Utilizing Machine Learning to Create an Effective Tool for Managing Food Waste

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Need Statement

Households need a system which detects whether foods in **refrigerators** are **spoiling** to reduce **food waste**.

Objective

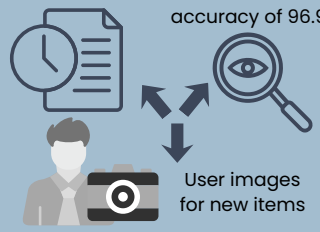
Identify food spoilage in refrigerators using **visual cues**, time elapsed, and user-provided images to display the state of foods in an application.

Abstract

1.6 million casualties due to food contamination and spoilage

Time-of-insertion

Visual Cues with an accuracy of 96.97%



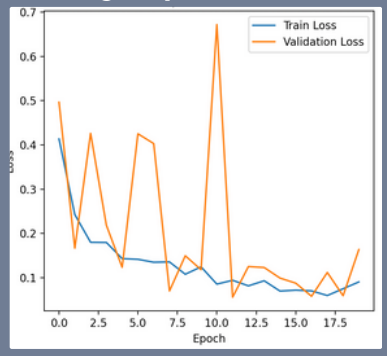
User images for new items

Refrigerator Monitoring Application

A refrigerator system, which detects the state of food using visual cues, time data, and user-provided images, is a practical solution to food waste with an accuracy of 96.97%.

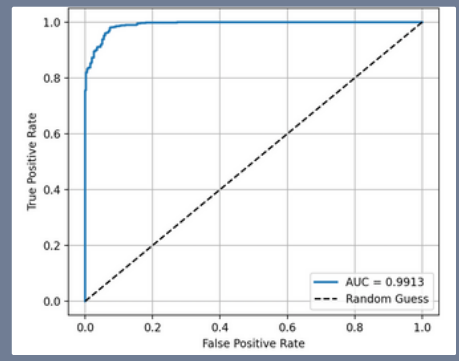
Data Analysis

Fig. 1: Epoch vs Loss



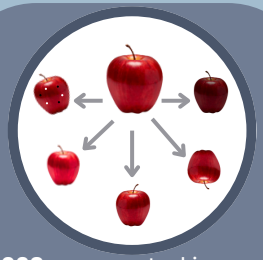
- Similarity between the final values of **0.0847** for training loss and **0.1594** for validation loss indicates limited overfitting.
- There are Multiple large spikes, once again suggesting a high learning rate.

Fig. 2: ROC Curve



- AUC (Area under the curve) value of **0.9913** shows that the model can achieve high true positive rates while maintaining low false positive rates.
- Indicates a **strong overall performance** of the model.

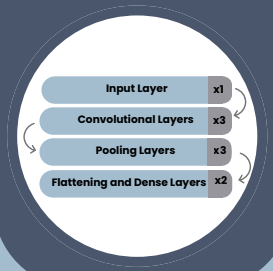
Methodology



5038 augmented images of 2 different classes of food
Train: **4039** images
Test: **999** images
Validation: **1782** images

Kaggle Dataset: Fruits fresh and rotten for classification

Input Size: 64 * 64
Filters: 32, 64, 128
Stride: 1
Filter Size: 3 * 3
Max Pooling: 2 * 2
1 Dropout Layer: 40% dropout



- Compare model prediction with the image's folder name
- Display misclassified images with predicted and true values

Coclusions and Next Steps

Highlights

- For training, more data with **fresh, uniquely-colored** apples, and data with **spoiled, wrinkled apples** is required.
- Given the number of images used to train the model for detecting spoilage in a single fruit, there is **potential** to **recognize unfamiliar foods** after augmenting the dataset.

Next Steps

Optimize the model for **real-time deployment** (motion blur) in environments which are **not ideal**