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RICE GRAIN CLASSIFICATION SYSTEM

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Abstract— **Rice grain Classification plays a vital role in agricultural industry. Rice is a staple food consumed Globally. Rice grain Classification is necessary to maintain quality, food safety and consumer satisfaction. Traditional methods which are employed for classification and identification of rice grains are time consuming and may lead to errors. The proposed system uses image processing techniques to identify and segregate rice grains into different types. The categorization and grading of rice grains is done on the basis of size, colour and texture. Various image processing methods such as image pre-processing, edge detection are employed for the analysis and identification of rice grains. This paper deals with three multiple kinds of rice grains that is Basmati, HMT and Rajgira. The system uses Pycharm an integrated Development Environment (IDE) designed for python development. The system has inherent applications in food industry ensuring effective classification of rice grains.**

Keywords— **Image Processing, Pycharm, Python, Rice grain Classification.**

I. INTRODUCTION

Rice is one of the widely consumed foods in various region of India. There are multiple classes of rice found in the region, with different size, texture and colour. Rice grain is popularly grown in the region which experiences heavy rainfall. India has the unique privilege of being the world's largest rice exporter. Over 2,00,000 varieties of Indian Rice are present in market in all over country. With the availability of various classes of rice in the market, it's a tedious task to classify each type of rice grain manually also distinct kinds of rice grains can be mixed during the process from cultivation, harvesting, transporting, to processing, which effects the purity, quality, and value of the subsequent products acquired. Recent Advancement in agriculture has presented an opportunity for agriculture companies, rice suppliers, small and big farmers in the field of farming.

The Presented paper is one such advance method to classify the classes of rice. The system discusses two parameters of rice i.e. size. The system includes image processing technique to determine the size and colour of rice grain. The system will reduce the human efforts of handling large datasets of rice and will be reducing time-consumption. Our project involves three datasets of Basmati, HMT, Rajgira rice and image processing techniques to perform classification operations. The software application used to operate the system is PyCharm, a Python Integrated Development environment used to write python code.

II. LITERATURE REVIEW

In this section, an overview is made to discuss the earlier researches which were done regarding rice classification, quality detection among the various classes of rice.

Anurag Bhattacharjee et al. (2024) focuses on the sorting and quality detection of 800 samples of rice from 8 distinct varieties by comparing conventional neural network method and other Machine Learning techniques. This system includes CNN model to achieve the desired output. The project is proposed to reduce labour effort, time consumption and quality degradation [1]

C Sindhu et al. (2021) suggests the methods that classifies four kinds of rice grains and it also determines the percentage of purity content in sampled rice grain using image processing techniques. The proposed paper classifies the rice grain samples based on size and colour of datasets [2]

K. Gopalakrishnan et al. (2022) proposed project captures the rice images and multiple pre-processing of images is done to enhance image quality. The image processing process is done through MATLAB. The system later classifies the image by Support Vector Machine [5]

Zainab Naser Azeez et al. (2024) aims to classify the rice grain more efficiently with 75,000 images from five widely produced rice varieties in Turkey. The system uses Image processing techniques, mainly deep learning algorithm. It improves the sorting and helps in determining grading efficiency in the rice industry among suppliers.[16]

Yonus Gulzar et al. (2020) aims to develop a seed sorting system based on machine learning and CNN. This system contains a structure that classifies 14 seeds, it involves decayed learning rate, model check pointing. The system fetches the image of seeds, resizes it and labels the image to acquire features.[10]

Vaibhav Amit Patel et al. (2017) developed a deep learning-based rice grain classification system using CNN and VGG16, the system includes two methods of classification, first is training CNN using segmented rice and second is pretraining VGG16 methods. The system is developed to reduce labour effort, error prone and time- consumption.[9]

Dipankar Mandal et al. (2018) proposed a model of quality testing and identification with the help of novel digital image processing and a knowledge-based system known as adaptive neuro-fuzzy inference system (ANFIS). The system works on

