Project Proposal

Banana Ripeness Through Image Classification

Domain Background

Bananas are one of the most consumed fruits around the world due to its accessibility, cost, and health benefits.

Bananas are also known for its fast ripening and most consumers can determine the ripeness level visually, but the people with color blindness have trouble determining when the banana is ripe enough to eat. The studies show that color blindness affects approximately 1 in 12 men and 1 in 200 women in the world [1].

There has been a lot of researches and applications of machine learning and deep learning in the food industry. One of the research papers uses various image classification architectures such as AlexNet, ResNet, GoogleNet, etc. to classify the different type of fruits from an image [2]. Another study resolves similar problem of classifying the ripeness level of the strawberry using CNN.[3]

Problem Statement

There are those that have color blindness which make them hard to determine whether the banana is ripe enough to eat. There are several devices and solutions offered for detection of the ripeness level, but these devices are mainly for agricultural applications and are very expensive. Also, a lot of the current solutions use a gas emission level of the banana to determine the ripeness level. This has a lot of limitation as it requires a physical device for ripeness detection.

Therefore, this project proposes image classification model that determines the ripeness level of the banana while being easily accessible by everyone.

The application will firstly determine whether banana is provided by the user and if the application detects the banana, it will predict and output the ripeness level to the user.

Dataset and Inputs

The dataset will be gathered through web scraping the Google images. Then, the labels will be created through visual inspection of the gathered images. The bananas will be classified into three categories: ripe, not ripe, overripe.

The total images collected from google is 338 where 129 images are ripe, 137 are not ripe, and 72 images are overripe.

The collected images do not have the same size or format. The image size will be 256x256 which is a common size used for training ImageNet architectures.

For the input, the users simply need to take a picture of their banana and upload the image to the web application.

Solution Statement

The implementation of the solution is through deep learning network. Firstly, we will use pre-trained architecture such as VGG-16 to determine whether the object uploaded is banana. Then, we will explore common image architecture such as CNN or even the pre-trained model to predict for the banana ripeness level.

The work will be done through use of Amazon Sage maker for both the training and deployment of the model.

Benchmark Model

There are no model available to us for direct benchmarking, as ripeness classification through image has not been done yet. Instead, for our benchmark model, we will implement a simple CNN with 3-layer and use the accuracy we get as our benchmark performance. The final model should be an improved model from the benchmark / baseline model.

Evaluation Metric

For this project, we will use accuracy as our main metric for evaluation. We expect the data to be evenly distributed, making accuracy a good metric overall.

Product Design

For development of the product, we will follow the steps in the following:

1. Collect data / images through web scraping and create labels for the bananas through visual inspections
2. Explore, preprocess, and split the dataset. Perform feature engineering through image augmentation.
3. Validate the pre-trained model for banana detection
4. Develop neural network architecture for banana ripeness classification and evaluate.
5. Deploy the model to a web app
6. Validate the product

References

[1] *Colour Blindness*. Colour Blind Awareness. (n.d.). https://www.colourblindawareness.org/colour-blindness/.

[2] Hameed, Khurram & Chai, Douglas & Rassau, Alexander. (2018). A comprehensive review of fruit and vegetable classification techniques. Image and Vision Computing. 80. 10.1016/j.imavis.2018.09.016.

[3] R. Thakur, G. Suryawanshi, H. Patel and J. Sangoi, "An Innovative Approach For Fruit Ripeness Classification," *2020 4th International Conference on Intelligent Computing and Control Systems (ICICCS)*, 2020, pp. 550-554, doi: 10.1109/ICICCS48265.2020.9121045.