

RotNot

**Preserve Freshness and
Fight Food Waste!**

Edmonton 5



The Problem

Food Waste

2.5 Billion tons of food is wasted globally

1.3 Billion tons of which is edible

Carbon Footprint : 3.3 Billion tons of CO2 eq. of GHG

Economic consequences of \$230 billion



A stylized illustration of a woman with dark skin and hair pulled back in a bun, wearing a red headband and a white and orange patterned top. She is smiling and holding a large, shallow brown bowl filled with various autumn leaves (orange, yellow, brown) and small white flowers. Several gold coins with red markings are falling from above and around her. The background is a solid brown.

Our Motivation

- relatable issue
 - invokes feeling of guilt
- environmental concerns
- lack of individual-scale solutions

Pre-existing models only perform binary classification into "fresh" and "rotten" categories



Our model can identify the "in-between" stage, adding more granularity to the solution.



A simple Google search of lifespan not enough! Multiple other factors affect freshness levels.



Easy to understand recommendations:
Produce is X% fresh ;
consume in Y days.



A novel solution.

Datasets Used

01 VegNet

Clean images but limited scope



02 Kaggle

Wide scope but messy images



Deleted Image Examples



Covers rotten part



Ambiguous



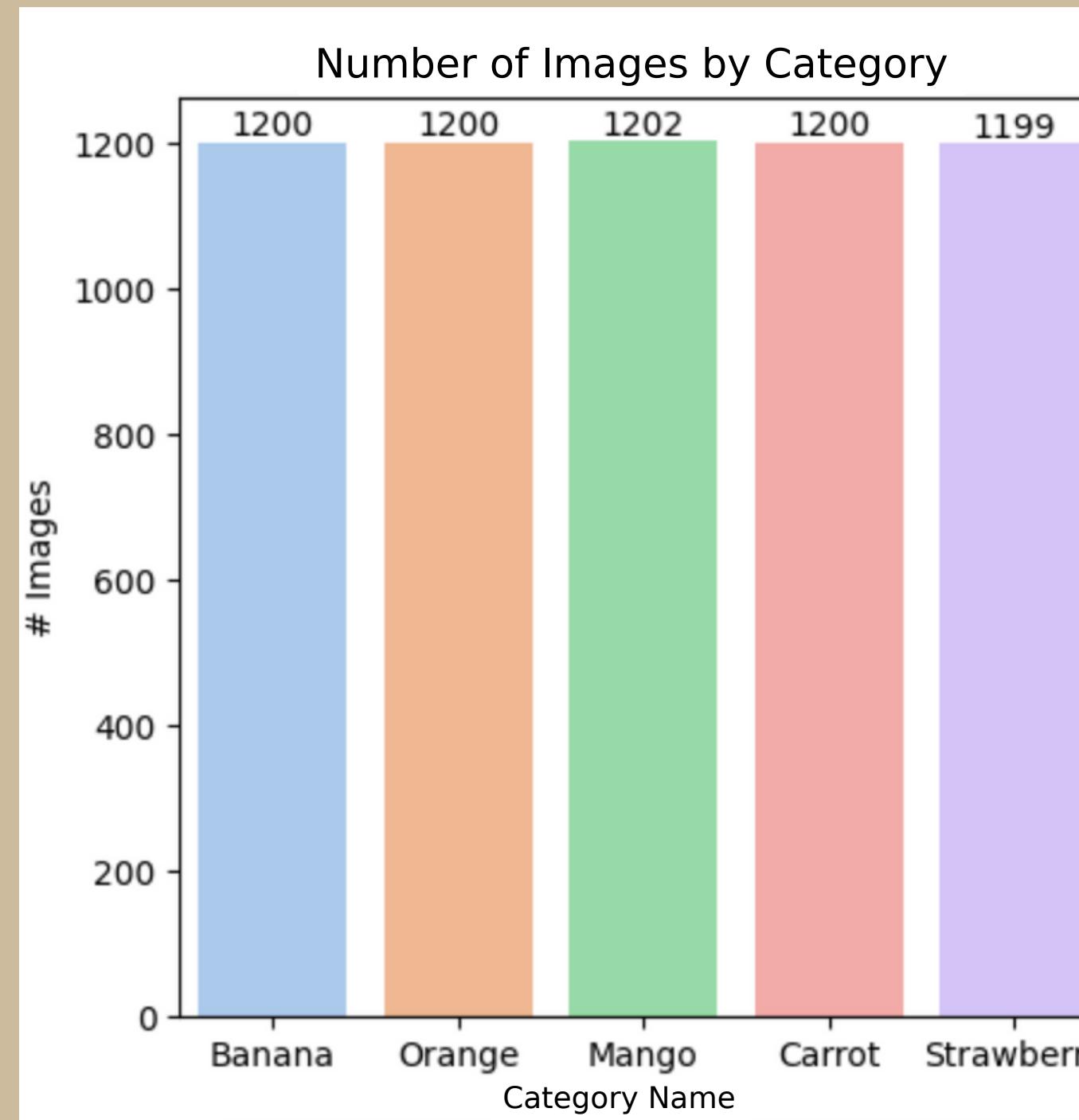
Fruit is too distorted



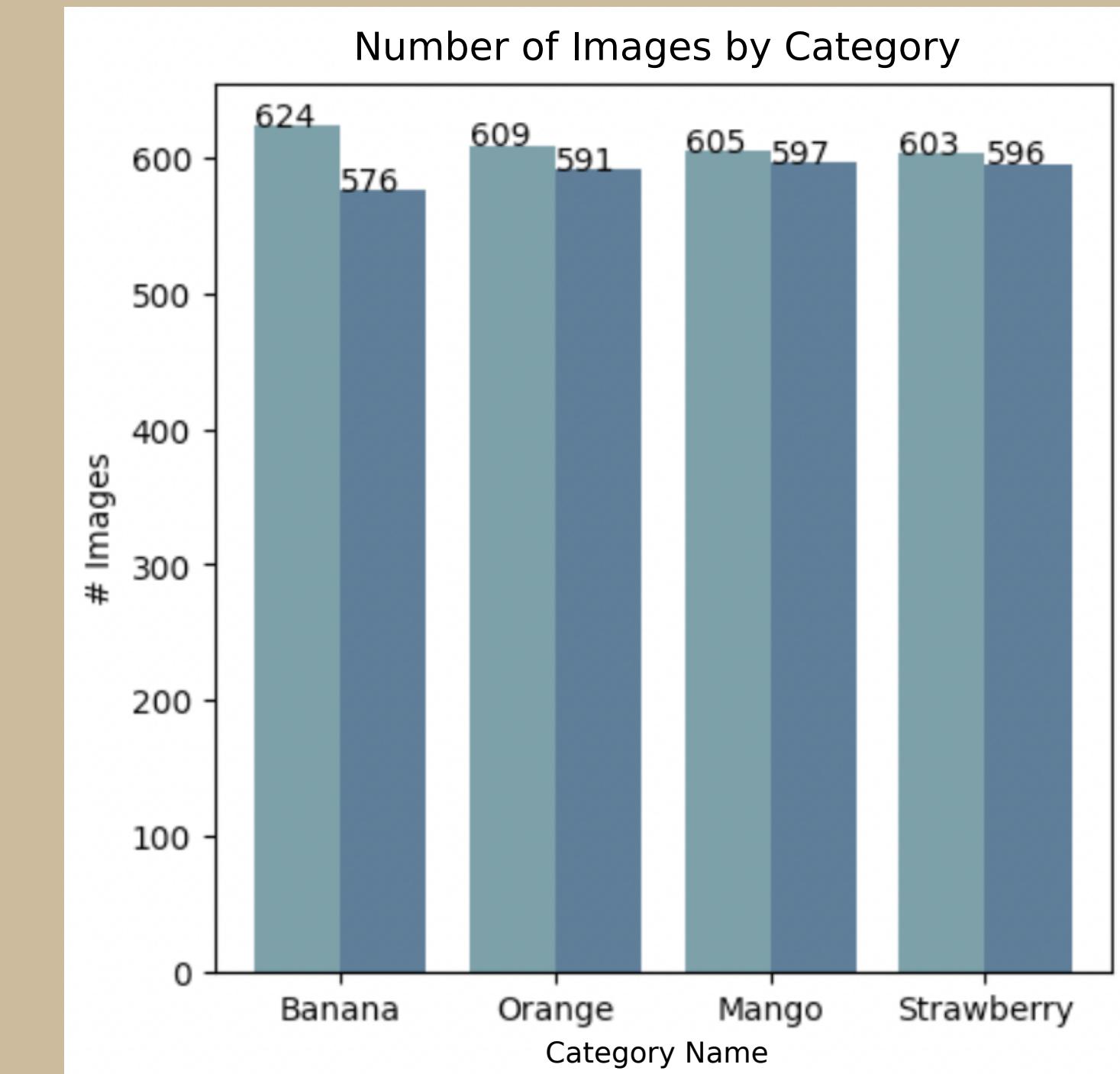
Not a real bell pepper



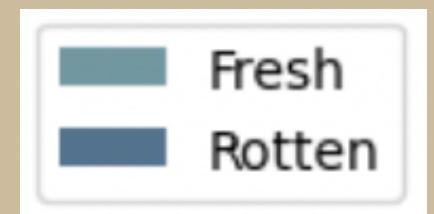
Original Data



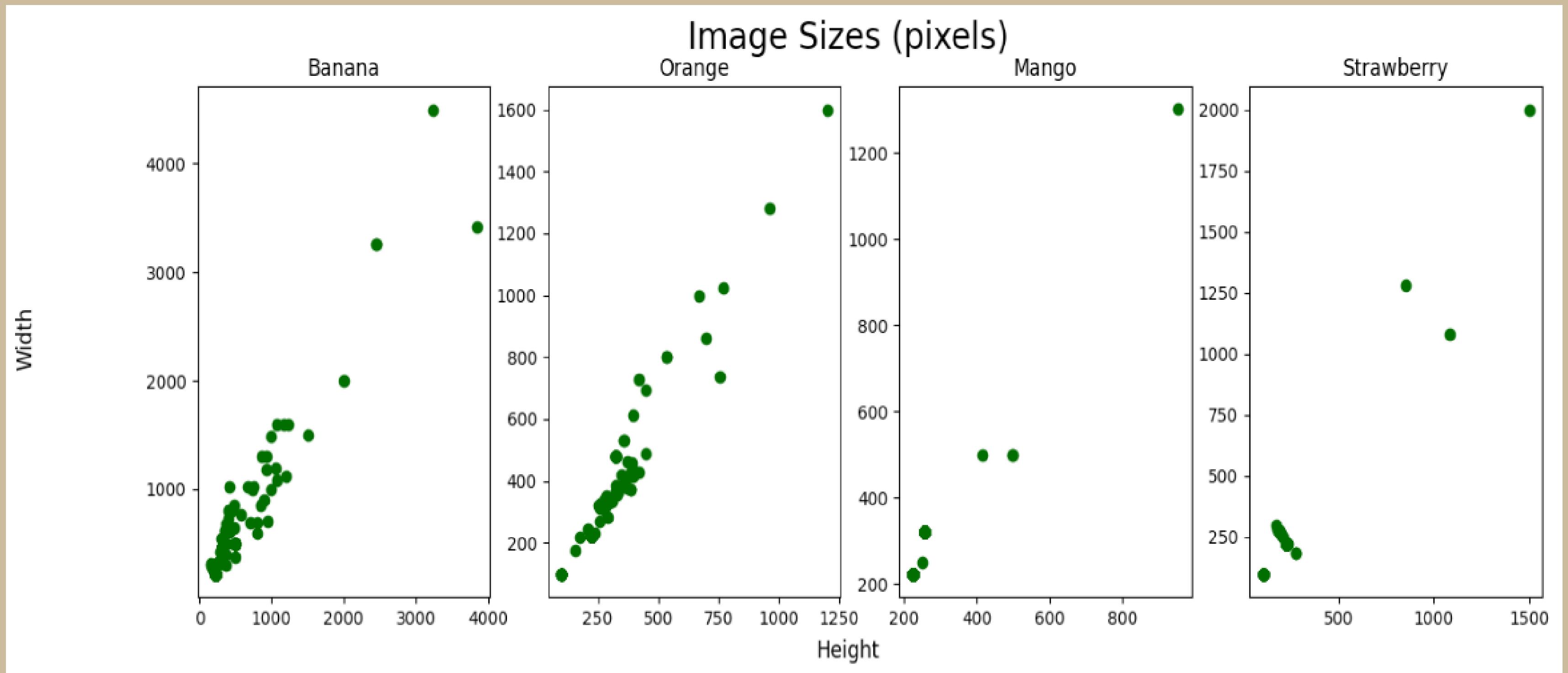
