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Research Article

Rice Quality Analysis Using Edge Detection Algorithm

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ABSTRACT

Micronutrients are known to play an important role in the metabolism and physiological activities of the human body. Unfortunately, over three billion people in the world are malnourished. The development of crops with enhanced mineral concentration is one of the most sustainable and cost effective approaches for alleviating micronutrient malnutrition. Bio fortification is considered as a suitable strategy of increasing the bio available concentrations of an element in edible portions of crop plants through traditional breeding practices or modern biotechnology to overcome the problem of micronutrient deficiencies. Quality refers to the suitability or fitness of an economic plant product in relation to its end use. Definition of quality varies according to our needs from the viewpoint of seeds, crop growth, crop product, post-harvest technology, consumer preferences, cooking quality, keeping quality, transportability etc. Quality trait is defined as a trait that defines the aspects of the produce quality. Grain quality evaluation is done manually but it is relative, time consuming, may be varying results and costly. To overcome these limitations and shortcoming image processing techniques is the alternative solution can be used for grain quality analysis. Rice quality is nothing but the combination of physical and chemical characteristics. Grain size and shape, chalkiness, whiteness, milling degree, bulk density and moisture content are some physical characteristics while amylose content, gelatinization temperature and gel consistency are chemical characteristics of rice. A solution of grading and evaluation of rice grains on the basis of grain size and shape using image processing techniques. Specifically edge detection algorithm is used to find out the region of boundaries of each grain.

Keyword: Quality analysis, Machine learning, Edge detection algorithm, Morphological features, Threshold values.

INTRODUCTION

In the statistical context, Machine Learning is defined as an application of artificial intelligence where available information is used through algorithms to process or assist the processing of statistical data. While Machine Learning involves concepts of automation, it requires human guidance. Machine Learning involves a high level

of generalization in order to get a system that performs well on yet unseen data instances. Machine learning is a relatively new discipline within Computer Science that provides a collection of data analysis techniques. Some of these techniques are based on well-established statistical methods (e.g. logistic regression and principal component analysis) while many others are not. Most statistical techniques follow the paradigm of determining a particular probabilistic model that best describes observed data among a class of related models. Similarly, most machine learning techniques are designed to find models that best fit data (i.e. they solve certain optimization problems), except that these machine learning models are no longer restricted to probabilistic ones. Therefore, an advantage of machine learning techniques over statistical ones is that the latter require underlying probabilistic models while the former do not.

Even though some machine learning techniques use probabilistic models, the classical statistical techniques are most often too stringent for the oncoming Big Data era, because data sources are increasingly complex and multi-faceted. Prescribing probabilistic models relating variables from disparate data sources that are plausible and amenable to statistical analysis might be extremely difficult if not impossible. Machine learning might be able to provide a broader class of more flexible alternative analysis methods better suited to modern sources of data. It is imperative for statistical agencies to explore the possible use of machine learning techniques to determine whether their future needs might be better met with such techniques than with traditional ones

The farming industry is one of the oldest and the most prominent industry since the beginning of mankind [3]. Rice is the most consumed and most favorite food in the world. It is easily available in all over the world. The rice grains are also ideal for the long term storage. It is used to produce number of value-added products for human beings for examples cereals, flour and kheer etc [4]. Quality inspection of rice grain is also important for both local as well as export purpose. It is necessary to propose an automatic solution to perform the quality analysis as well as to distinguish between different classes of rice [2]. Analyzing the quality of rice is one of the vital roles in machine learning. Several researchers suggest that object shape is more information than its appearance properties such is more color vary between objects instances more than the shape.

The main purpose of this method is to offer an alternative way for quality control and to analyze the quality of rice which reduces the required effort, cost and time [6]. The first process is to collect the dataset of rice grain images, and then the image will go under the preprocessing process. After that the feature extraction of rice will happen, according to the feature it will go under some threshold values that values will fix the quality. Thus the quality of the rice is determined.

