COMSATS University Islamabad – Abbottabad Campus

Department of Electrical & Computer Engineering

CEP Proposal: CSC354__Machine Learning

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Students:

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Detection of Spoiled Fruits in Agriculture:

Short Description:

This project aims to develop a machine learning model to detect spoiled fruits in images taken from orchards or packaging lines. The objective is to ensure quality control in the agricultural supply chain by automating the identification of spoiled produce.

CEP Summary

Brief Introduction to CEP:

The Comprehensive Engineering Project (CEP) is designed to provide students with hands-on experience in applying machine learning techniques to solve real-world problems. This project will focus on developing an image processing solution to detect spoiled fruits in the agricultural sector.

In this project, students will focus on the agricultural sector, specifically on developing an image processing solution to detect spoiled fruits. This involves using advanced machine learning methods, such as convolutional neural networks (CNNs), to analyze images and accurately identify spoiled produce. The project not only enhances students' technical skills but also addresses a significant problem in agriculture, promoting food safety and reducing waste. Through this CEP, students will gain experience in data collection, model development, and real-world deployment, preparing them for future roles in the field of machine learning and artificial intelligence

Motivation and Applications:

Quality control is crucial in the agricultural industry to maintain the health and safety of consumers and to reduce food waste. Manual inspection of fruits for spoilage is labor-intensive and prone to human error. Automating this process using machine learning can significantly enhance efficiency, accuracy, and scalability. Applications include sorting systems in packaging lines, quality control in orchards, and supply chain management.

Problem Statement and Proposed Solution:

Problem Statement: Spoiled fruits can negatively impact the quality of produce and lead to significant economic losses. There is a need for an automated system to accurately detect spoiled fruits in real-time from images.

Proposed Solution: This project proposes the development of a convolutional neural network (CNN)-based model to detect and classify spoiled fruits from images. The model will be trained on a dataset of images containing both fresh and spoiled fruits, and will be integrated into a real-time detection system for use in orchards and packaging lines.

Steps of the Project:

i) Data Collection and Preprocessing:

Collect a dataset of images of fresh and spoiled fruits from online repositories like Kaggle and custom-collected data from orchards.

Preprocess the images by resizing, normalizing, and augmenting to increase the dataset size and diversity.

ii) Model Development:

Choose an appropriate CNN architecture (e.g., ResNet, VGG) for image classification.

Train the model on the preprocessed dataset, tuning hyperparameters for optimal performance.

Validate the model using a separate validation dataset to ensure robustness and accuracy.

iii) Model Evaluation:

Evaluate the model's performance using metrics such as accuracy, precision, recall, and F1 score.

Perform cross-validation to ensure the model generalizes well to unseen data.

iii) Deployment:

Integrate the trained model into a real-time detection system using a suitable platform (e.g., TensorFlow Lite for mobile devices, edge computing for packaging lines).

Test the system in a real-world environment to validate its performance and reliability.

iv) Documentation and Reporting:

Document the entire process, including data collection methods, model architecture, training process, and evaluation results.

Prepare a final report and presentation to summarize the project outcomes and insights.

Objectives / Outcomes:

Develop a robust image classification model to detect spoiled fruits.

Automate the quality control process in agriculture to reduce manual labor and human error.

Enhance the efficiency and accuracy of fruit sorting and packaging systems.

Contribute to reducing food waste and improving food safety in the supply chain.

References:

Kaggle Datasets: Fruit Freshness Detection

TensorFlow Documentation: TensorFlow for Image Classification

Research Paper: "Deep Learning for Image-Based Fruit Classification and Detection" (DOI: 10.1016/j.compag.2018.12.004)