

## RICE TYPE AND QUALITY DEDUCTION USING ONTOLOGICAL MODEL

Mubasher Hussain Malik<sup>1</sup>, Aqsa<sup>2</sup>

<sup>1</sup>[Hodcs@usp.edu.pk](mailto:Hodcs@usp.edu.pk), <sup>2</sup>[aqsaaltaf305@gmail.com](mailto:aqsaaltaf305@gmail.com)

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**Mubasher Hussain Malik**

### Abstract

The world wide crops are grown in the vast and diverse realm of agriculture to support life on Earth. Rice as a gluten diet, especially in Asia. The rice sector is vital to the international economy, the rice as a gluten diet in Asia. In addition to being a vital source of nutrition, it plays a crucial part in the economic stability of many countries, and diseases that destroy rice plants have a huge impact on large portions of the world's population. In this situation, it is even more important to ensure the sort and quality of rice. In increasing the precision and efficacy fresh rice quality and type deduction, you can guarantee sure the proper kind is grain reaches the correct market, cutting down on waste and raising general efficiency in the supply chain. In the domain of agricultural image processing, it is investigated in the literature, the quality of rice crops is not considered as important up to the perspective. Five types of rice apply five classifier Logistic Regression accuracy 78.45, Support Vector Classifier accuracy 91.82, K- Nearest Neighbours accuracy 93.47, Random Forest accuracy 99.21 and Decision Tree accuracy 99.82 in rice data set.



## Introduction

The world wide crops are grown in the vast and diverse realm of agriculture to support life on Earth. Rice as a gluten diet, especially in Asia. It is not only a source of food, but also a cultural icon, a means of support, and an important component of the world economy. One of the biggest problems is accurately identifying the type and quality of rice, which is essential for figuring out the crop's market worth and suitability for various culinary uses (Advancements, 2016). The rice sector is vital to the international economy the rice as a gluten diet in Asia. In addition to being a vital source of nutrition, it plays a crucial part in the economic stability of many countries, and diseases that destroy rice plants have a huge impact on large portions of the world's population (author BEJO, 2014). When infections in rice (plants) are found early on, they can be treated more successfully by swift corrective action. Such disease identification by human experts, however, is time-consuming and does not scale because a human can only thoroughly study a very small number of plants (author Sethy).

Highlight Rice is one of, if not the most important crop grown for human consumption globally, according to the International Rice Research Institute (commonly known as IRRI) and other academic and professional institution farmers in Latin America, the Caribbean, and Africa (Author Mahale, 2014).

Rice, one of the most consumed staple grains worldwide, has a significant effect on both food security and the world economy. The sort and quality of rice have a significant impact on its market value, nutritional benefits, and suitability for use in a variety of culinary applications. It is still challenging to correctly determine the kind and quality of rice complexity every rice or the range every rice type. Rice is a dependable food

source that offers vital nutrition to the world's population (Lysaker, December 2003). The subjectivity and inconsistent nature of traditional techniques of grading rice quality occasionally leads to inconsistencies in the evaluation process. The use of cutting-edge technologies, notably in crop quality monitoring, is significantly changing the worldwide agricultural business. (Zhang et al., 2020) [27]. The laborious, labor-intensive, and time-consuming traditional methods of rice quality detection are prone to human error [28]. Rice is one of the main agricultural commodities that is significant in many farming. Good rice grain is crucial to consider while evaluating rice production [2].

## Literature Review

This section describes Working with five different types of rice, take 75,000 grain images of one type of rice, and test Artificial Neural Network (ANN), Deep Neural Network (DNN), and Convolutional Neural Network (CNN) algorithms on 250\*250 pixels. The classification process employs a confusion matrix with 160 features to aid in the identification of correct and incorrect classification information. The accuracy of these methods was determined to be 99.95% for the DNN method, 99.69% for the ANN method, and 100% for the CNN method. The DNN approach was found to have a remarkable accuracy rate of 99.95%, while the ANN method lagged slightly behind with an accuracy rate of 99.69% M Koklu.et al [4]. Rice kernel morphology feature classification, reduced classification feature using statistical analysis system (SAS) software. This method was intended to focus on the most important and distinctive characteristics while avoiding those that shared characteristics with others and, as a result, would not greatly improve the specificity of the categorization. The preferred original features are not far from other features, MATLAB 12

megapixel (Coolpix S2500) with CCD image sensor having a sensor size of 28.0735 mm<sup>2</sup>, image size of 4000\*3000 and resolution of 300 dpi, use 400 images morphological feature show 97.75% accuracy.

In particular, SS Chawathe's research focuses on several bacterial illnesses affecting rice leaves as well as a brown spot identification, exploring the significant challenges people working in the field of plant health check confront SS Chawathe [6].

To achieve its goals, this innovative system combines various digital image processing techniques with the powerful computing power of the MATLAB tool. The camera system helps of the exact classification of the grains. Rice grains is methodically segregated using the processing capabilities of the MATLAB program, which surpassed the ANN and achieved an astounding accuracy of 91%.

PK Sethy and his team explore the use of image processing for accurate crop estimating and the detection of plant diseases in their ground-breaking research article. For the identification and discrimination of numerous illnesses, including but not limited to Leaf Scald, Brown Spot, and Bacterial Leaf Blight, image processing, a revolutionary field in the digital age, is used.. They do this by examining the chosen pixels PK Sethy.et al [7].

