RICE GRAIN QUALITY GRADING USING DIGITAL IMAGE PROCESSING TECHNIQUES

Y.supraja[1], P.SubbaRao[2], K.Sri Tapaswi[3], P.Vemanth Harsha[4], Sri M.Dilip Kumar[5]

[1,2,3,4]Student-IT Department, Gudlavalleru Engineering College, Krishna, Andhra Pradesh

[5]Assistant Professor-IT Department, Gudlavalleru Engineering College, Krishna, AP

Abstract **:** Grain quality is extremely important to humans since it has a direct impact on their health. As a result, there is a considerable requirement to test grain quality and identify adulteration or non-quality materials, and manually evaluating grain samples is a time-consuming and complicated operation. Errors are possible due to the subjectivity of human perception. Machine vision-based solutions have evolved to attain uniform standard quality and precision. Rice quality is determined by a mix of physical and chemical factors. Chalkiness, whiteness, milling degree, bulk density and, grain size and form are all factors to consider. Some physical qualities include moisture content. This paper compiled a list of all physical characteristics and graded the rice grains using canny edge detection.

IndexTerms **- Shape, Rice Grading, Image Processing, Canny Edge Detection.**

I.INTRODUCTION

The need for high-quality food products, which we have a proclivity to consume, is growing by the day. Because the Republic of India's attainment rate is rising, so is the desire for higher-quality food production. The Republic of India is the world's second-largest rice producer, after China. Because rice production is expanding, so is the need for high-quality rice. The need for high-quality food grains is growing as a result of certain traders defrauding shopkeepers by selling low-quality food grains that contain particles such as stones, sand, leaves, shattered and broken seeds, and so on. This type of rice is marketed without being observed, and there is no distinctive theme to look for such low-quality grains. As a result, it's been a long road for both buyers and sellers. These days, we have a tendency to use chemical methods to identify rice grain seed variations and quality. The chemical approach utilised also destroys the sample and is a time-consuming technique. By utilising a machine vision or digital image processing system, they will be avoided. These techniques may be less dangerous, take less time, and are less expensive than chemical techniques, as well as an attempt to solve the disadvantages of the manual method. A photo processing technique is used to extract several rice grain alternatives and classify the grains based on geometrical options.

II. PROBLEM DEFINITION

2.1 Existing System

In agricultural industry quality analysis of product is very important. Quality of grain seeds is analyzed visually by experienced technician. But the outcome of such measurement is relative, varying in results and time consuming. The quality also gets affected by the mood of technician; to overcome the shortcomings occurred due to traditional methods new and advanced technique i.e., image processing technique is proposed.

2.2 Problems In Existing System

- Difficult to identify each and every grain if there is a huge crowd (some persons may miss) in the markets.
- It takes more time than proposed system to identify the quality of rice.
- Needs manual power, concentration and attention.
- Sometimes it may lead false outcomes.

2.3 Proposed System

Our Project presents a solution of grading and evaluation of rice grains on the basis of grain size and shape using image processing technique canny edge detection. Canny Edge Detection algorithm is used to find out the region of boundaries of each grain. In this technique we find the endpoints of each grain and after using caliper we can measure the length and breadth of rice grain. This method requires minimum time and it is low in cost.

2.4.Advantages of Proposed System

- Used to grade the quality of rice grains automatically.
- Low-cost Process.
- Less processing time
- Has better accuracy than manual checking.

III. PROBLEM SOLUTIONS

The below listed are several modules, libraries and techniques that are helpful in accomplishing the goal. They are as follows:

3.1 Image Processing

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.

Image processing basically includes the following three steps:

1. Importing the image via image acquisition tools;
2. Analysing and manipulating the image;
3. Output in which result can be altered image or report that is based on image analysis.

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

To implement Deep Learning on our project we are using the following libraries in python.

- TensorFlow
- Keras
- OpenCV
- NumPy
- Matplotlib
- Digital Image Processing Techniques

3.1.1 TensorFlow

TensorFlow is a free and open-source software library for dataflow and differentiable programming across a range of tasks. It is a symbolic math library, and is also used for machine learning applications such as neural networks. TensorFlow is available on 64-bit Linux, macOS, Windows, and mobile computing platforms including Android and iOS. Its flexible architecture allows for the easy deployment of computation across a variety of platforms (CPUs, GPUs, TPUs), and from desktops to clusters of servers to mobile and edge devices.