Number of images by category



Number of images by category, sorted into fresh or rotten

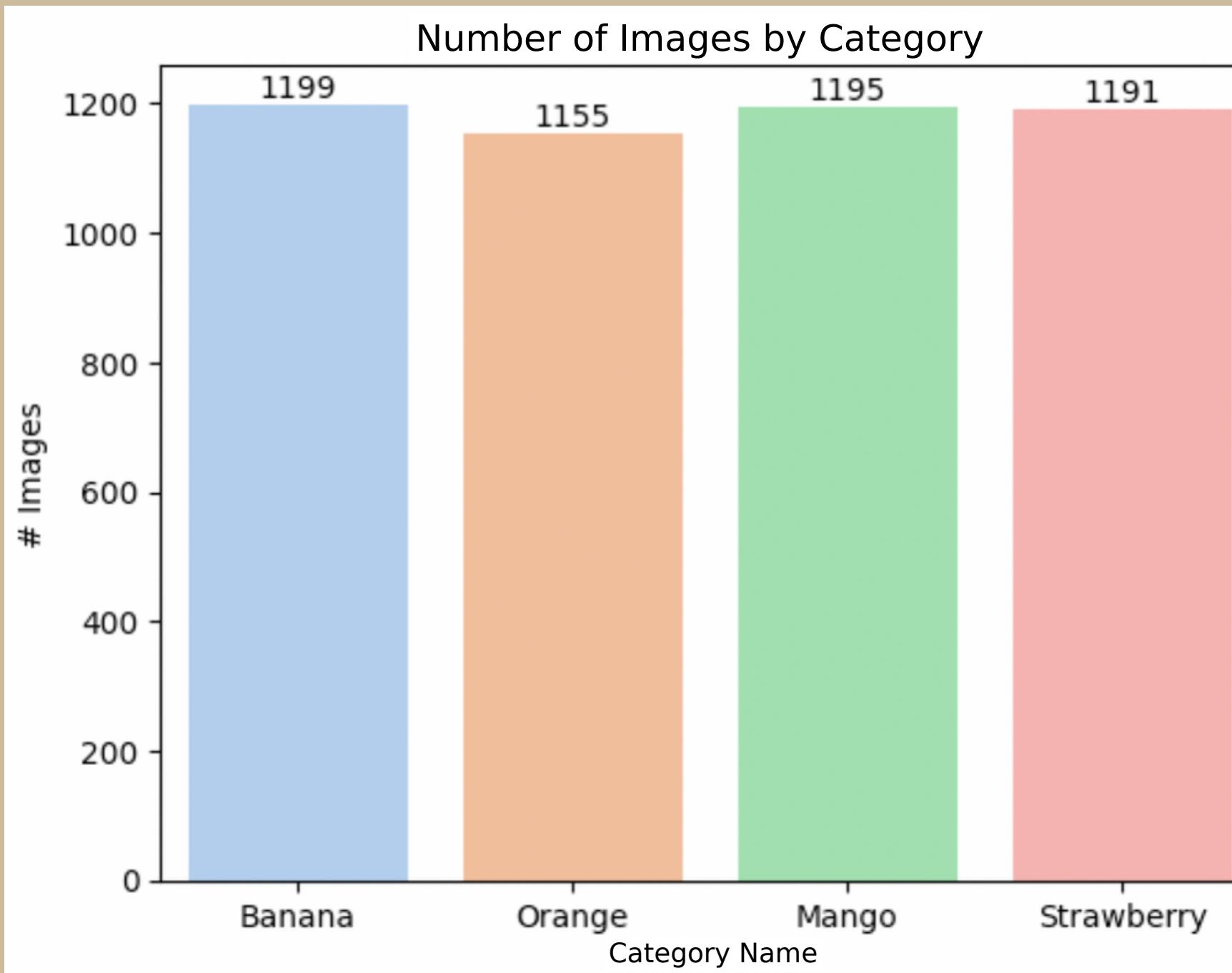


Original Data

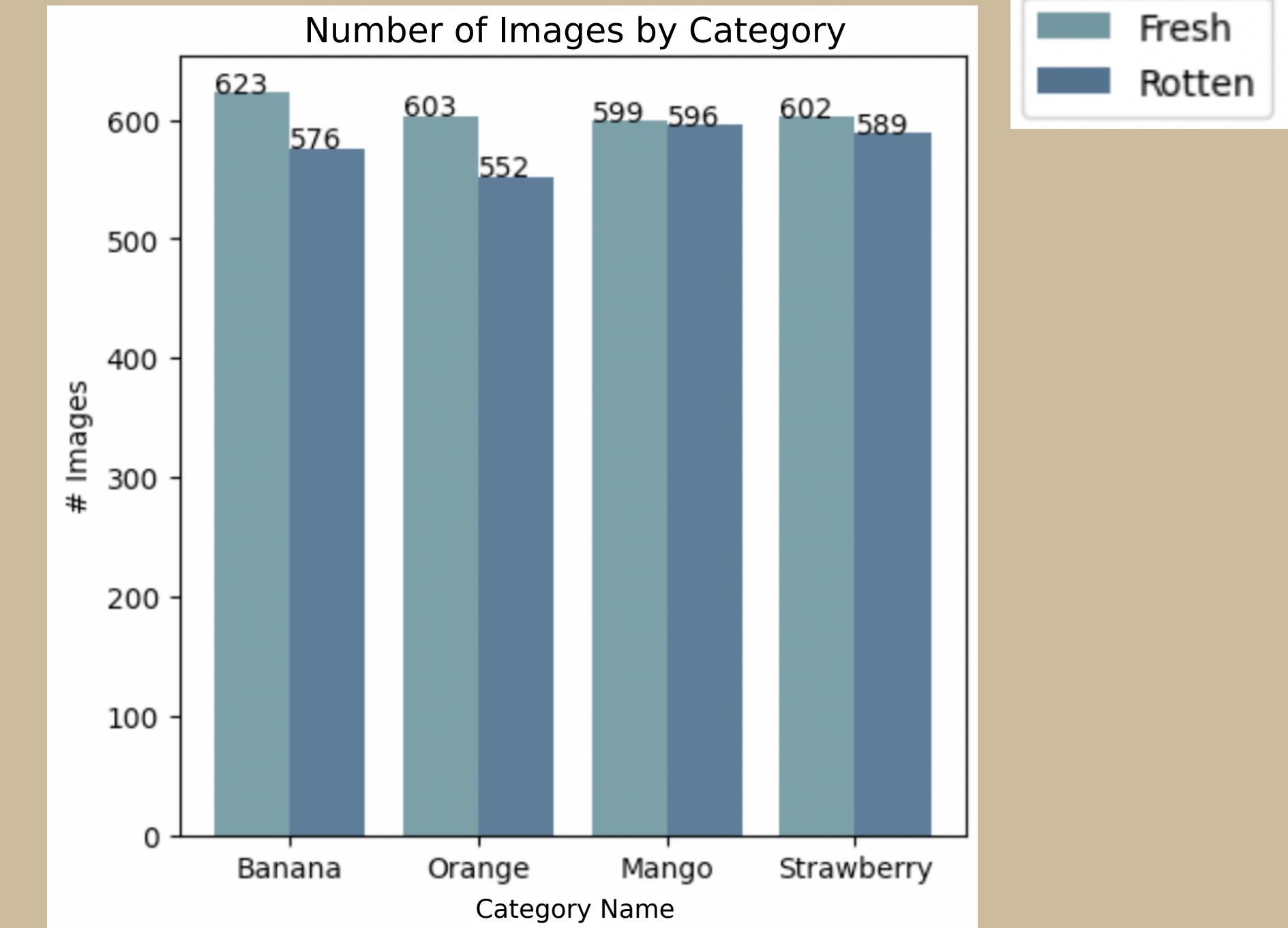


Distribution of image sizes before preprocessing

Data After Preprocessing

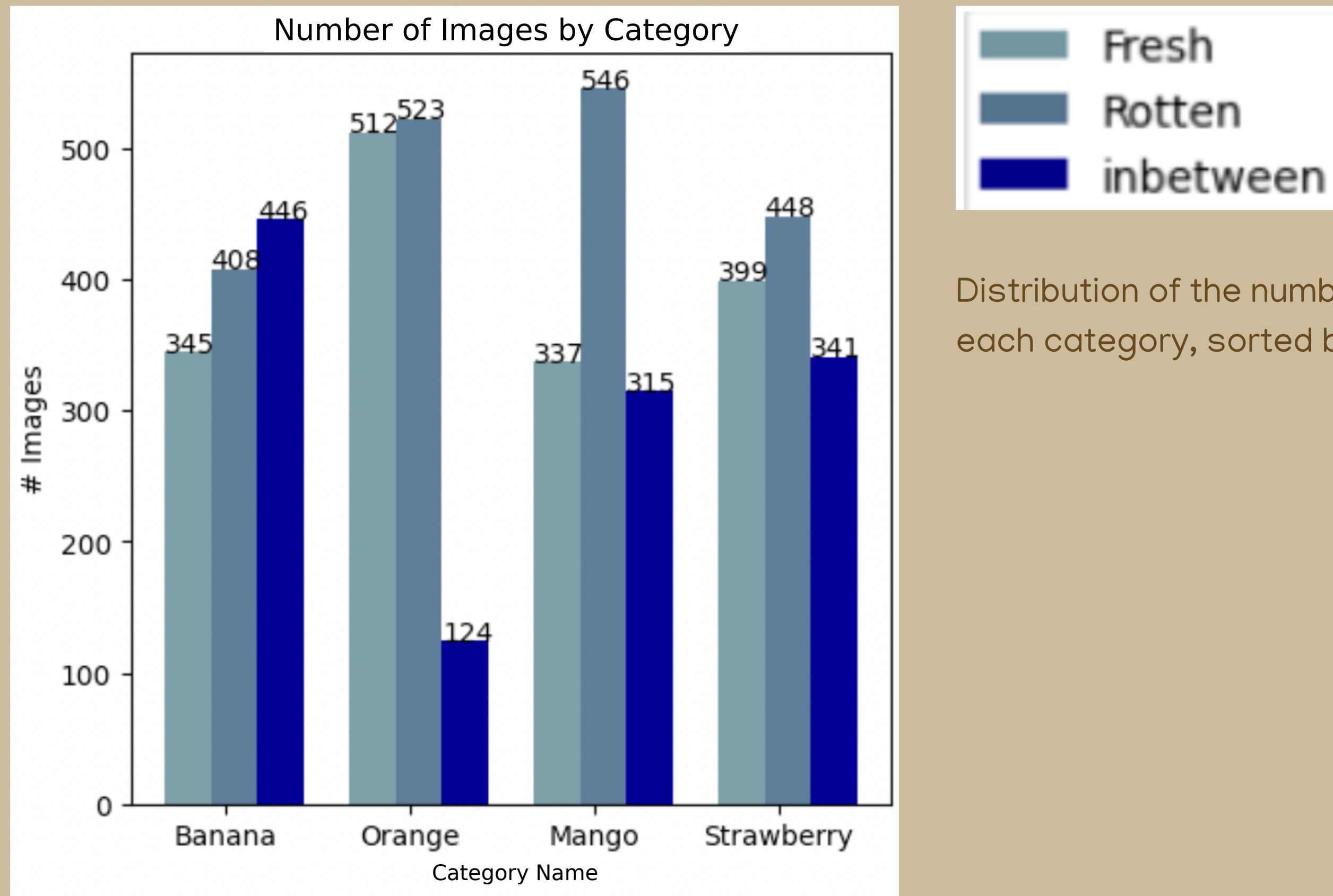


Number of images by category after preprocessing

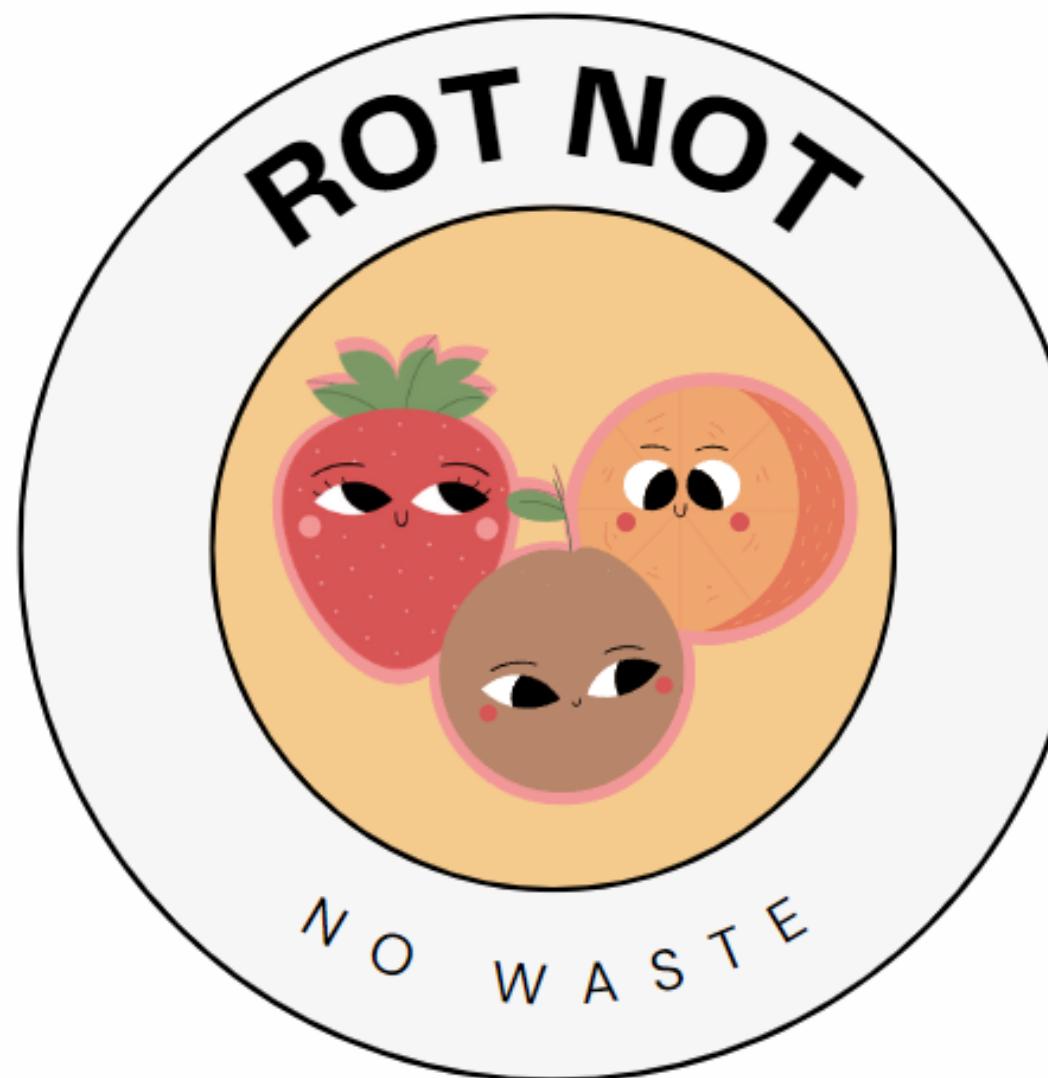