In the study conducted by ME Pothan and his research team, referenced as [6], they develop deep into the analysis as well as the recognition of diseases of rice that include Bacterial Leaf Blight, Leaf Smut, and Brown Spot, using sophisticated digital image processing techniques and machine learning algorithms ME Pothan.et al [8].

The article analyzes the rice's quality as it is employed in manufacturing. Rice quality is determined by considering several elements,

including grain size and shape, moisture content, lightness, as well as bulk density of the grain.

One such technology entails creating a rice quality detecting system using the language of programming, Python, and associated capabilities. Utilizing cutting-edge image processing methods, the use of Python resources enables the recognition and categorization of grain particles due to their characteristics such as length, width, size, shape, and edge attributes. The system is able to quickly and effectively analyze large numbers of rice grains by making use of Python's capabilities. resulting in dependable and consistent results MCA Prabowo .et al [9].

A noteworthy study by S. Hua et al. [8]. To further enrich the existing body of knowledge, Jiang et al. (2010) contribute to the field by collecting a vast dataset consisting of 5200 images, encompassing bacterial blight-infected leaves as well as healthy ones. Convolutional Neural Networks (CNNs) have revolutionized visual analysis and have proven to be highly effective in analyzing complex visual data S Hua.et al [10].

To develop a computer-aided approach for precisely determining rice quality. In order to address those challenges, it has been shown that many tasks can be automated. The RGB color space is used to take a picture of the grains of rice as the initial stage in this automated method. Considering the three main hues of RGB, the system may obtain an accurate depiction of the grain of rice by applying this color model V Sonawane .et al [29].

Classification of rice grains plays a vital role in agriculture and food production. CNN model is utilized as a starting point for training on a specific task. A smart camera with a resolution of 1024x1024 pixels, containing 10 rice grains per image. The results were remarkable, with the CNN model achieving an accurate rate of 80%. K

Aukkapinyo et al [12] Study conducted by (Bhupinder Verma) in the focus on utilizing a computer vision system to analyze basmati rice. The experimental setup consisted of a Flatbed Scanner with dimensions of 11x9 inches and a resolution of 300 dpi. The scanner had a USB interface and supported 8-bit grayscale, providing a range of 0 to 255 for pixel values. Each sample contained 500 grains of rice altogether, with between fifteen and twenty individuals being used for examination. By taking 20% chalkiness into account while processing. Siti Khairunniza Bejo [13] Study concentrated on 16 features of brown rice, such as kernel form, color, and flaws, to evaluate the worth of rice grown from paddy fields. Each paddy sample measured 10 grams, there was an overall of 78 paddy tests (forty-three ripe and thirty-five immature). With a processing rate that exceeded 1200 kernel every minute, image based methods were used. The outcomes showed that every one of the methods produced low values for determining the grade of paddy rice ranging in the range of 0.01.. The average identification rate was found to be 92.31%. The remaining thirty percent of the total samples evaluated had been included in the study's sample set, which included 30 mature paddy samples and 25 young paddy samples.

Rice, one of the most significant grain products globally, holds a crucial position in agricultural production, standing alongside wheat and corn. A comprehensive set of 106 the images' includes had been obtained. Ninety color features were extracted from the images, spanning five separate shades of color, RGB, HSV, L\*a\*b\*, YCbCr, and XYZ are a few instances. Each color space provided a unique perspective on the color properties of the rice grains, enabling a comprehensive understanding of their visual characteristics Dolly Indra [14]. paper working on Manual detection is the visual observation of diseased spots by the human eye,

sheath blight, flax leaf spot, leaf streak and rice blast, including 500 images of each disease, different type of disease of rice plants white leaf blight, Stripe blight, Hoary leaf spot, Stripe disease and Rice leaf blight. YOLOv3 model was compared with traditional convolutional neural network models, including the Alex Net, Google Net, VGG-16 and ResNet-34 models 91.84%, 92.14%, 91.87% and 91.84%, respectively, which were all improved compared with the traditional algorithms Ilkay CINAR [15].

Diagnosis of the plant disease amount of diseases deduction and qualification in few years 2007 to 2018 develops state of the art By 2025, the World Bank predicts that the demand for rice would have increased by 51%., this situation, damage of rice crop by any cause is unacceptable. Detection of rice plant disease and its severity has always been challenging. Earlier naked eye observation in rice plant caused by fungi damage to the plants, Probabilistic Neural Network, 134 diseased image and 94 of these used for training, 20 image, 2017 Determine what kind of leaf disease it is. FCM ninety-five Finding a disease in rice seeds in the year 2009, K-Mean Segmentation Accuracy K-Mean 85.05% A support vector algorithm has a 97.2 percent accuracy rate Prabira Kumar Sethy [16].

In this paper using deep learning methods to detect gain rice and classify rice disease spots. Specifically, the research explored the effectiveness of several popular Alex Net, Google Net, VGG-16, and ResNet-34 have been convolutional neural network (CNN) models, as well as the YOLOv3 model. To begin the investigation, a dataset of 2500 images was meticulously curated for training the YOLOv3 model showing results (AlexNet, GoogLeNet, VGG-16, ResNet-34) 91.84%, 92.14%, and 91.84% respectively. Additionally, the YOLOv3 model has remarkable overall accuracy in categorizing rice illnesses, demonstrating its

capacity to continuously make accurate predictions Jiapeng Cui [17].

