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Project Proposal

Identifying Freshness of Fruits and Vegetables

Goal/Objective:

Based on images of 6 different fruits and vegetables (12 total) to determine if the fruit is classified as fresh or rotten. Try out additional fruits and vegetables (if time permits).

Potential Challenges:

Figuring out which architecture is most effective, we will try out several different network architectures (including 2 network classifiers).

Determining how many classes exist for the data i.e. just determining the freshness of a given fruit or vegetable and what the fruit or vegetable is, potentially both.

Labeling/normalizing the data, figuring out how to work with large/different image sizes (standardizing the data).

Training time/runtime, and resource restrictions.

Approach/Techniques:

Load data and label each image with their respective fresh/rotten categories

Reformatting the images so they are a consistent size and compressing images possibly through dimension reduction or resolution reduction. Goal is to have faster training time while minimizing loss.

Use different neural network architectures, like LeNet-5, AlexNet, ResNet50, and others, and compare their performances to see the best, try out having 2 different networks for classifying freshness and type of fruit respectively, and combining both. Comparing performance metrics and seeing which is the best.

Tune hyperparameters and comparing different tuning methods including but not limited to finetuning and feature extraction (for pretrained models), different weight initialization methods, and batch size/learning rate experiments.

Check if the sequence of classifiers affects the performance of the networks, like if determining the fruit/vegetable then freshness has a better or worse performance compared to determining freshness then see what fruit/vegetable it is.

Performance should preferably be based on precision, as when dealing with rotten food, a false positive is much less consequential compared to a false negative. (i.e. avoid labeling rotten food as fresh). Compare using AUROC, PR Curve, etc.

Why precision? Ideally rotten fruit should not be eaten so veer on the side of caution.

Compare performance given our use case among architectures, with visuals and quantitative metrics, and see which architectures have strengths and weaknesses among different performance metrics.

Implementation details: hardware (type of compute GPU/TPU etc, cloud based, edge devices), software (framework, existing code to reuse), dataset

Possibly use NYU supercomputer, if not use GPU (Through google colab pro, Tesla K80 GPU or more powerful GPUs).

Use a personal desktop GPU as a backup if running into issues with colab pro. VSCode or Jupyter.

Reuse code from pre-existing architectures for image classification, preferably ones that perform well and are not outdated.

Demo planned:

A report showing results and comparing performance for the different types of architectures we tested for the fruits, making use of visual graphs to explain and compare performances. Also come up with potential explanations for the results we have.

References (if any):

- https://www.kaggle.com/datasets/muhriddinmuxiddinov/fruits-and-vegetables-dataset
- https://www.kaggle.com/datasets/shashwatwork/fruitnet-indian-fruits-dataset-with-quality
- Mukhiddinov, Mukhriddin, Azamjon Muminov, and Jinsoo Cho. 2022. "Improved Classification Approach for Fruits and Vegetables Freshness Based on Deep Learning" Sensors 22, no. 21: 8192. https://doi.org/10.3390/s22218192