



## Quality Testing of Food Grains Using Digital Image Processing Techniques

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### Abstract:

Grain production is the principal agricultural crop for our country. Farmers pay close attention to yield while the crop is still in the ground, but once the grain has been processed and sold, quality takes over as the primary determinant of its viability. These grains contain a variety of impurities, such as stones, weed seeds, chaff, damaged seeds, etc. Today, scientific methods are used to identify grain seed variations and quality. We suggested a grain classification system based on machine learning and image processing algorithms to distinguish between distinct types of grains and assess the purity of grains using image processing techniques based on several factors like particle size and form.

**Keywords:** Digital Image Processing, Machine Learning, Grain Classification.

### Introduction:

The most important food that a sizeable population in Asian nations consumes is grains. The Poaceae family of plants includes rice. Around the world, rice is grown in a number of different regions. The second-largest producer of rice in the world is India. With an increase in consumption, there is a rising demand for high-quality food grains. In regional industries, food grains are distinguished using manual categorization techniques based on regional geometric traits. The proposed study uses a technique for recording digital photos of food grains, analysing them, and extracting important data. The type of cereal grain is determined by examining morphological traits. Image processing techniques are applied to the acquired image to extract various information.

The food granules are evaluated by a neural network after picture processing. The results are acquired by putting the rice grains through a series of tests. Using image processing and neural network technologies. Images for rice are captured here using a webcam. MATLAB is used to conduct image pre-processing techniques such as Thresholding, segmentation extraction on the obtained image. For training purposes, the features are supplied to the neural network. The trained network is then utilized to determine the quality of the

unknown contaminants. The grading system was created to ensure product quality consistency.

### Objective:

The objective of the project is to study the food grains using different image processing techniques. Kernel based technique, Neural Network Technique, Phase based technique and propose the quality of the food or food grain. This is helpful in judging the type of grains, grain classification and other food processing techniques.

### Scope of the Study:

The application potential of image processing techniques to the food industry has long been recognized. The food industry ranks among the top ten industries using image processing techniques, which have been proven successful for the objective and non-destructive evaluation of several food products. The core techniques in computer vision is always related to image analysis and processing, which can lead to segmentation, quantification and classification of images and objects of interest within images. Computer vision has also proven successful for applications like online measurement and classification of several food products ranging from complex vision

guided robotic routine inspection to the complex vision guided robotic control.

In the food industry, some quality evaluation is still performed manually by trained inspectors, which is tedious, laborious, costly and inherently unreliable due to its subjective nature, increased demands for objectivity, consistency and efficiency have necessitated the introduction of computer-based image processing techniques. Recently, computer vision employing image processing techniques has been developed rapidly which can quantitatively characterize complex size, shape, color and texture properties of foods objects. Image processing systems play a more and more important role in the food quality evaluation by maintaining accuracy and consistency while eliminating the subjectivity of manual inspections. They offer flexibility in application and can be reasonable substitutes for the human vision decision-making process.

Therefore in order to develop an automated system for food quality evaluation, Image processing techniques are often combined with mechanical and instrumental devices to replace human manipulative effort in the performance of a given process. In such a system, the image processing system is the centre, which controls the operation of the

machinery. For example, an automated system for apple surface defect detection was created through digital image processing methods. The apple were fed to the machine vision system for the defect with the feeding and uniform spacing conveyors and graded with the sorting unit.

#### **Texture Features Extraction:**

Texture features are broadly classified as

1. Gray level Texture features
2. Color Texture features.

Color texture feature includes the invariant color histogram, correleogram, and various texture maps of various color space like the skin map used for fruits or human face or food objects etc. Generally color texture model is used where the image blocks presents various different color blocks. As the current study is encentric around almost unique and distinguishable color space, color based features are not of best use. This is because the color based texture has a high feature vector overhead.

The other feature model is the gray level features. We convert the images into gray scale image and extract the gray scale textures. Histogram, GLCM, Wavelet based features are some of the gray level features. Wavelet based features are considered here.



Figure: An image of Dal grains boiled at 100° and it's corresponding gray scale image.

Once the image is converted to gray level, a wavelet decomposition with haar wavelet will be carried out at the images and subsequent features will be extracted.

