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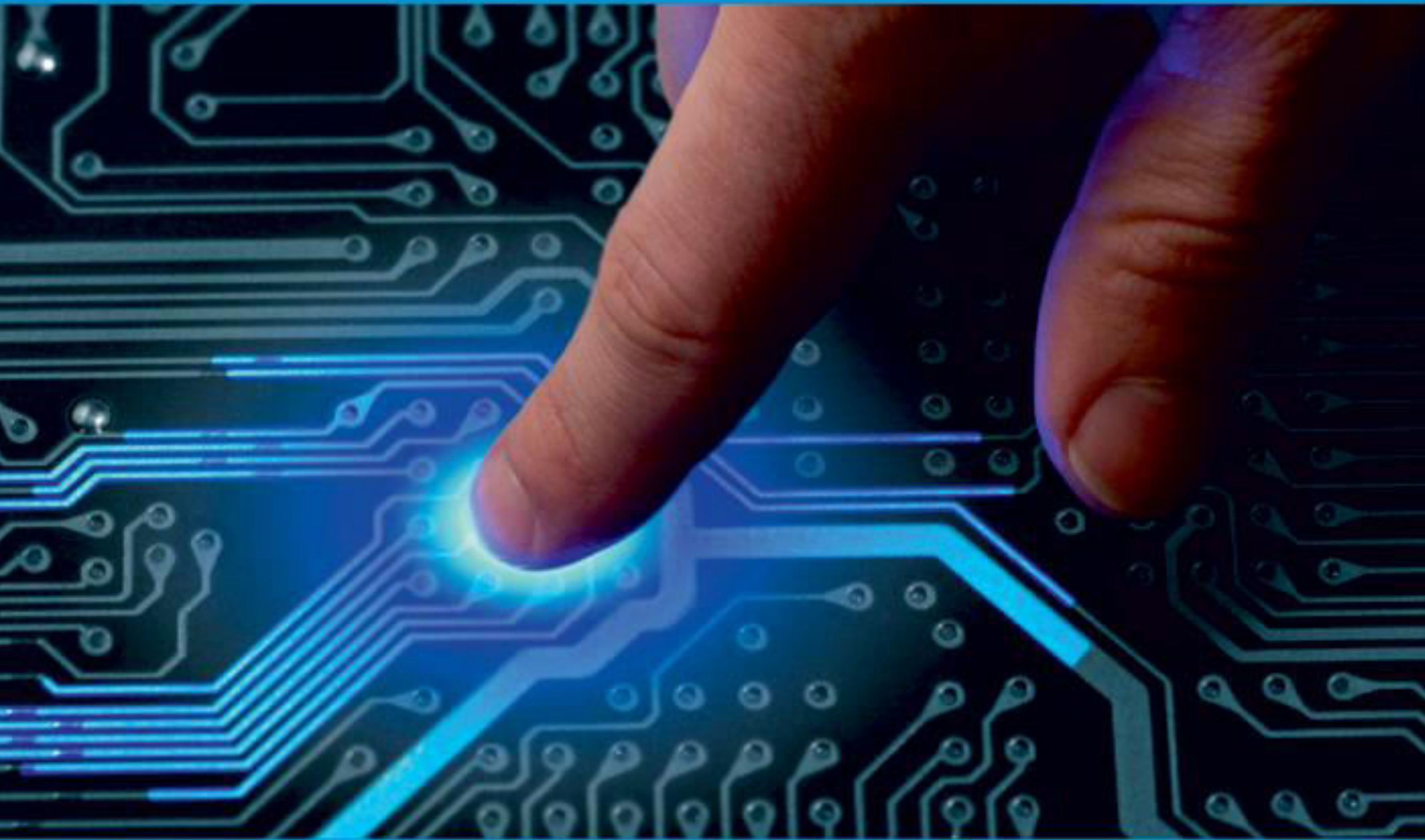

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Rice Kernels Defect Detection and Muti Classification Using Yolo