The sort of disease rice can show matter, to develop a method using preprocessing techniques about YOLOv3 model, that include Convolutional Neural Networks (CNN). Collect dataset 16,770 images rice grain affiliated facing grain rice bout sickness. Another data split was performed, allocating 70% for training (11,740 images), 30% for validation (5,030 images), and again using 1,600 images for testing. Through their rigorous experimentation, the researchers achieved a remarkable accuracy rate of 90.8% in disease detection Md. Sazzadul Islam Prottasha [18].

Hyper spectral images (HSI) provide valuable information for material identification, and recent advancements comprehensively learning tools. The proposed method is evaluated using a dataset from Houston University, consisting of with a spectral range of 600 to 1700 nm and 268 bands and 150 900 pixels each band. It comprises 268 bands, capturing spectral information across a broad range, and contains a substantial number of pixels per band ( $150 \times 900$  the outcomes gathered through experiments demonstrate a remarkable the incorporation of AN-GCN enhances accuracy. The overall accuracy of Houston University data has risen considerably from 81.71%. (Achieved by Mini GCN) to an impressive 97.88% with AN-GCN Jairo Orozco [19].

The term "vision for computers" refers to the discipline of imaging used by computers accurate assessment of rice grain quality is of utmost importance for ensuring food safety and meeting consumer demands Myrtel Bernardo [20].

A study in 2022 focusing on grain rice production. The paper addressed the numerous challenges faced by farmers in this industry, particularly the issues of fissures or cracks both in grain size as well as chalkiness which significantly impact the worth

of kernels of rice worldwide. The grain area was measured as 11x11 pixels, while for the chalky area, a structuring element of size 5x5 pixels was utilized Davood Pour Yousef an Barfeh [21].

The focus was on the evaluation of the majority essential grain being consumable, rice. The Rice grain inspection for quality is primarily dependent on various factors, including the percentage of chalkiness, grain breakage, grain temperature, and grain moisture Jyoti D. Bambole [23].

2017 In the research paper titled "Quality Assessment of Food Grains Using Neural Network Technology" by published in 2017, These preprocessing techniques are implemented using MATLAB, a widely used software tool for image processing. To train the neural network, the extracted features are presented as training data Nikhade Pratibha [24]. (Abhishek Gudipalli,) in his paper, addresses the significance of rice as a staple food for approximately 65% of the Indian population. Rice cultivation spans across all continents, except for Antarctica, and encompasses an astonishing array of over 40,000 distinct varieties.

In the study conducted by (S. Khunkhett and T. Remsungnen in 2014,) the authors emphasized the significance of color and texture analysis in agricultural breeding and quality testing. Farmers often face challenges in identifying rice seeds due to their similar surface colors. By computing the ratios between segment images and different shades of RGB histograms, the high correct classification rates, with a reported accuracy of 98%, demonstrate the effectiveness of the proposed method in distinguishing good rice seeds.

Three dimensional point cloud datasets, yielding a total of 3194 samples. A large increase to 97.4% in the average accuracy percentage for late integration of predicted possibilities Xinyi He [27].

Rice plants frequently display indications of nutrient shortages around their leaves. Overall as well as each the DCNN algorithm consider achieved over ninety percent verified and test reliability levels, beating estimates Zhe Xu [30].

Farming is a technique of decreasing input requirements while supplying the growing demand for agricultural products. Every mAP score for the three models was 70.0%, 95.5 percent, as well as almost one hundred percent in training, but 70.2%, 83.2%, as well as 88.8% throughout evaluation, respectively Hsin-Hung Tseng [31],

### Materials and Methods

Applied Research will be conducted which involves the study of ongoing research and new model will be develop to deducting the quality of rice. Descriptive research methodology development life cycle will be used for design and development of model using proposed architecture. The descriptive research basically conduct qualitative as well as quantitative research for this model. Methodologies for evaluating treatments, services,

programs, and policies include those that quantify their effectiveness, impact, performance, or quality. Decision-making, improvement, and innovation all depend on evaluation because it enables stakeholders to recognize their strengths and weaknesses, as well as opportunities and threats, and to take wise actions to increase the productivity and effectiveness of their operations. Among these techniques were N-Nearest Neighbors, Logistic Regression, Support Vector Classifier, and Random Forest. To model the likelihood of rice quality based on data, logistic regression (LR), a straightforward classification technique, was applied. Finally, the power of collaborative learning was realized using the Random Forest technique, which blends various decision trees to boost classification accuracy.

The MLTI framework is described in given section below.

### Proposed Methodology

The proposed MLTI algorithm is presented in detail, including all steps.

MLTI algorithm: Multi-class Liver Tumor Identification (MLTI) Algorithm

Input: Rice type Dataset  
 Parameters: Camera Dataset (Images)  
 Output: Classification Accuracy

1. Function MLTI ( Dataset)
2. Begin
3. For each image in camera Dataset do
4. Image pre-processing
5. FE ← feature extraction (histogram, text, RGB, binary, texture)
6. FR← (Principal Component Analysis)
7. End For
8. Function machine learning classifier (FE,FR)
9. Return rice type classification accuracy
10. End function
11. End
12. End function

### Data Acquisition

In this experimental process, machine learning classifiers were employed to distinguish between various types of rice, including Double Steam, Kachi Kainat, Pakki Kainat, Kachi Kernal and Pakki Kernal. The data collection took place in an open climate setting at the Institute of Southern Punjab in Multan, Pakistan, located at coordinates 30.2892°N (North) and 71.5001°E (East). Rice grain images were captured using a 13-megapixel camera on an OPPO F19 cell phone, specifically between 10:00 AM and 12:00 PM according to the Pakistani time zone. The images exhibited variable pixel sizes and were stored in the Joint Photographic Expert Group (JPEG) format.