#### **System Analysis:**

There are many different methods suggested for various types of object classification and recognition. The work includes usage of different pattern types to using different classifiers. There is no specific methodology proposed in “study of boiled Indian food grains or objects”. Hence, it can be assumed that various generalized methods are available for image classification, but no method corresponding to the current work.

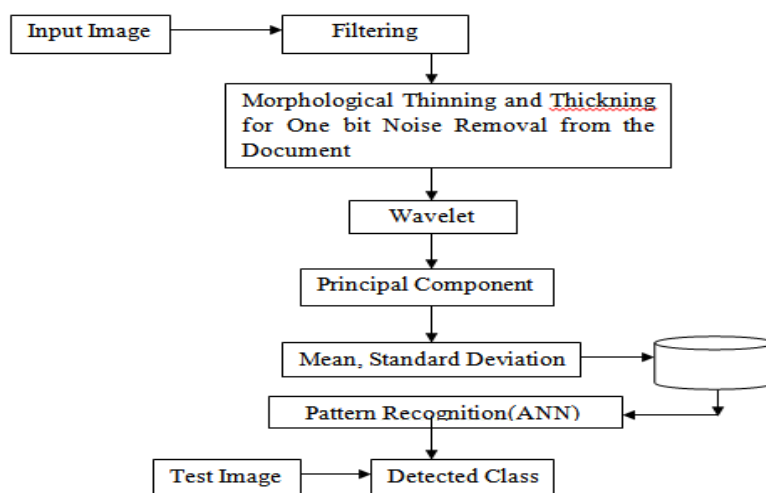
Hence, we will discuss about the features and available classifiers here. Gray Label Co-Occurrence Matrix(GLCM) is one of the most common gray label features that is been in use. These features presents the probability of the occurrence of one color w.r.t other colors. This is significantly helpful if the image has different color distribution. HSV based color models and color masks or color maps are also used as feature vectors. “Average Texture” of the boiled object image is sufficient for it's classification, Hence entire color model or vector space is not required. Histogram based features are not invariant in nature and are quite sensitive to light effects.

Similarly many different classifiers are also available for classification. It includes statistical classifiers like the Gaussian or Nearest Mean classifier, Support Vector Machines, Fuzzy logic. All the above classifiers are considered as single plane or layer classifiers where the query domain is mapped linearly to the class that the image belongs to. Wavelet decomposed images presents good texture representation of the images and are invariant to rotation or light effects. Therefore sub band images are good representation for classification. Once the image is decomposed into sub band images, results are H,A,V and D components. These in themselves are gray images. The average map of each region gives the average spectrum represented by that spectra. Therefore combining the statistical values of the sub band images will provide a full representation of the image class. Hence in

our work, we have decomposed the image into sub band images and extracted mean and standard deviation from each bands. We combine them to form our feature matrix. Neural Network is a Multi layer classifier where the features are mapped in a vector plane. Therefore rate of correct classification is always very high in the case of neural networks. Hence we have used neural network as our classifiers.

Generally the result of classification depends to a great extent on the number of images given to the system for the training purpose. Hence, we considered ten images each from each boiling effect class of each food objects. For example, there will be ten images each of boiled grains of 45',75',100' and 120'. And there will be a set comprising of ten images randomly chosen from each of these class.

#### System Design: Block Diagram:



#### Conclusion:

The complexity of the grading problem was significantly decreased through image processing and careful selection of the species that were taken into consideration in this work for extracting features from rice grains. Grading rice particles using a neural network is successful. The created neural network can also be used to grade different grains and food items. When there is no granule overlap, the probabilistic based Neural Network can classify well, but when there is granule overlap, it can categorise the test datasets with 90 percent accuracy. We worked on the area detection on the rice grain and created an image processing system to grade the rice based on length,

width, area, and area of chalky. Based on the findings, it can be said that some rice are better based on length, some are better based on breadth, and some may be considered to be of good quality based on area and area of the chalky. All of the traits need not, however, be represented in the rice grain. For further verification of our methods, additional data can be collected. The amount of moisture in a rice grain can be added to a grade to indicate the overall quality of the rice for more research.

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