Number of images by category after preprocessing, sorted into fresh or rotten

Data Sorted into 3 Categories



OUR SOLUTION



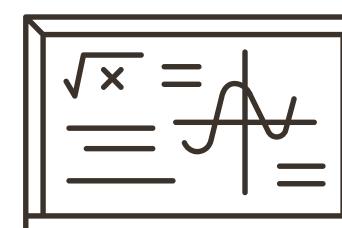
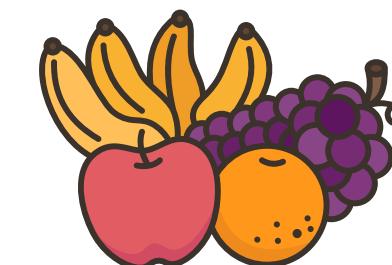
Rot Not

"An AI app that tackles global food waste by helping consumers detect produce freshness"



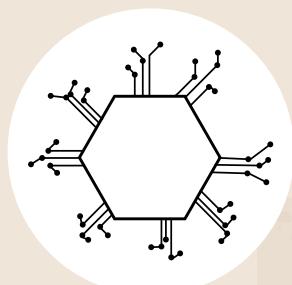
Uses CNN (Convolutional Neural Networks) for image classification

With image input, identifies type of produce as well as freshness level



Using a curated formula, predicts remaining lifespan of produce

Model and Some Results



ResNet Model

State-of-the-Art Image Classification CNN
model



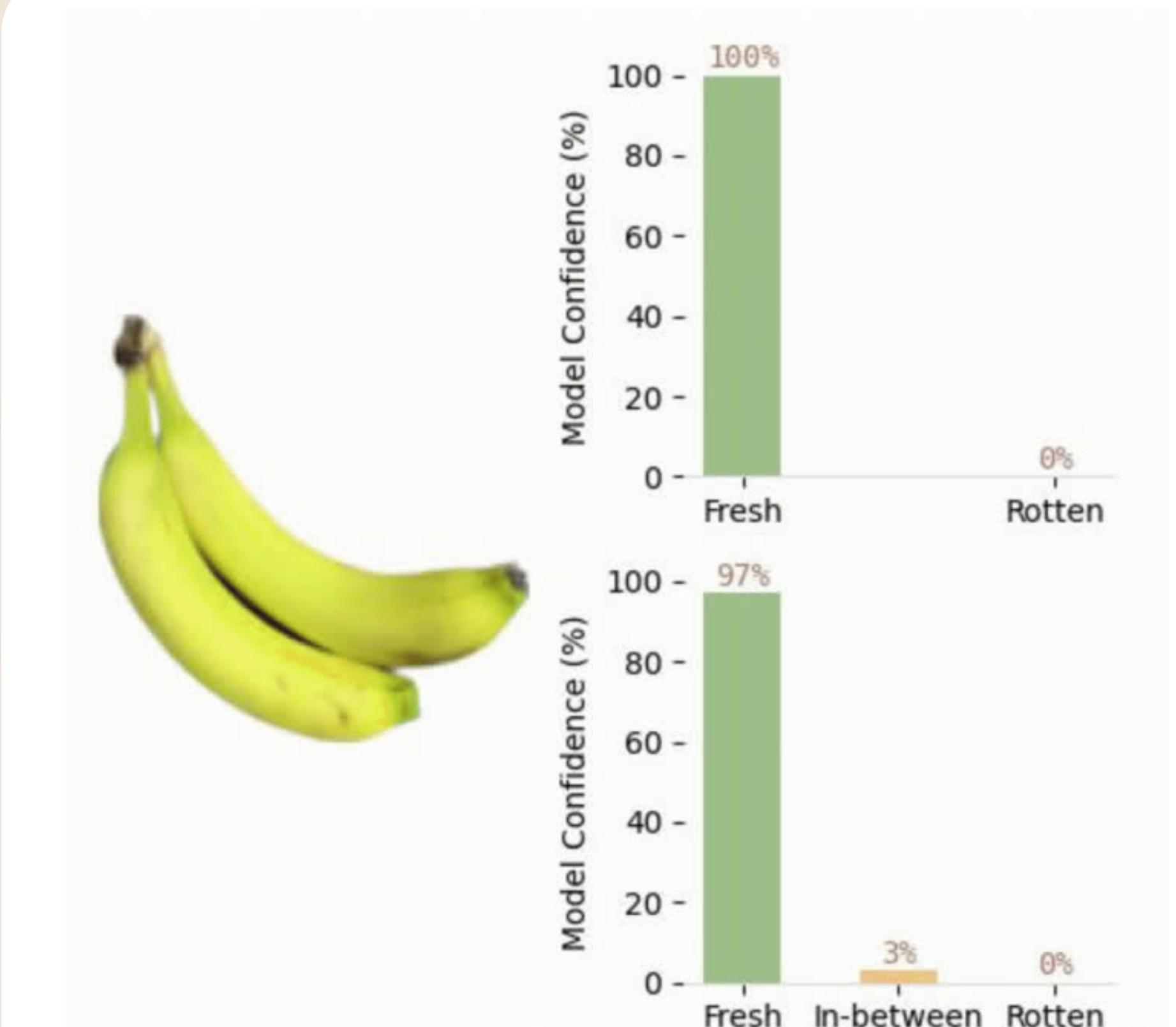
Two Heads for Output

One head outputs type of fruit
Another head outputs freshness level.