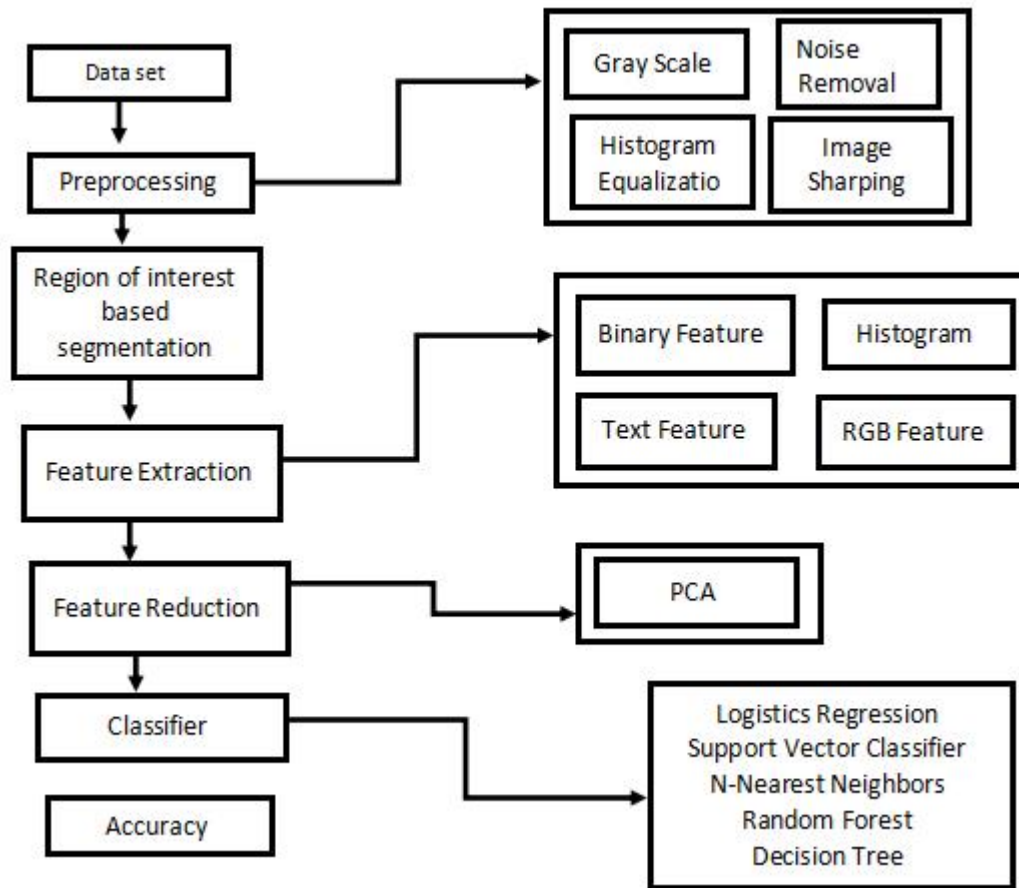
For this study, approximately 2000 healthy rice grains were gathered for each rice variety, resulting in a dataset of 100 images per variety. The images were taken from a height of 1.5 feet to minimize sun shadows. To ensure image quality, the dataset underwent preprocessing. This involved converting all images to grayscale and applying a Median filter. Additionally, free image conversion and resizing software were employed to standardize the resolution to 512x512 pixels and 8-bit grayscale. Each rice grain image was segmented into five non overlapping Regions of Interest (ROIs). These images were then used in the experimental process for rice classification.



*Figure 1. Rice type Dataset images.*

The contrast enhanced computed tomography (CECT) images using invasive approach while

unenhanced CT images involved noninvasive approach (Balagourouchetty et al. 2018).  
Modules



### Image Preprocessing

Our proposed method 1<sup>st</sup> step is preprocessing which use grayscale conversion then use Noise Removal for remove the noise in images, use histogram equalization utilize the entire dynamic range of the mathematical equation. To create a high contrast image, the grayscale image is transformed into a Histogram Equalized (HE) image by harmonizing the image's contrast levels, then use image sharpening for clear the pixel in images and modify the better the image, then the 2<sup>nd</sup> step feature extraction use four type of feature extraction binary features, histogram feature ,text feature and RGB feature extraction then the 3<sup>rd</sup> step feature reduction using PCD then 4<sup>th</sup> step is classification algorithms then 5<sup>th</sup> steps accuracy as shown in Figure 1.

### Gray Scale Conversion

Image is converted from shade to grayscale, each megapixel is represented by a single intensity amount that ranges from black to white. This process is known as gray scale conversion. Grayscale images prevent computing complexity and simplify image processing operations through the elimination of color information. There are several domains, such as image analysis, computer vision, and medical imaging, where grayscale representations are sufficient for analysis and color information is not essential (Lu, June 2009).

$$I(a, b) = \alpha \cdot J(a, b) + \beta \cdot K(a, b) + \gamma \cdot B(a, b). \quad (1)$$

The weighted average in grayscale, a, b is the result of the calculation (Lu, June 2009).

Noise Removal

The practice of reducing or completely removing undesired interruptions or artifacts from digital signals or images is referred to as noise reduction, sometimes known as de noising.

