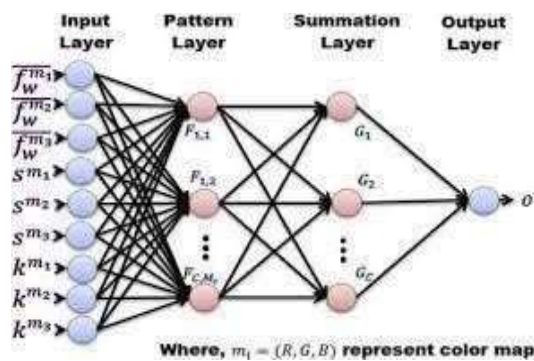


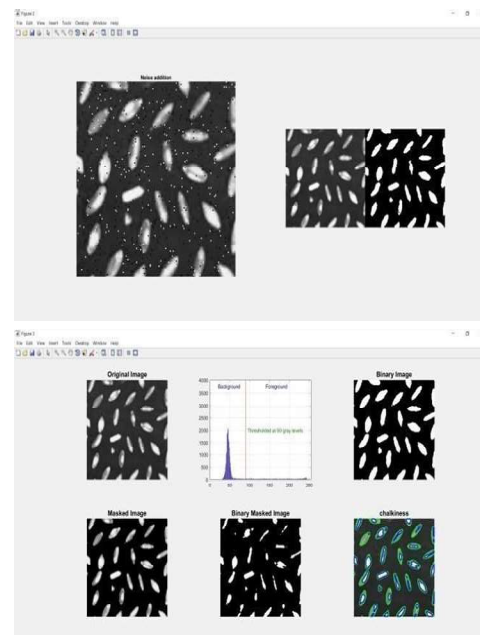
FIG 4.1 ARCHITECTURE OF PNN

Gaussian windows are positioned at each training sample in probabilistic neural networks (PNNs) in order to calculate an estimate of the probability density. By essentially "memorising" replies to the training data, this produces a non-zero response over a specific area of the input space. PNNs can provide comparable replies for fresh inputs that mirror the training data by selecting window locations and responses based on the training patterns. PNNs, on the other hand, are unable to interpolate between Missing the classification they need training data from the whole solution space domain. PNNs are feed- forward neural networks without feedback pathways, allowing them to exclusively respond to inputs that are located in the same area of the input space for training data. Moreover, this enables the flagging of

inputs beyond the learning domain, preventing extrapolation mistakes. Moreover, the network's ability to respond properly in one area of the measurement space is unaffected by teaching it to do so in other, distant areas. PNNs have a number of benefits, one of which being quick training with only one pass over the data needed. The smoothing factor, the only free parameter provided by probabilistic neural networks (PNNs), can be changed by the user at runtime without the requirement for network retraining. By choosing appropriate values for the smoothing factor, the complexity of the decision surface may also be modified as necessary. PNNs can function well with sparse samples and are unaffected by the training data's randomisation order. The network can be progressively taught as Old patterns can be updated with new ones as required when new data becomes available. The PNN design does have one node or neuron required for each training example, though, which can be computationally challenging for big training data sets due to the significant amount of computer memory needed.

V. RESULTS AND DISCUSSION

Shows the 'grain quality detection' message when system is initialized.



With the help of values such as centroid, major axis and minor axis of a ricegrains , the grains are graded as cateogry 1, 2,3,4,5. The trained values for the code as follows: the major outputs Insert results and explain them stats = 36×1 struct array with fields:

Centroid

Major Axis Length

Minor Axis Length

Summary tabular =36×3 table

Centroid	Major Axis Length	Minor Axis Length
3.8588 69.612	15.266	7.344
92 5.7735	11.1547	5.7735
9.9154 9.4077	22.774	7.5004
22.853 98.942	27.799	9.3998
18.278 132.91	24.316	9.7778
22.977 34.368	28.456	7.8815
17.5 162	2.3094	1.1547
29.635 72.842	23.856	12.017
40.908 152.54	25.411	9.4178
43.932 3.8729	21.536	7.508
56.788 24.64	26.706	10.936
59.033 94.092	24.952	9.6106
53.892 115.92	8.1223	6.3733
61.047 60.651	29.361	7.8608
67.197 159.06	12.673	7.5748
68 137	1.1547	1.1547
73.405 127.41	22.11	7.1096
70.778 140.89	4.4645	2.9007
71 120	1.1547	1.1547
89.975 29.383	28.334	7.599
88.389 105.56	29.858	6.6884
97.877 155.56	22.816	9.0578
93.357 52.786	4.8814	3.8627
95.83 64.33	17.771	7.6429
112.71 5.2396	13.091	10.076

Number of objects in the image are 33

Average Width of each food grain is Width = 7.057707

Average Height of each food grain is Height = 20.321097

This belongs to category 4

Mean = 72.1348

Standard_Deviation = 55.5602

Entropy = 5.8428

RMS = 15.9687

Median = Columns 1 through 17

45 44 43 44 44 45 43 43 43 42
43 43 46 47 48 49 49

Columns 18 through 34

49 49 49 50 48 49 50 48 48 46
46 47 47 47 47 48 47

Columns 35 through 51

45 45 44 45 45 45 46 45 45 45
46 45 44 46 47 46 47

Columns 52 through 68

47 47 48 48 47 49 48 48 48 49
50 49 48 48 49 47 47

Columns 69 through 85

47 48 48 48 48 47 47 47 46 45
45 45 44 45 45 45 45

Columns 86 through 102

45 46 46 46 46 46 46 46 45 45
45 46 47 47 47 46 46

Columns 103 through 119

45 45 45 45 45 45 45 45 45 45
45 45 45 45 45 44 44

Columns 120 through 136

44 44 46 46 46 47 47 48 46 46
46 47 47 47 47 45 45

Columns 137 through 153

45 45 45 46 46 47 47 47 47 47
48 48 48 48 47 47 47

Columns 154 through 165

47 46 45 46 46 47 50 55 71 102
121 123

Variance = 2.9379e+03

Elapsed time is 5.581409 seconds.

vi. CONCLUSION

The proposed system has been worked on wheat, corn and rice samples to determine the quality. The analysis is based on color, shape and size. The data base of the hundred images are trained for classification. The classification has been done with the help of PNN classifier. It results Grading of grains and its quality in the category 1 to 5. This system is fully automated in food industry and gives cost effective solution and also quality grains for public. Also, it is relaxed, reliable and less time consuming. The results found are more accurate and effective in terms of both performance evaluation parameters and various measurements with centroid length and width of the grains.

vii. REFERENCES

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