3.1.2. Keras

Keras is an API designed for human beings, not machines. Keras follows best practices for reducing cognitive load: it offers consistent & simple APIs, it minimizes the number of user actions required for common use cases, and it provides clear & actionable error messages. It also has extensive documentation and developer guides. Keras contains numerous implementations of commonly used neural network building blocks such as layers, objectives, activation functions, optimizers, and a host of tools to make working with image and text data easier to simplify the coding necessary for writing deep neural network code.

3.1.3. OpenCV

OpenCV (Open-Source Computer Vision Library) is an open-source computer vision and machine learning software library. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS.

3.1.4. NumPy

NumPy is the fundamental package for scientific computing in Python. It is a Python library that provides a multidimensional array object, various derived objects (such as masked arrays and matrices), and an assortment of routines for fast operations on arrays, including mathematical, logical, shape manipulation, sorting, selecting, I/O, discrete Fourier transforms, basic linear algebra, basic statistical operations, random simulation and much more.

3.1.5. Matplotlib

Matplotlib is an amazing visualization library in Python for 2D plots of arrays. Matplotlib is a multi-platform data visualization library built on NumPy arrays and designed to work with the broader SciPy stack. It was introduced by John Hunter in the year 2002. Matplotlib is a plotting library for the Python programming language and its numerical mathematics extension NumPy. It provides an object-oriented API for embedding plots into applications using general-purpose GUI toolkits like Tkinter, wxPython, Qt, or GTK. There is also a procedural "pylab" interface based on a state machine (like OpenGL), designed to closely resemble that of MATLAB, though its use is discouraged. SciPy makes use of Matplotlib.

3.1.6.Digital Image Processing Techniques

The use of a digital computer to process digital images through an algorithm is the digital image processing system. The digital image processing has many advantages over analogue image processing as a subcategory or field for digital signal processing. It makes it possible to use a much wider range of algorithms on input data and can prevent issues such as noise build-up and distortion in processing. Since images are defined in two (maybe more) dimensions, the digital image processing in multi-dimensional systems can be modelled.

One such technique is Canny Edge Detection. In which we will get the edges of objects in an image by using canny filter. Canny Edge Detection contains following steps:

1. Noise Reduction
2. Gradient Calculation
3. Non-Maximum Suppression
4. Double Threshold
5. Edge Tracking by Hysteresis

STEPS IN DIGITAL IMAGE PROCESSING

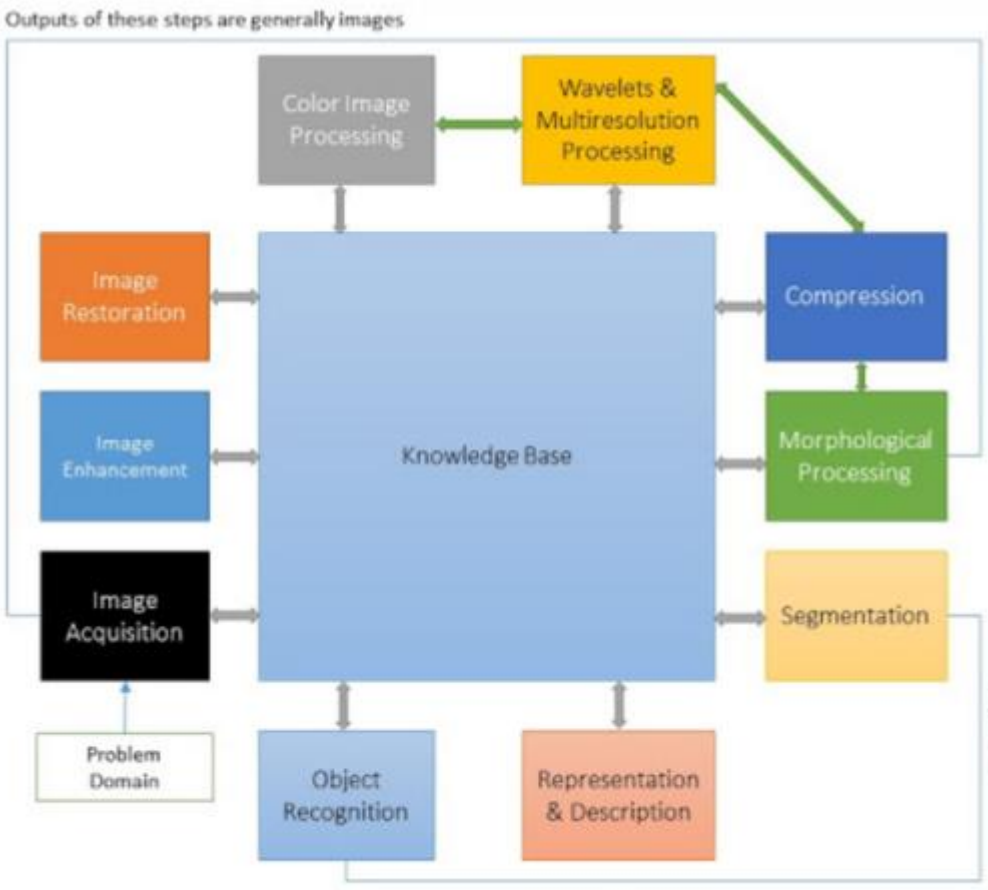

Figure: Steps in Digital Image Processing

1. Image Acquistion

This is the initial step or process in digital image processing's fundamental steps. The acquisition of images could be just as simple as a digital image. Generally, pre-processing is involved in the image acquisition stage, for example scaling etc.

2. Image enhancement

Improvement of image is one of the most attractive and simple areas in digital image processing. The idea behind improvement techniques is basically to show details that are obscured, or simply to underline certain features of an image's interest. For example, brightness and contrast changes etc.

3. Image Restoration

Image restore is also an area to improve the image appearance. In contrast to enhancement, however, in that restore technology tends to be based on mathematical or probabilistic models of image degradation, image restoration is objective.

4. Color Image Processing

The field of colour image processing has grown in importance as digital images use over the Internet has significantly increased. This may include colour modelling and digital domain processing, etc.

5. Wavelets and Multiresolution Processing

Wavelets are the building blocks for representing images at varying resolutions. For data compression and pyramidal representation, images are successively subdivided into smaller areas.

6. Compression

Compression refers to methods for minimising the amount of storage or bandwidth necessary to save or transmit an image. Compression of data is extremely important, especially while using the internet.

7. Morphological Processing

Morphological processing is concerned with tools for extracting picture components that can be used to represent and describe shape.

8. Segmentation

Segmentation is a technique for dividing a picture into its component components or objects. In general, one of the most difficult tasks in digital image processing is autonomous segmentation. A robust segmentation approach takes the process a long way toward solving image challenges that need individual object identification.

9. Representation and Description

The output of a segmentation stage, which is normally raw pixel data, is nearly always followed by representation and description, forming either the region's boundary or all of the points within the region. Choosing a representation is simply one aspect of the process of translating raw data into a format that can be processed by a computer. Extracting qualities that result in quantitative information of interest or are fundamental for distinguishing one class of objects from another is the subject of description.

10. Object Recognition

Recognition is the process of assigning a label to an object based on its descriptors, such as "car."

11. Knowledge Base

Knowledge can be as easy as identifying portions of an image where the information of interest is known to be located, hence reducing the amount of time spent searching for it. An interconnected list of all main conceivable flaws in a materials inspection problem, or an image database containing high-resolution satellite photos of a region in association with change-detection applications, are examples of knowledge bases.

IV. METHODOLOGY

The methodology of the project is shown with help of flow Diagram

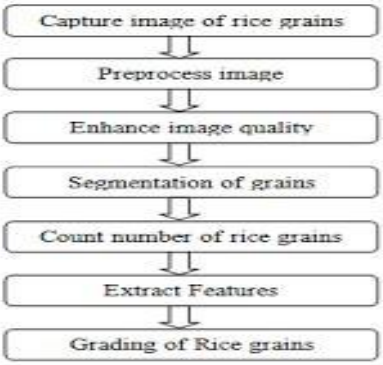

Fig 2: Flowchart for the Methodology Diagram

V. RESULT ANALYSIS

When we run the program, a window is opened and asks for choose an image. After choosing respective image we have to click predict button. The internal Process goes like this, it will convert the given image into following