Different causes, such as sensor limits, transmission faults, or ambient conditions, might cause noise (Mallick, June 2014). Methods for removing noise are intended to improve quality of image by protecting crucial information while suppressing unwanted noise parts remove help of this equation .These methods take advantage of the noise's statistical characteristics and spatial and temporal dependencies to significantly lessen its effect (Lysaker, December 2003).

$$u_0(a, b) = (a, b) + \eta(a, b). \tag{1}$$

Histogram Equalization

Histogram equalization is a contrast-enhancing method used to enhance the details and visual appeal of digital image. It changes the intensity distribution of an image so that the histogram's output image has a roughly uniform distribution. In the histogram equalization algorithm, the source graphic's histogram's cumulative distribution function (CDF) (The International Arab Journal of Information Technology, November 2013).

$$H_{EF} = \{h(b_1)_{EF} h(b_2)_{EF} \dots \dots \dots h(b_L)_{EF}\}$$

(1)  $h(b_1)$  is frequency of EF coefficient in bin  $i_1$  and  $i_2$  is the histogram of the J bin and the histogram DC coefficient are also quantized into L bin

$$H_{DC} = \{(b_1)_{DC} J(b_2)_{DC} \dots \dots \dots J(b_L)_{DC}\} \tag{2}$$

Image sharpening

An image's borders and small details are in sensitive to high-frequency parts, attenuating or completely eliminating these high frequencies can have a significant negative impact on the perceived quality of an image. The term "sharpening" refers

to any type of picture enhancement that highlights an image's more delicate details and edges. With the goal of improving the local contrast and sharpening the images, image sharpening is regularly used in the printing and photographic sectors. (Kim, December 2016).

$$S_{A,=XA,B} + \lambda F(X_{A,B}). \tag{1}$$

3.4 Regions of Interest (ROI) Segmentation

The following is a description

1<sup>st</sup> step using a dynamic threshold to segment the saliency map, as shown in figure.

2<sup>nd</sup> step removing borders from the segmented image to obtain the regions of interest's contour.

3<sup>rd</sup> step the extraction outcome after adding the outline image to the original image.

$$T(x) = \begin{cases} 0 & T(x) < threshold \\ 1 & T(x) \geq threshold \end{cases} \tag{1}$$

Threshold = 2 \* E (T)

Where E (T) is the expectation of the saliency map and S is the saliency map.

Feature Extraction

Raw data is converted into process able mathematical characteristics by an approach that keeps the original data set's information intact (The International Arab Journal of Information Technology, November 2013), Use this model binary features, histogram features, text feature and RGB feature.

Binary Features

Binary features are compact and effective data representations that use binary codes to encode particular traits or patterns. They are also known as binary classifiers or binary representations. Since binary features are computationally efficient and noise-resistant, they are frequently utilized in artificial intelligence, pattern recognition, and machine learning tasks Binary features, which

describe information with binary bits (zero and one), differ from conventional continuous-valued features in that they enable faster computation (Grewal & Patterson, 2023).

2  $B_2$  point (1,1) is assigned to the class B, point (0,1) then  $x_1 = 0$   $x_2 = 1$  if put the 3rd variable  $x_3 = 1$  ,  $x_3 = 0$  can phase the problem.

$$3 \quad B_2 = B_1 x_1^2 = x_1 x_1^2 \quad (1)$$

4 Problem can be solve three feature throw this equation

$$5 \quad B_3 = B_2 + x_3 = x_3 + x_1 x_1^2 \quad (2)$$

### Histogram Features

Histogram features are visual representations of an image's or a particular region of interest's random distribution of the intensity of pixels or other pertinent image attributes. The gray level distribution of a picture is represented in two dimensions by the image histogram. It reveals the image's optical composition. The amount of light and darkness in an image is what is meant by optical content. (The International Arab Journal of Information Technology, November 2013).

$$6 \quad Q = (b) \text{ --- } (b) \quad (1) M$$

By capturing the crucial statistical characteristics of an image and minimizing the overall dimension of the data, histogram features enable effective and reliable image analysis (The International Arab Journal of Information Technology, November 2013).

### Texture Features

Texture characteristics offer information on the arrangement of pixel intensities or shades by describing the perceptible visual patterns, structures, or attributes in a picture. In image analysis, texture is essential because it offers helpful hints for object detection, segmentation, and scene

comprehension. The purpose of texture features is to record the frequency-based statistical, or structural characteristics of the textures that appear in an image (Grigorescu, 2002). These properties allow for the differentiation of various textures and are utilized in a variety of applications, including as material salute, medical imaging analysis, and texture creation

(The International Arab Journal of Information Technology, November 2013).

$$mean = \sum_{b=1}^L bP(b) \quad (1)$$

### 3.5.4 RGB Feature

It is based on the combination about visual as well as thermal modalities, RGB tracking is a subset of single-object tracking which based on the efficient utilization of complementing data from various modalities to create more steady and reliable monitoring ability. Designing a responsive architecture that enables the model to convert between appearance model as well as motion modeling while utilizing single-modality tracking while completely taking account of motion rule (ACIJ, March 2012). The transformation in this instance consists of a rotation matrix and a three-dimensional translation vector using transformation formula  $(M, J) = \text{Image}(a, b, 1)$ ;  $\text{Green}(a, b) = \text{Image}(a, b, 2)$ ;  $\text{Blue}(a, b) = \text{Image}(M, J, 3)$  (Luo, Learning Modality Complementary Features with Mixed, June 19, 2023).

$$\{ T_1, T_2, T_3 \dots T_n \} \quad (1)$$

### Feature Reduction

The method of lowering the amount of features in a computation that uses a large number of resources without losing important information is referred to as feature detection or dimensionality reduction. Having some functions means having some variables, which makes the machine's task easier and faster.