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the milled basmati rice class and characterize it in terms of its physical properties. The milling efficiency is accessed by ratio between head rice and broken rice.[6]
Saurabh Chaudhary et al. (2020) aims to classify rice different types of rice grain classes based on four parameters i.e. morphology, colour, texture and wavelet. The project is based on image processing and deep learning. The proposed project applied to decrease labour efforts, time consumption and error [17]
Jyotsana Malla et al. (2023) strives a to develop an image processing system to classify rice grain efficiently based on their size and area. The system assesses and classifies predicating their dimensions and morphological operations of the samples. The image of rice samples is taken and processed.[15]

III. PROPOSED METHODOLOGY

Rice is a broadly consumed staple food globally. There are various kinds of rice grains available in the industry and agriculture sector. In terms of their size, length, colour and texture these rice grains are visually identical. Therefore, it increases need for an automated system which identifies and segregates the rice kernels accurately.
Image Processing is a technique which uses various computer algorithms to analyze digital images, extracting useful and required information. Image processing is implemented in wide range of applications. The proposed project deals with the categorization of rice kernels using image processing. PyCharm and Python is deployed to distinguish rice grains depending upon length and colour.

STEPS INVOLVED:
Input Image:
The first step is to take the picture of the sample image of rice grains with black background. The image should be precise and clear with accurate lighting. The captured images are then uploaded in the database of the pycharm which can be later accessed for processing.
.
Image Preprocessing:
The first step is image processing where the quality of the image is enhanced. The main aim of this phase involves the removal of noise caused during image acquisition. To eliminate noise, filters are used. Filters are algorithms which help to separate the unwanted information from an image extracting necessary information. These filters also improve the image sharpness simultaneously.

Shrinkage Morphological Operations:
Morphological Operations are used to address the problem of touching rice kernels.When rice grains are placed in a black background randomly, there is a chance of overlapping within the grains which leads to difficulty in the analysis and to classify them. To separate rice grains and study them individually morphological operations are employed. The rice grains are separated individually by maintaining the integrity of the individual rice granules. Process such as erosion, dilation and masking are used.

Edge Detection:
Edge detection plays a major role in in this process. It highlights and identifies the edges, curves, outlines and boundaries of the rice grain. It is very crucial to identify them in terms of their structure to classify correctly. Canny Edge Detection Algorithm is utilized in case of rice grain classification system.

Object Measurement:
The fourth step is object measurement where the parameters height and width are calculated. The lower and upper bound is calculated by defining HSV range. After applying the algorithms of edge-detection the respective height and width of the different kinds of rice grains are measured and then area is calculated depending upon height and width.

Object Classification:
The final step after utilizing and implementing algorithms is object classification. This involves compiling a set of measured, calculated, and standard outcomes. This paper deals with the segregation and classification of three varieties of rice such as Basmati, HMT, and rajgira.

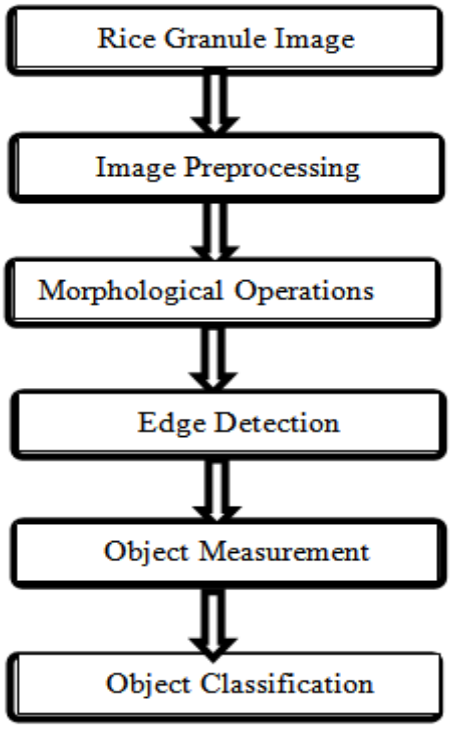

Fig.1. Architecture Diagram of proposed Model.