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ABSTRACT: Rice is the staple food for people in many parts of the world, and its quality is related to food health as well as the economic interests of agricultural dealers, who make offer to the farmers according to the quality of the collected rice kernels. In the process of rice trading, the purchaser needs to evaluate the quality of the rice and then determine the purchase price. Historically, this job was largely relied on manual work. It requires professionals to manually pick and weigh different types of rice from randomly selected samples. Rice grades are assigned by calculating the weight ratio of defective rice in the overall samples. Manual rice quality estimation is quite tedious, as it requires experienced inspectors to identify and pick up the kernels with various defects one by one and weigh them carefully. To solve these problems which existing literature are not able to handle and replace traditional manual tasks with automated process, this project proposes a novel system for automatic quality estimation of rice kernels. In this project, the detection of the main types of kernel flaws for new rice, including Partial-Chalky kernels (PC), Mass-Chalky kernels (MC), Yellow-Colored kernels (YC), Spotted kernels (SP), and Broken kernels (BR). To detect and classify the rice kernels with various types of defects, this project employed a multi-stage classification approach to perform multi-classification of rice flaws, such that a single kernel with dual defects can be identified and the classified using Yolo5.

KEYWORDS: Attribute-Based Encryption, re-encrypt, implementation, encrypted data.

I. INTRODUCTION

Rice is our most important cultivated plant, feeding more people than any other crop. It is a n annual or short-lived perennial grass species native to Asia. Its domestication (i.e. cultivation and modification by humans) started 8 to 13 thousand years ago. Much of the world, especially Asia, has rice as its primary food source and rice production is critical for feeding the world. Rice requires warm, moist conditions for growth and is grown world-wide in tropical and warm temperate habitats. As is the case in all ‘cereal grains’ the ‘cereal’— the portion eaten — is a one-seeded fruit with the cells of a very thin fruit fused to those of the seed coat.

Rice processing and uses

The harvested rice kernel, known as paddy, or rough, rice, is enclosed by the hull, or husk. Milling usually removes both the hull and bran layers of the kernel, and a coating of glucose and talc is sometimes applied to give the kernel a glossy finish. Rice that is processed to remove only the husks, called brown rice, contains about 8 percent protein and small amounts of fats and is a source of thiamine, niacin, riboflavin, iron, and calcium. Rice that is milled to remove the bran as well is called white rice and is greatly diminished in nutrients. When white rice forms a major portion of the diet, there is a risk of beriberi, a disease resulting from a deficiency of thiamine and minerals. Parboiled white rice is specially processed before milling to retain most of the nutrients, and enriched rice has iron and B vitamins added to it.

II. EXISTING SYSTEM

Manual rice quality estimation is quite tedious, as it requires experienced inspectors to identify and pick up the kernels with various defects one by one.

DISADVANTAGES

- Traditional rice grain classification is costly, time-consuming and requires sophisticated human expertise.
- The accuracy of machine learning algorithms is limited by the quality of the input images. If the images are blurry or low-resolution, it can be more difficult for the algorithm to accurately detect defects.

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- Lab-based instruments are costly
- Existing method is slow, labor intensive.
- Computational overhead
- Low accuracy

III. PROPOSED SYSTEM

The proposed system of the project is to employ deep neural networks to classify the rice flaws. It is straight forward to use the object detection algorithm Yolov8, to detect rice kernels in the whole image in one step. While the obtained kernel location is accurate, the classification precision of some types of rice is not high, especially for the partial-chalky and mass-chalky kernels. Therefore, we separately process PC and MC kernels with another Yolo and a classification network based on grayscale images inspired by the project.This multi-stage work flow is divided into two branches. One is the detection of YC, SP, BR, and SO kernels. The other is the localization and classification of PC and MC kernels. The output of the two branches are fused together to form the final result. The whole process includes five stages: the detection of YC, SP, BR, and SO kernels, the detection of chalky kernels, segmentation, the classification of PC and MC kernels, and the fusion stage.

ADVANTAGES
The advantages of using a Convolutional Neural Network (CNN) algorithm for rice kernel defect detection are:

High Accuracy: CNNs have shown to have high accuracy in image classification tasks, and therefore, can accurately detect the defects in rice kernels. Compared to traditional image processing techniques, CNNs can capture complex patterns and features in the images, leading to better accuracy.

