



# International Journal of Innovative Research in Computer and Communication Engineering

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)





# AI-Powered Vision System for Automated Quality Grading using Image Recognition

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**ABSTRACT:** The AI-powered vision system for automated quality grading of agricultural produce uses image recognition techniques to analyze fruits and vegetables based on their size, color, shape, and surface defects. The system captures images using a camera and processes them using image processing and machine learning algorithms. Features such as color uniformity, texture patterns, and defect detection are extracted and compared with trained models to classify produce into different quality grades. This automated grading system reduces manual effort, increases accuracy, and ensures consistent quality assessment in agricultural industries.

**KEYWORDS:** Artificial Intelligence, Image Processing, Machine Learning, Quality Grading, Computer Vision.

## I. INTRODUCTION

Quality grading of agricultural produce is an important process in food industries and markets. Traditionally, grading is done manually by human inspectors, which is time-consuming and prone to errors due to fatigue and subjective judgment. Automated grading systems provide consistent and accurate results while reducing labor costs.

Image processing and artificial intelligence techniques are widely used for analyzing visual characteristics of fruits and vegetables. Using cameras and machine learning algorithms, the system can detect defects such as bruises, spots, discoloration, and irregular shapes. These features help classify the produce into different quality grades.

## II. RELATED WORK

Several researchers have proposed automated grading systems using computer vision techniques. Early methods focused on basic image processing such as thresholding and edge detection. Later approaches introduced machine learning models to improve classification accuracy.

Recent studies use deep learning algorithms such as Convolutional Neural Networks (CNNs) for feature extraction and classification. These methods provide high accuracy in identifying defects and grading agricultural products. However, many systems require high computational resources and large datasets for training.

## III. METHODOLOGY

The proposed system consists of image acquisition, preprocessing, feature extraction, classification, and grading stages. First, images of agricultural produce are captured using a digital camera. Preprocessing techniques such as noise removal, resizing, and color normalization are applied to enhance image quality.

Feature extraction methods analyze color, shape, size, and texture of the produce. Machine learning algorithms such as Support Vector Machines (SVM) or Convolutional Neural Networks (CNN) are used to classify the produce into different quality categories. Finally, the graded results are displayed on the system interface.



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### IV. EXPERIMENTAL RESULTS

The experimental results demonstrate the effectiveness of the proposed AI-powered grading system. Images of different fruits and vegetables were tested under varying lighting conditions. The system successfully identified defects and classified produce into quality grades with high accuracy.