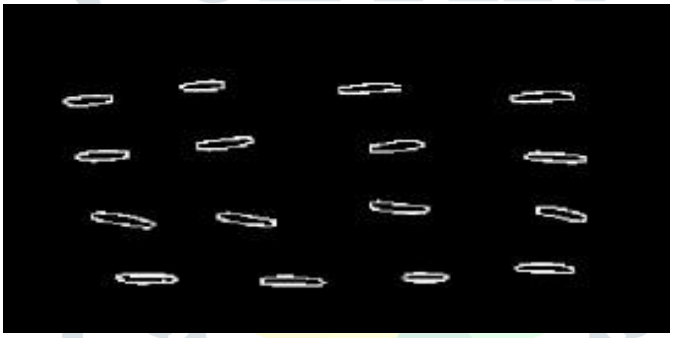

Fig 3: canny edge detection output

From the Edge detected image it will calculate the length and breadth of rice grains. It will then gets the length to breadth ratio of each rice grain. Later classify the grains as slender, medium,bold depending upon the value obtained as follows

Long Slender (LS)	Length 6 mm and above, L/B ratio 3 and above
Short Slender (SS)	Length less than 6 mm, L/B ratio 3 and above
Medium Slender (MS)	Length less than 6 mm, L/B ratio 2.5 to 3.0
Long Bold (LB)	Length 6 mm and above, L/B ratio less than 3
Short Bold (SB)	Length less than 6 mm, L/B ratio less than 2. 5

Table:length to breadth ratio table

Finally we get the output as Number of rice grains present in the given in the image and average aspect ratio of all the rice grains present in the image.

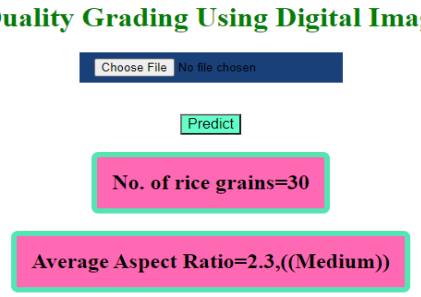

Fig 4: user interface view

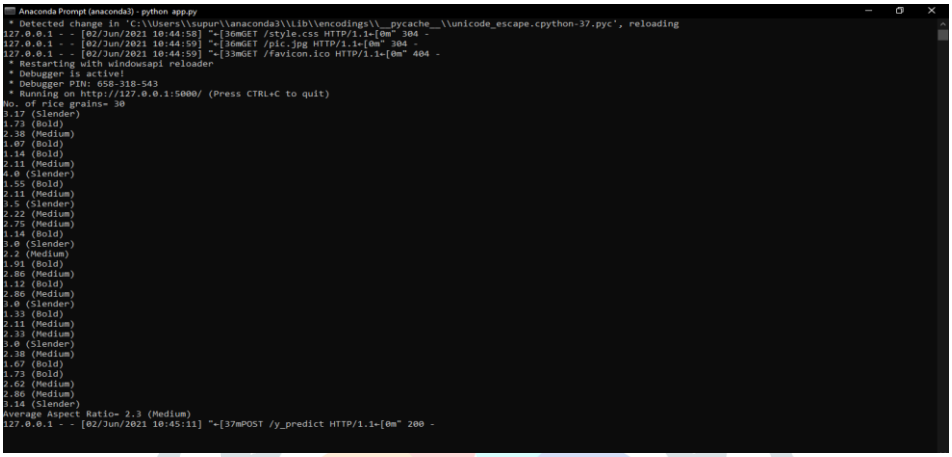

Fig 5: output on command prompt

VI. CONCLUSION AND FUTUREWORK

As more and more adulteration in food grains is disclosed in the media, today's customers are very quality sensitive about the food grains they buy and consume. In this study, an attempt is made to grade rice grains using image processing and morphological methodologies. Preprocessing is done on the image first, and the individual grains are segmented. The grain's geometric characteristics, such as area, main axis length, and minor axis length, are extracted and classified. The results have been found to be positive. Rice is graded according to the length of the grain. Finding more quality attributes of rice grains and dealing with moving images could be added to the project in the future.

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