RELATED WORKS

Samson Damilola Fabiyi, Hai Vu, Christos Tachtatzis et al., implements varietal classification of rice seeds using RGB and Hyperspectral images. Inspection of rice seeds is a crucial task for plant nurseries and farmers since it ensures seed quality when growing seedlings. Conventionally, this process is performed by expert inspectors whom annually screen large samples of rice seeds to identify their species and assess the cleanness of the batch. In the quest to automate the screening process through machine vision, a variety of approaches utilise appearance-based features extracted from RGB images while others utilise the spectral information acquired using Hyperspectral Imaging (HSI) systems [1].

T. Gayathri Devi, Dr. P. Neelamegam, S. Sudha, proposed Machine Vision based Quality Analysis of Rice Grains. It is great challenge to meet the needs of quality assessment on rice grains. Testing on quality is gaining importance in food industry for classifying and grading the grains. Since manual testing is time consuming, costly and inaccurate, machine vision based quality analysis of rice grains is preferred. In this proposed image processing algorithm, quality and grading of rice grains were analyzed using the average values of the features extracted and it was implemented in Mat Lab. Edge detection is the process of detecting the boundaries of rice grains. The different types of edge detection method like differentiation, gradient, Perwitt, Roberts, sigma, Sobel and Canny method are available. The proposed method used the Canny Edge Detection. The main objectives of the canny edge detection are: Low Error rate: The probability of detecting all edge points should be found, with a minimum of spurious responses, Localization: The detected edges should be as close as possible to the true edge points, Number of responses: Only one should be detected for each real edge point [5].

Namita Patel, Hardik Jayswall, Amit Thakkar, designed Rice Quality Analysis Based on Physical Attributes Using Image Processing Technique. This paper is for quality control of rice which is most important crop for human as well as in food market using image processing techniques and computer vision. Basic problem in Indian food industry that performs quality check manually by human inspectors which is non-reliable, costly and time consuming. The main purpose of the proposed method is, to offer an alternative way for quality control and analysis which reduce the required effort, cost and time. Image processing is significant and advanced technological area where important developments have been made. [Efforts are being geared to replace the traditional human sensory panel. MATLAB R2014b s/w is used to implement proposed image processing algorithms for grain quality analysis. Digital Color camera is used to image acquisition and using USB cable captured image can be stored in system [6].

You-yi Zheng, Ji-lai Rao, Lei Wu, implemented Edge Detection Methods in Digital Image Processing. Edge detection is one of the fundamental issues of digital image, in this paper, mathematical morphology method and several classical edge detection operators are reviewed. This paper provides two methods: Canny operator and mathematical morphology, which summaries relatively good image edge detection methods, and provides a reference for some detection occasions where requires smaller edge width in practical application [7].

Biren Arora, Nimisha Bhagat, Sonali Arcot, Saritha L R, proposed Rice Grain Classification using Image Processing & Machine Learning Techniques. Rice Grain Classification becomes very important as there are multiple rice grain types available in the market today. Classifying rice grains as per rice types manually is neither feasible nor efficient. Classification can be a really tedious task when it comes to doing it manually instead of automatically. The algorithms used in this paper are Logistic Regression, Decision Tree Classifiers, Random Forest Classifier, and SVM Algorithm [3].

PROPOSED WORK

Rice is the real sustenance source in Southern India. It is the stable food for more than 80% of people around the globe. Many varieties of rice are cultivated and exported. Detecting the defected grains and distinguishing rice variety is crucial in rice quality analysis when it is done manually. So, an automated system is introduced which can be used for rice grain identification and classification where digital imaging, edge detection algorithm, SVM is recognized as an efficient technique to extract the features from rice grains and analysis the quality in a non-contact manner. Images are captured by using a camera. Image Pre-processing techniques, Filtering, Segmentation, and edge detection are performed on the acquired image. The morphological features that are extracted from the image are given to Machine Learning Algorithm and the output is displayed.

METHODOLOGY

To detect an ideal hyper plane for different distinct examples in a high dimensional space is the main process of the SVM. To fulfill this model there is more than one hyper plane. This process depends upon the bolster vector which the information that lies nearest on the closed surface and coordinating with the ideal choice surface. It performs classification by planning the input vectors into a high dimensional space and constructing the hyper plane to separate the data. This strategy is mainly used to solve a quadratic programming problem and non-convex, unconstrained minimization problem. The SVM is the most effective method in the classifier process

Step1: Pre-process the images of rice to remove background noise

Step2: Convert the preprocessed image to binary image using threshold algorithm.