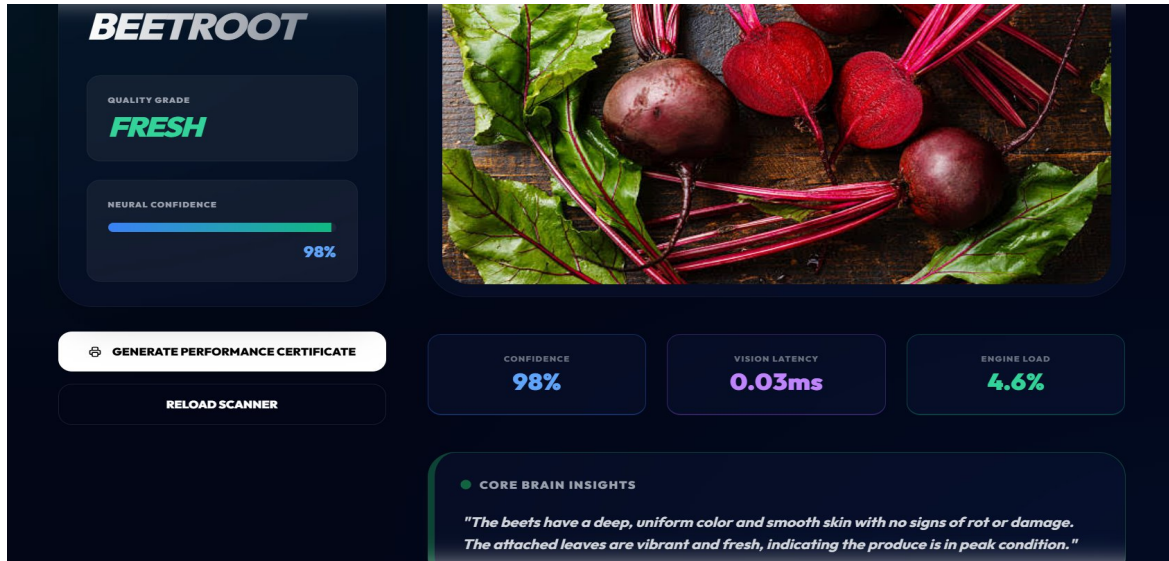


Fig: Fresh vegetables analysis

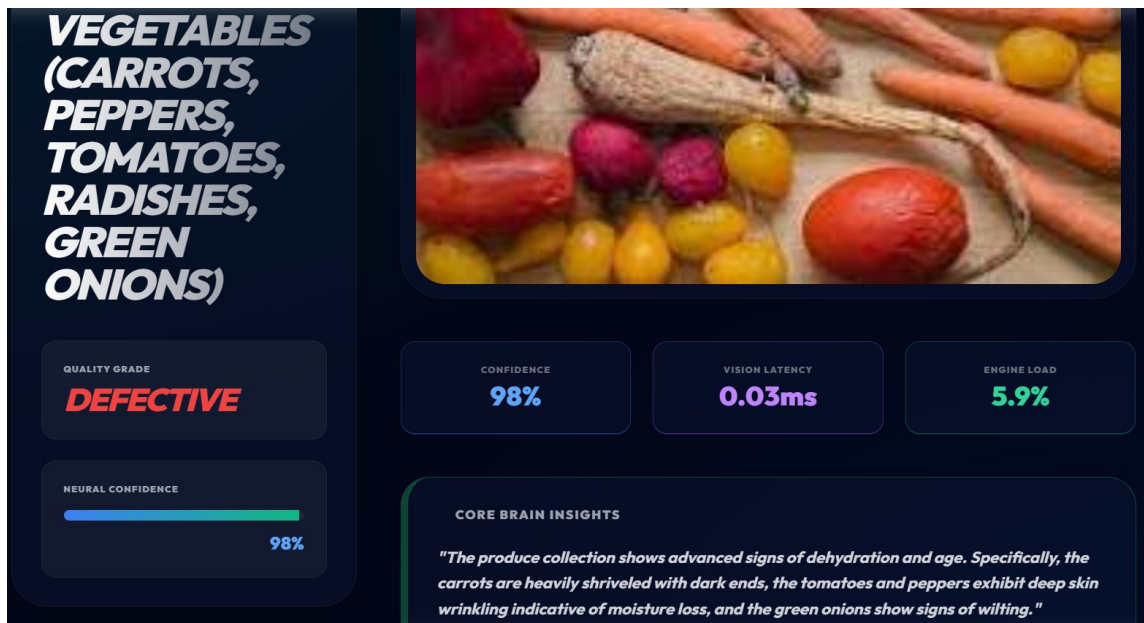


Fig: Spoiled vegetables analysis



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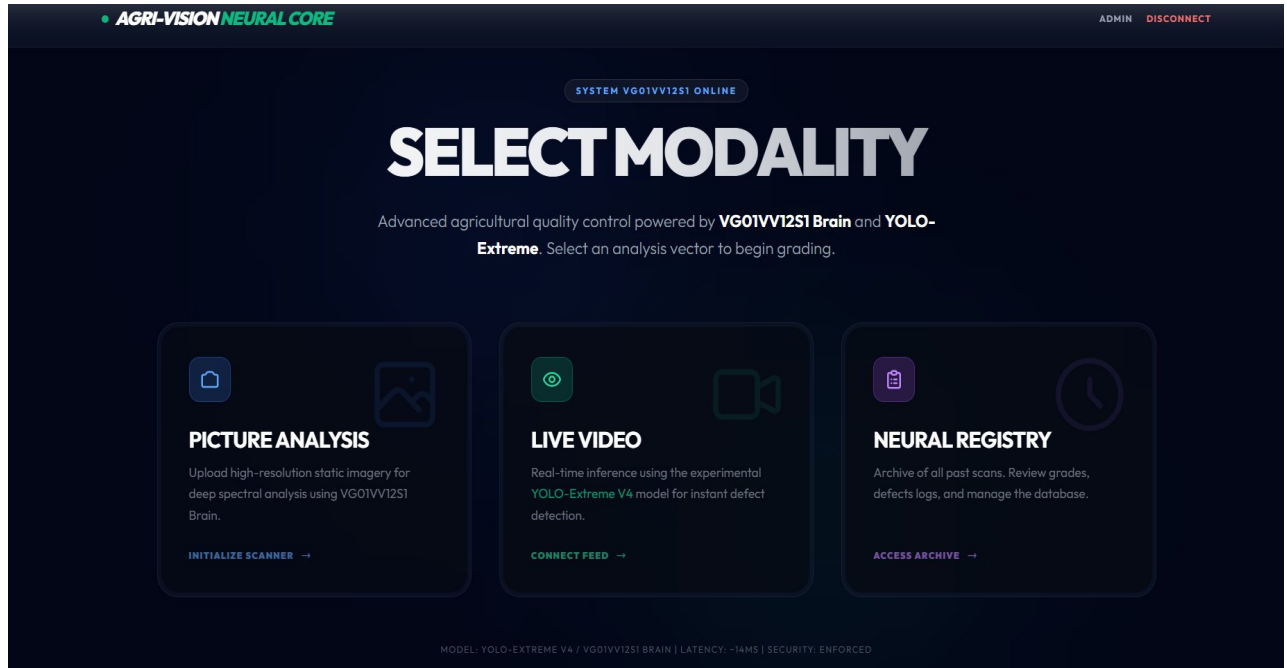