Robustness: CNNs are robust to variations in image orientation, scale, and lighting conditions. This is achieved through techniques such as pooling, convolution, and normalization layers. **Automated:** Once trained, the CNN algorithm can automatically detect the defects in rice kernels. This eliminates the need for manual inspection, which can be time-consuming and error-prone.

Flexibility: CNNs can be adapted to different types of rice kernels and defect types. The same model can be used for different types of rice kernels with minimal modification.

Cost-effective: By automating the detection of defects, the need for manual inspection is reduced, leading to cost savings for rice processing companies.
Overall, CNN algorithms provide an efficient and accurate way to detect defects in rice kernels, helping to ensure the quality and safety of rice products.

- Rice Defect Classification and Localization can be carried out automatically and tedious manual works can be replaced.
- Classification of defected rice grains with high accuracy.
- Cost-effective, and user-friendly tool for the rapid assessment of the rice quality traits associated with consumer perception.
- This project will help the industry to certify rice without defects

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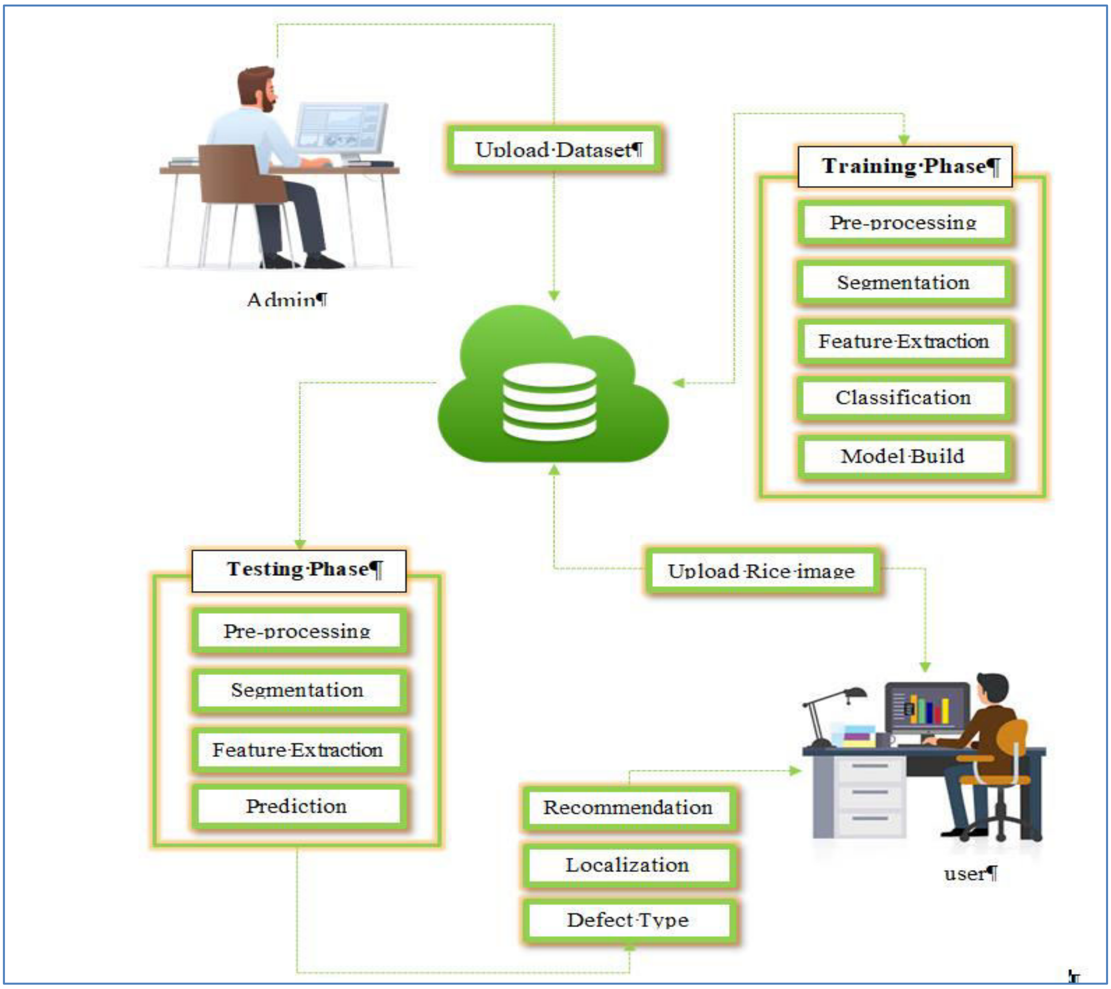
IV. SYSTEM ARCHITECTURE