Step3: Region labels the binary image.

Step4: Segment/crop the individual grains present in the image.

Step5: Extract the geometric features major axis, minor axis and area of all the individual grains

Step6: Perform analysis on the quality using the average values of the features extracted

Step7: Classify the sample for the Type and grade based on the analysis

Step8: Stop [12].

MODULES

This system is divided into smaller modules. The modules are as follows:

1) Image Acquisition

This is the first step in any image processing technique. Different variety of rice are identified and taken as samples and image of these rice kernels are captured by high quality camera system with uniform and adequate light. The rice kernel size is an important aspect to determine the class of the rice. So proper placement of rice grains is a key point in this module of image acquisition

2) Pre – processing

The preprocessing procedure is used to obtain a new value for brightness and color in the output image. The term preprocessing of images comprises the following essential steps:

i) Resize

ii) RGB to Gray

iii) Noise Removal

iv) Image Enhancement

3) Training

In this module the machine will be trained with collected images after preprocessing and the model accuracy is tested with various classification algorithms. The system will be trained with deep learning

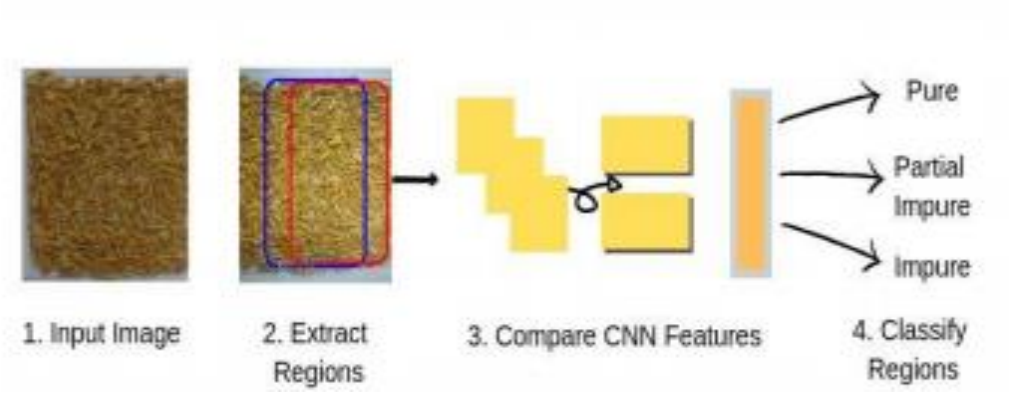
4) Feature Extraction

Feature extraction is the process of extracting relevant shape information from the pattern. In this process the input sample rice grains will be matched with trained pattern information. In this module the shape, size and color will be tested against our model

5) Price Updation

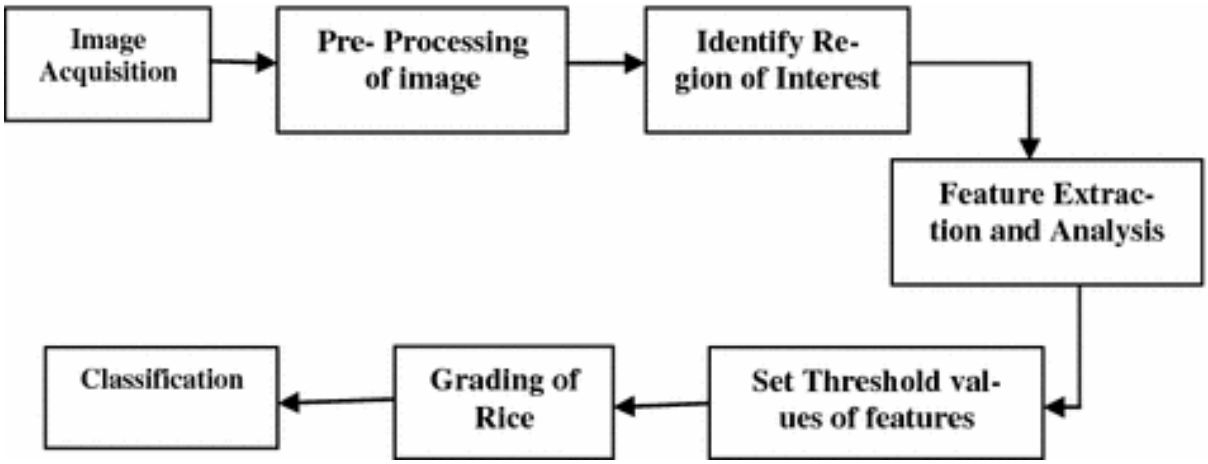
After prediction the system will return the threshold value based on the value we are classify as low, normal and high quality. Based on quality returned by system the corresponding price will be updated.