**Principal Component Analysis (PCA)**

Rule component analysis (PCA) identifies the principle components as orthogonal information space instructions that pictures the majority of the data variance. The resulting reduced dimensional representation, referred to as the PCA subspace, can be employed for feature extraction. PCA is used to streamline data analysis, deduct the redundant information, and underlying structures or patterns in a variety of fields, including image processing, methods recognition, genetics, and data compression (Rahman, Texture Feature Extraction Methods: A Survey, 03 January 2019).

$$\int (a, b) = s(t) dt = \lambda s(t). \quad (1)$$

The s (b) functions, which constitute the equation's analytic solutions.

**Classifier**

A Process that is connected to grouping, which is the process by which logics and things are specified, distinguished, and comprehended. It could also be used to describe a procedure that groups like items together and separates those that aren't, classification (Grewal & Patterson, 2023).

$$s_{j+i} = B^{i-B} i j^{ai-i} = 1 - a \frac{i}{B} + i j^{bi} \quad (1)$$

**Logistics Regression**

A famous statistical technique for situations involving (0,1) type is logistic regression. In this type of regression analysis, important are estimated to describe the relationship between a dependent (0,1) variable and one or more independent variables. The logistic graph that is made by logistic regression, often called as a curve with an S shape, aids when making forecasts or judgments based on the likelihood that an event will occur. Throw this techniques detect including spam and disease diagnosis

**Support Vector Classifier**

The classification, of Support Vector Classifier, often known as the Support Vector Machine (SVM), is a potent supervised learning methods. Two type categories in a dataset, SVM is chose the show hyperplane drive to them. This methods is show for its capacity to manage complicated effective in both (0,1) and multi-class classification high-dimensional data and is SVMs are flexible for handling a types of classification issues because data into higher dimensional spaces using a short of kernel .

**N-Nearest Neighbors**

K-Nearest Neighbors (K-NN) algorithm two classification and regression tasks, is a parametric in nature, instance-based machine learning approach. The k -nearest depend on the type class (for classification) or average (for regression) of those neighbors, the system first locates the "k" nearest data points in the area of features to the new data point. Although K-NN is an easy-to-understandable technique.

**Random Forest**

Many decision trees are used in the Random Forest ensemble learning technique to carry out regression or classification assignments. The random forest combines each tree's projection result to generate the most accurate estimate. Unplanned events lowers overfitting and optimizes adaptation in picking features as well as sampling. The success uses random forest models across various fields, like object recognition, picture categorization, bioinformatics, or remote sensing. (Qi, 2021)

**Decision Tree**

A supervised machine learning approach known as a decision tree is utilized for issues related to regression and classification. The determination of what typical to divide the data upon occurs at each internal node within the tree, whereas the final

forecasts and assessments are made at the leaf nodes. Decision trees are well-liked for their transparency and understanding since they are simple to picture and understand.

#### Algorithm

Calculations and processing data, algorithms are employed as specifications. Conditionals are a powerful tool that may be used by more complex algorithms to automate reasoning and machine learning by directing the conduction of the code down several paths and drawing conclusions that are true. (Author Mahale, 2014).

#### Results & Discussion

Among these techniques were N-Nearest Neighbors, Logistic Regression, Support Vector Classifier, and Random Forest. To model the likelihood of rice quality based on data, logistic regression (LR), a straightforward classification technique, was applied. The Support Vector Classifier hyperplane was implemented to widen the distance between the quality categories. Five classifier showing table and figure separately which consist of classifier name and accuracy, F1-score, precision and recall and then over all classifier showing in one table and figure to achieve the accuracy ,F1 - source ,Precision and recall.

**Table 2 Classification Results of Logistic Regression ML classifier using 80%-20% (Train-Test) Ratio**

Classifier	Accuracy	F1-Score	Precision	Recall
Logistic Regression	78.45	77.97	78.55	78.49

For this experiment, 80-20 train-test split was adopted the as shown in Table 2

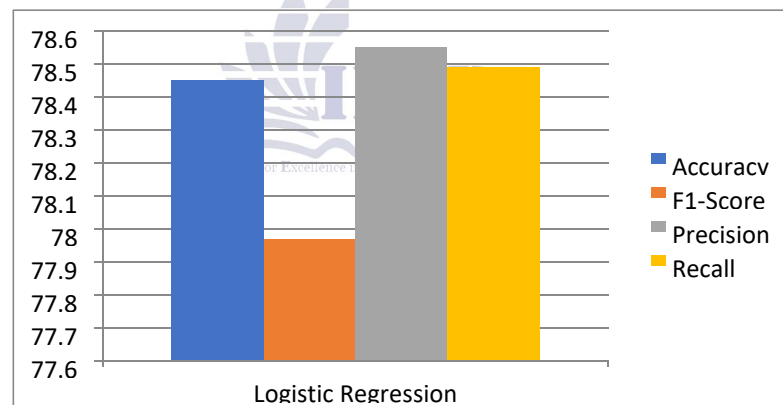


Figure 14 Graphical Representation of Rice Type using Logistic Regression on 80-20 Ratio

Graphical representation of classification results using Logistic Regression on 80-20% train test split shown in Figure 14.