MODULE

- Rice Defect Monitor Dashboard
- Rice Defect Classifier
- Rice Defect Predictor
- End User Control Panel
- Quality Analyzer

MODULE DESCRIPTION

Modules Description

Rice Defect Monitor Dashboard

The Rice Kernel Defect Detection web dashboard is an interactive web-based application that allows users to perform rice kernel defect detection using the YOLOv8 object detection algorithm and a convolutional neural network (CNN) from a web browser. The dashboard provides a user-friendly interface that enables users to upload images of rice kernels, view the detected rice kernels, and analyse the classification results for each kernel. The interface displays a graphical representation of the uploaded image with the detected rice kernels highlighted and classified according to their defect type. The dashboard also includes interactive tools that allow users to adjust the detection and classification parameters, such as the confidence threshold and the number of detection boxes. These tools provide users with greater control over the detection and classification process, allowing them to fine-tune the parameters to achieve optimal results.

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Rice Defect Classifier

The Classification module for Rice Kernel Defect Detection is a machine learning model that is designed to accurately classify different types of defects in rice kernels. It is built using a Convolutional Neural Network (CNN) architecture that has been trained on a large dataset of high-resolution images of rice kernels with different types of defects, such as broken, cracked, discoloured, and insect-damaged kernels.

Dataset Annotation

The Dataset Annotation module provides a web user interface (WUI) that allows users to load images and manually annotate the images with bounding boxes around the rice kernels and their respective defect labels. The WUI provides tools for adjusting the size and position of the bounding boxes as well as selecting the appropriate defect label from a predefined set of categories.

Pre-processing

The Dataset Pre-processing module provides a set of image processing functions that prepare the images by resizing, cropping, and normalizing them. The functions also apply various image augmentation techniques such as rotation, flipping, and color jittering to increase the variability of the dataset, which helps improve the generalization ability of the models**2.3.**

Feature Extraction

The Feature Extraction module for Rice Kernel Defect Detection is a machine learning model that is designed to extract features from pre-processed rice kernel images using convolutional neural networks (CNNs). This module is typically used in conjunction with a classification model, which uses these extracted features to classify rice kernels as either defective or non-defective. The Feature Extraction module works by analysing the features extracted from the pre-processed images of rice kernels.

Rice Defect Predictor

The Prediction module for Rice Kernel Defect Detection using YOLOv8 and CNN is a deep learning model that is designed to predict the probability of a rice kernel being defective or non-defective, as well as the specific type of defect**.**

End User Control Panel

The End User module for Rice Kernel Defect Detection using YOLOv8 and CNN is a user-friendly application that allows end-users to input rice kernel images and obtain real-time results on the probability of defects and the specific type of defect. The end user can input images through a user-friendly interface, which may be a web-based dashboard, mobile application, or desktop application. The output is then displayed in an easily interpretable format.

Quality Analyzer

The Quality Analyzer module for Rice Kernel Defect Detection using YOLOv8 and CNN is a module that analyzes the overall quality of a batch of rice based on the number and types of defects detected in the kernels. The module then computes various quality metrics, such as the percentage of defective kernels and the distribution of defect types, to provide an overall assessment of the quality of the rice batch.