Fig: Frontend dashboard

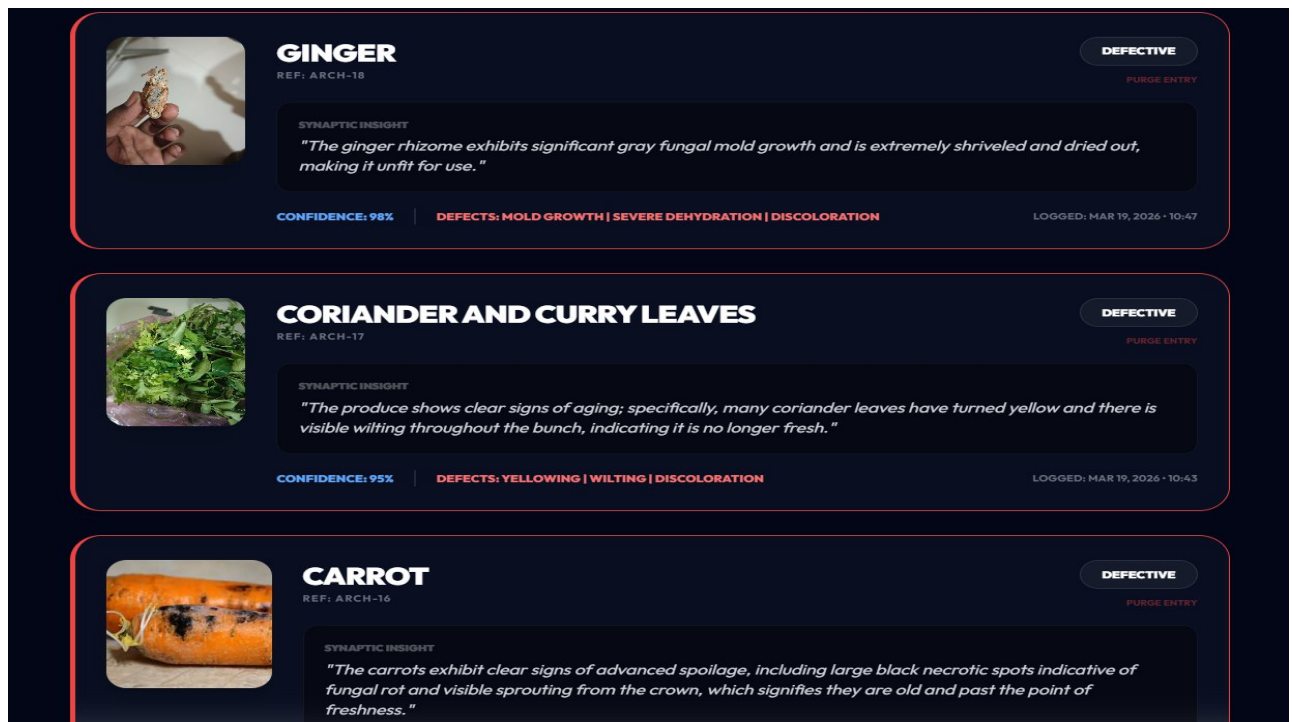


Fig: Analysis Data stored in Data Base



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### V. CONCLUSION

The AI-Powered Vision System Provides An Efficient Solution For Automated Quality Grading Of Agricultural Produce. The System Improves Grading Speed, Reduces Manual Effort, and Ensures Consistent Quality Evaluation. Future Enhancements May Include Integration With IoT Devices And Cloud-Based Monitoring Systems For Real-Time Analysis.

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