**Table 3 Classification Results of Support Vector ML classifier using 80%-20% (Train-Test) Ratio**

Classifier	Accuracy	F1-Score	Precision	Recall
Support Vector Classifier	91.82	91.93	91.88	91.90

For this experiment, 80-20 train-test split was adopted the as shown in Table 3.

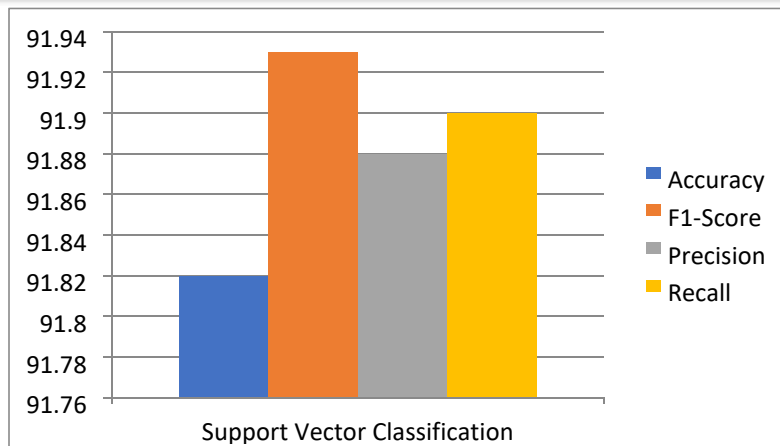


Figure 15 Graphical Representation of Rice Type using Support Vector Classifier on 80-20 Ratio

Graphical representation of classification results using support vector classification on 80-20% train test split shown in Figure 15

**Table 4 Classification Results of K- Nearest Neighbours ML using 80%-20% (Train-Test) Ratio**

Classifier	Accuracy	F1-Score	Precision	Recall
K- Nearest Neighbours	93.47	93.15	93.17	93.27

For this experiment, 80-20 train-test split was adopted the as shown in Table 4.

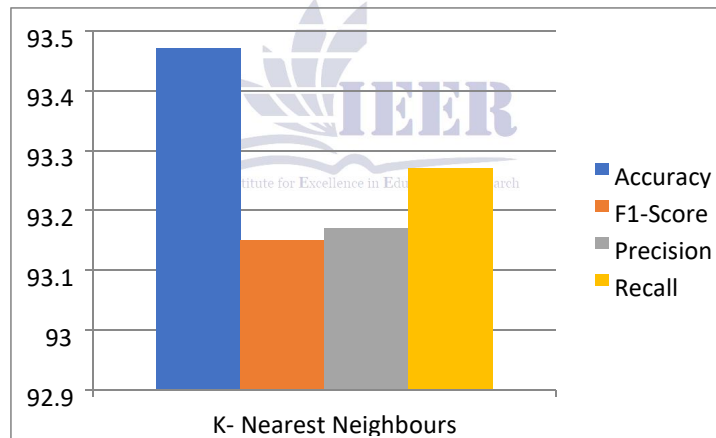


Figure 16 Graphical Representation of Rice Type using K- Nearest Neighbours on 80-20 Ratio

Graphical representation of classification results using K- Nearest Neighbours Classifier on 8020% train test split shown in Figure 16.

**Table 5 Classification Results of Random Forest ML classifier using 80%-20% (Train-Test) Ratio**

Classifier	Accuracy	F1-Score	Precision	Recall
Random Forest	99.21	99.17	99.16	99.19

For this experiment, 80-20 train-test split was adopted the as shown in Table 5.

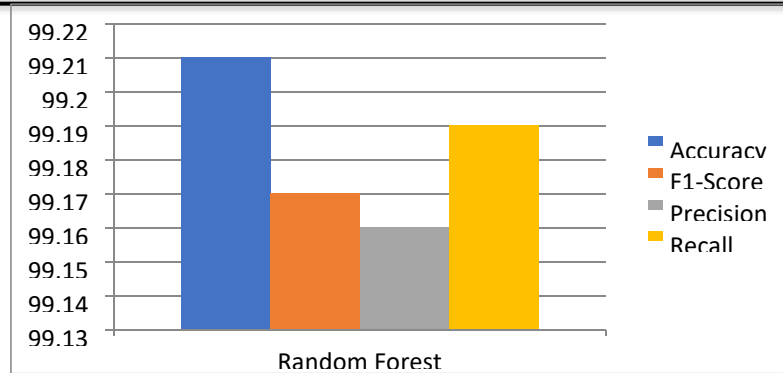


Figure 17 Graphical Representation of Rice Type using Random Forest Classifier on 80-20 Ratio

Graphical representation of classification results using Random Forest Classifier on 80-20% train test split shown in Figure 17.

Table 6 Classification Results of Decision Tree ML classifier using 80%-20% (Train-Test) Ratio

Classifier	Accuracy	F1-Score	Precision	Recall
Decision Tree	99.82	99.76	99.78	99.80

Classification. For this experiment, 80-20 train-test split was adopted the as shown in Table 6.