BLOCK DIAGRAM



1.1 Process of Rice Quality Analysis

FLOW CHART



1.2 Step by step process of Rice Quality Analysis

RESULTS & DISCUSSIONS

This presents recent advancements of using computer- vision based systems for classification of rice varieties. A computer-vision application using image processing techniques involves five basic processes such as image acquisition, pre- processing, segmentation, object detection, and classification. This survey highlights these approaches in the context of rice grading practices and summarizes their relevancy to precision farming. The below mentioned table summarizes research that has been reported on methods developed using image processing techniques and provides an assessment of techniques used in terms of accuracy for practical usability in an agricultural context.

Year and Ref no	Technique	Data set	Extracted features	Colour spaces	Training	Average Accuracy
(2013), [36]	Filter, dilation and erosion	9 rice varieties	Morphological, colour and texture	RGB	Multi-Layer Perceptron	92%
(2013), [37]	Threshold	Mixed rice samples	Morphological, colour and texture	Gray scale	Nil	75%
(2013), [38]	Maximum variance method	4 to 5 samples	Chalky volume, shape, purity	RGB	Multi-Class SVM	86%
(2014), [39]	Image segmentation	4 paddy varieties	Texture, shape, and texture-n- shape	RGB	Levenberg Marquardt	86%
(2014), [40]	Image segmentation	3 rice varieties	Morphological	RGB	Nil	98%
(2014), [41]	Image segmentation	5 rice varieties	Morphological, shape	RGB, HSV and YCbC	Multi-Layer Perceptron	98%
(2015), [42]	Color cooccurrence matrices	15 paddy varieties	Color, Texture	HIS	Multilayer feedforward artificial neural network	92.33%
(2015), [43]	Image segmentation	3 rice varieties	Geometric	RGB	Nil	93%
(2016), [44]	Image Processing	Seville dataset and Ipsala dataset	Mean, Variance, Homogeneity, Contrast, Dissimilarity and Entropy	RGB	SVM	98%
(2016), [45]	Image Processing	115 rice leaf images.	Color, shape	YCbCr	Minimum Distance Classifier and k-Nearest Neighbor classifier.	89.23
(2017), [46]	Internet of things (IOT)	5 crop images.	Crop monitoring easy and efficient to enhance the productivity of the crop	Nil	Wireless sensor networks and micro controller	85.69%
(2017), [47]	Image processing	22 Rice image samples.	Area, Major axis Length, Minor axis Length, Length and width	RGB, HSV	Nil	96%
(2018), [48]	Artificial intelligence techniques	Five most produced grains	Morphological and color shape	RGB	Deep learning network	97.75%

1.3 COMPARATIVE STUDY OF EXISTING AND PROPOSED SYSTEM

CONCLUSION

This study focused on analyzing visual features of rice seed images such as color, shape, texture. It can be applied different classification models using these types of features. This research indicated that image processing techniques can combine with classification techniques such as MLP, SVM, and Decision tree and Bayesian network to identify rice seeds in mixed samples. All the methods using simple features proved the best capability and accuracy of classification; on average it achieved 90. 27%, 90.54% respectively. The performance can be improved by using other types of features and further investigation of classification models. It attempted to highlight the basic problems of rice industry to analyse the quality of rice grains and also highlighted the related work of researchers to eradicate the problem related to quality analysis of rice grains. This system gives 90.5 % accuracy, and the features tested are size and shape. In future it will be increase in accuracy and the feature may include the chalkiness of rice with different algorithms.

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