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IV.EXPERIMENT AND RESULT

The Table represents the height and width of contour along with the colour of the specified Rice Grain:

Sr. No.	Rice Type	Dimensions (height, width in pixel)	Colour
1.	Basmati	Greater than30<h, w<60	White
2.	HMT	30<h, w<60	White
3.	Rajgira	1<h, w<30	Off white

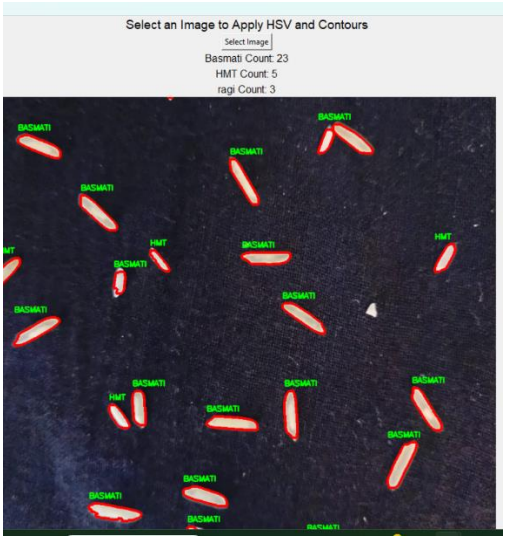
Fig. 2. Represents height and width of contour with colour of rice grain.

The implemented image processing application successfully detects and classifies objects based on color segmentation and contour detection techniques. Using OpenCV and Tkinter, the system provides a user-friendly interface for selecting an image, processing it through various transformations, and identifying objects within the image. The process begins with the selection of an input image, which is then converted into the HSV color space to facilitate color-based segmentation. By defining specific HSV threshold values, the system extracts relevant objects from the background while filtering out unnecessary details.

Throughout the process, the effectiveness of HSV-based filtering and morphological transformations plays a crucial role in achieving accurate object detection. The outcome of the system is moderately accurate. The system effectively counts rice grains and identifies it.

Below are images that illustrate different stages of the process:

Step 1. Input image Selection



Step 2. Contour Detection and Classification

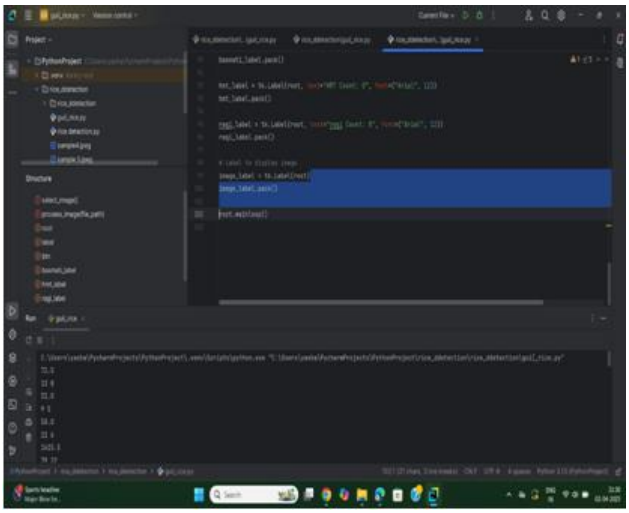


Fig.3. The image shows the values of height and width of contour.

V. CONCLUSION

This project successfully demonstrates how digital image processing techniques can be used to segment and classify objects based on color properties. By leveraging the HSV colour space, the system is able to isolate specific objects with greater accuracy compared to direct RGB-based segmentation. One of the major strengths of this approach is its simplicity and efficiency. The use of OpenCV functions enables rapid processing, making it feasible for real-time applications with minimal computational overhead. However, one of the limitations observed is the sensitivity of HSV-based segmentation to lighting conditions and variations in object appearance. Slight changes in illumination or color tone can

impact the segmentation accuracy, leading to misclassification or partial detection of objects. Additionally, relying solely on contour area for classification may not be robust enough for distinguishing between objects with similar sizes but different textures or shapes.

Despite these challenges, the project successfully validates the effectiveness of basic image processing techniques in object recognition tasks. It provides a solid foundation for further enhancements that can improve accuracy and adaptability in practical applications.

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