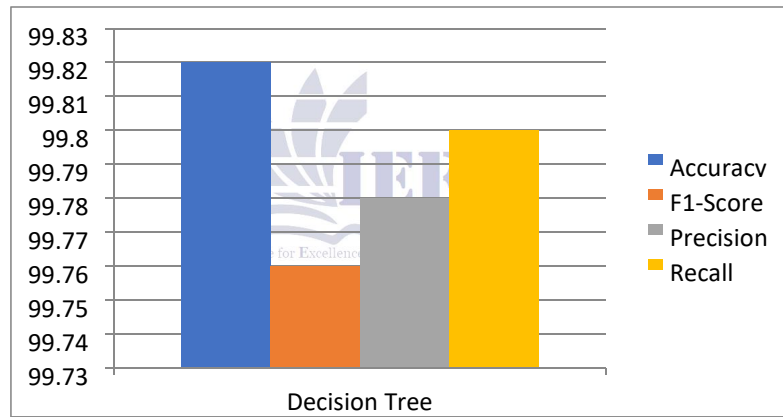


Figure 18 Graphical Representation of Rice Type using Decision Tree Classifier on 80-20 Ratio

Graphical representation of classification results using decision tree Classifier on 80-20% train test split shown in Figure 18.

Table 7 Classification Results of ML classifier using 80%-20% (Train-Test) Ratio

Classifier	Accuracy	F1-Score	Precision	Recall
Logistic Regression	78.45	77.97	78.55	78.49
Support Vector Classifier	91.82	91.93	91.88	91.90
K- Nearest Neighbours	93.47	93.15	93.17	93.27
Random Forest	99.21	99.17	99.16	99.19
Decision Tree	99.82	99.76	99.78	99.80

Showing this Table 7 over all experiments of classifiers the best result show in decision tree the highest accuracy 99.82 ,the highest F1-score 99.76

the highest ,highest precision 99.78 and recall 99.80 .The 2<sup>nd</sup> best result random forest accuracy 99.21, F1-Score 99.17, precision 99.16 and recall

99.19. The 3<sup>rd</sup> is good result K- Nearest Neighbors accuracy 93.47, F1-Score 93.15, precision 93.17 and recall 93.27. The 4<sup>th</sup> Support Vector Classifier accuracy 91.82, F1-Score 91.93, precision 91.88 and

recall 91.90. The 5<sup>th</sup> Logistic Regression accuracy 78.45, F1-Score 77.97, precision 78.55 and recall 78.49.

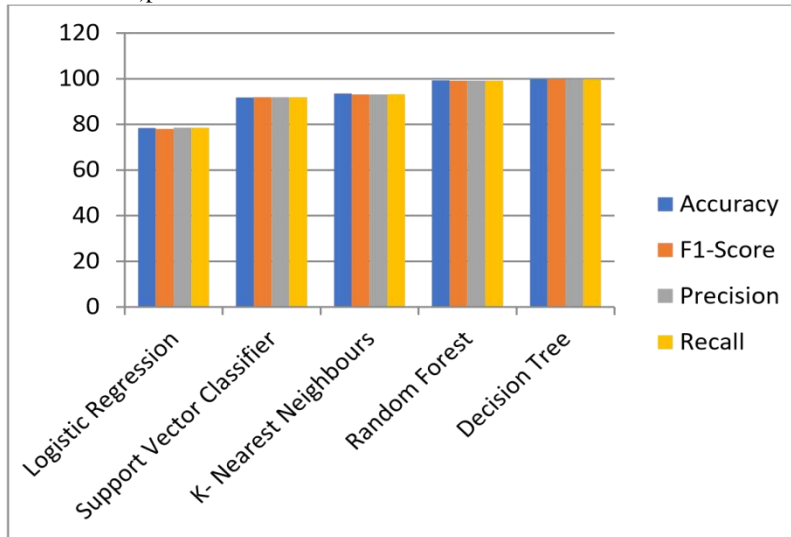


Figure 19 Graphical Representation of Rice Type using ML Classifier on 80-20 Ratio

Graphical representation of classification results using Graphical Representation of Rice Type Classification using ML classifier 80-20% train test split shown in Figure 19.

### Conclusion

This procedure had a substantial impact on the effectiveness of subsequent algorithms, therefore it proved essential in getting better, cleaning, and preparing the dataset. To guarantee the dataset's quality machine learning methods, logistic regression, decision tree, SVM, K-NN, and Random Forest, were then applied to the processed photos to categorize and rate the quality of the rice. This study represents a significant development in the use of technology to enhance food quality and manufacturing all experiments of classifiers the best result show in decision tree the highest accuracy 99.82 ,the highest F1-score 99.76 the highest ,highest precision 99.78 and recall 99.80 .The 2nd best result random forest accuracy 99.21, F1-Score 99.17, precision 99.16 and

99.19. The 3<sup>rd</sup> is good result K-Nearest Neighbors accuracy 93.47, F1-Score 93.15, precision 93.17 and recall 93.27. The 4<sup>th</sup> Support Vector Classifier accuracy 91.82, F1-Score 91.93, precision 91.88 and recall 91.90. The 5<sup>th</sup> Logistic Regression accuracy 78.45, F1-Score 77.97, precision 78.55 and recall 78.49

### Future Work

Our primary goal in doing this research was to create and refine a novel model for predicting rice kind and grade using machine vision methods, particularly machine learning models. On an image dataset, we constructed and applied our model while including various machine learning methods, and we got the results we were looking for. We attempted to create ontologies by identifying relationships between various factors, but owing to time restrictions, we were unable to do so at the model level. For improved outcomes, we will investigate deploying and implementing ontology further in the future.

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