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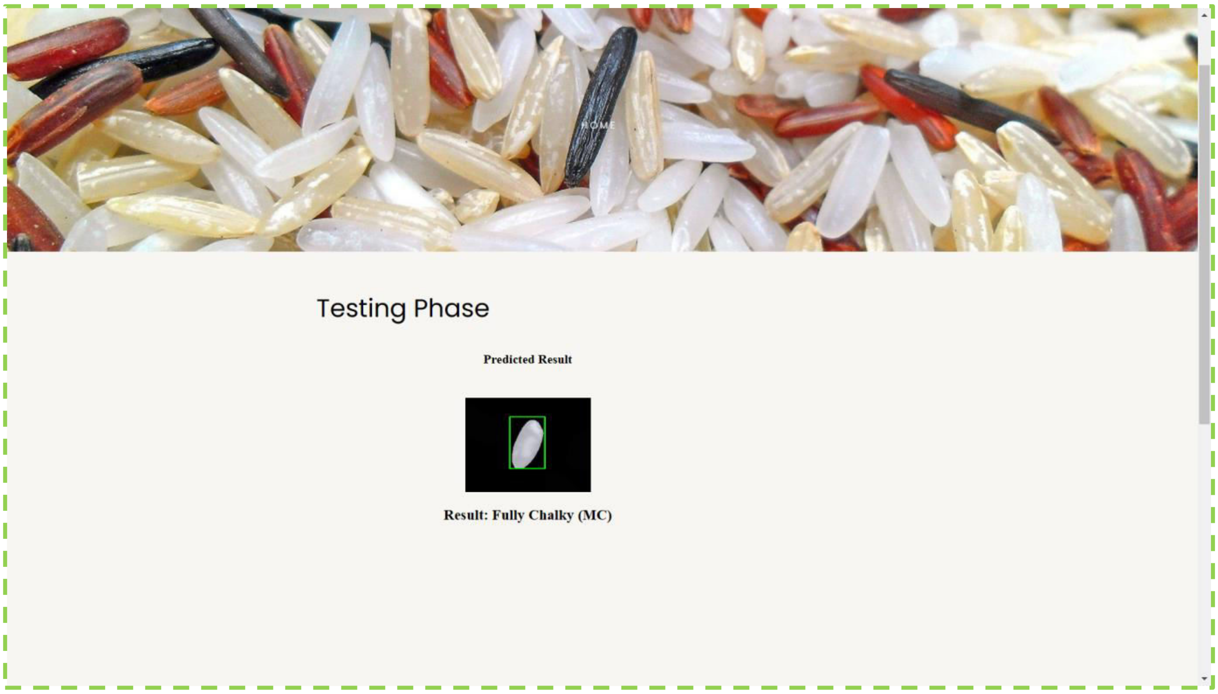
V. RESULT

CONCLUSION

In conclusion, the use of YOLOv8 and CNN models for rice kernel defect detection has significantly improved the efficiency and accuracy of the quality control process in rice production facilities. The YOLOv8 model allows for fast and precise object detection and segmentation of rice kernels in images, while the CNN model provides accurate classification of the type of defects present. Combined, these models provide a robust and accurate solution for detecting and classifying various types of defects in rice kernels, improving the overall quality of rice production. The various modules, including dataset annotation, preprocessing, feature extraction, classification, and segmentation, work together to provide an end-to-end solution for rice kernel defect detection. Additionally, the end-user and quality analyzer modules provide accessible and user-friendly interfaces for both operators and managers to access the results and assess the overall quality of the rice batches.The use of YOLOv8 and CNN models for rice kernel defect detection is a valuable tool for rice production facilities to improve their quality control processes, reduce waste, and increase efficiency in their production processes.



VI. FUTURE ENHANCEMENT

There are several potential future directions for rice kernel defect detection using YOLOv8 and CNN models:

1. **Real-time defect detection:** The current implementation of the models is not designed for real-time processing. Further research can focus on optimizing the models for real-time processing to allow for more rapid and efficient quality control in rice production facilities.
2. **Automated defect removal:** Once defects have been detected and classified, there is the potential to develop automated systems to remove defective kernels from the batch. This would further reduce the need for manual inspection and improve the efficiency of the production process.
3. **Expanding to other grains:** The current models are designed specifically for rice kernel defect detection, but the same approach could be applied to other grains, such as wheat or barley. Adapting the models to other grains would require retraining on a new dataset, but the underlying principles and techniques would remain the same.
4. **Integration with other quality control systems:** The YOLOv8 and CNN models could be integrated with other quality control systems, such as moisture measurement, color sorting, or foreign object detection. Combining these systems would provide a more comprehensive approach to quality control and improve the overall efficiency of rice production facilities.

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