Better Interpolation

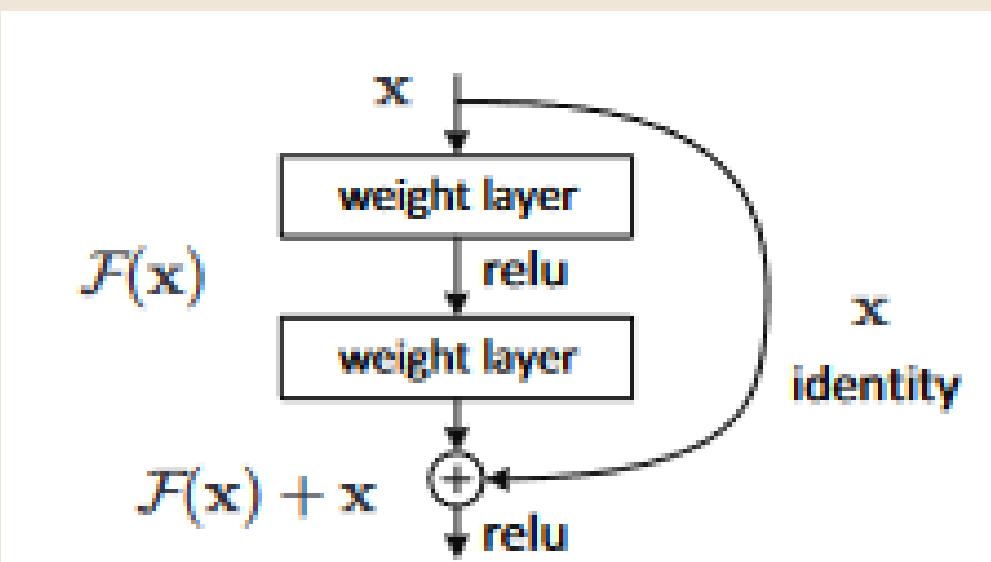
Using 3 classes results in improved interpolation



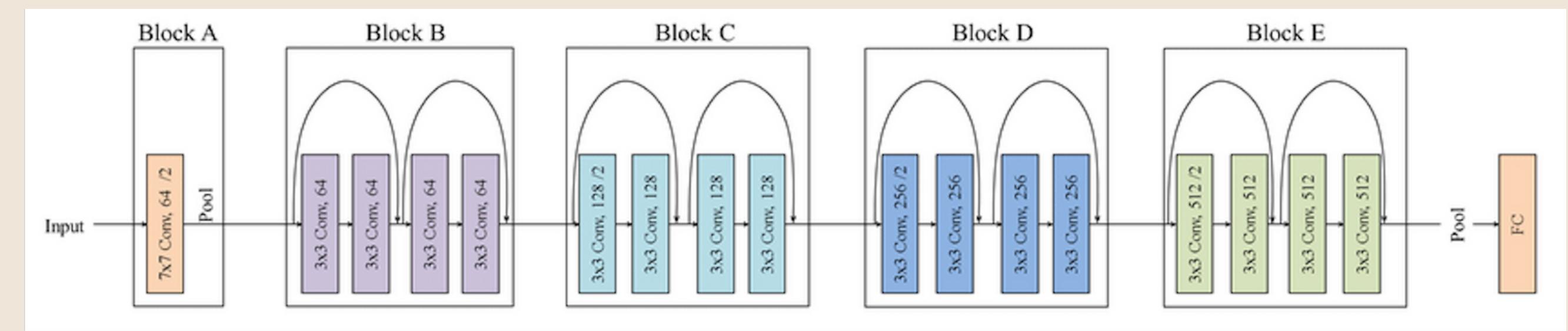
Freshness score from 2-label classifier (above) vs 3-label classifier (below) as the banana ages.

Residual Network (ResNet)

- ResNet is a highly effective CNN architecture for image classification tasks.
- It utilizes deep layers and innovative residual connections.
- Residual connections with skip connections enable smoother gradient flow and address the vanishing gradient problem.
- ResNet has been widely adopted due to its ability to learn intricate features and achieve high accuracy.
- Previous papers have successfully used ResNet for fruit freshness classification, making it a reliable choice for our project.



Residual Block



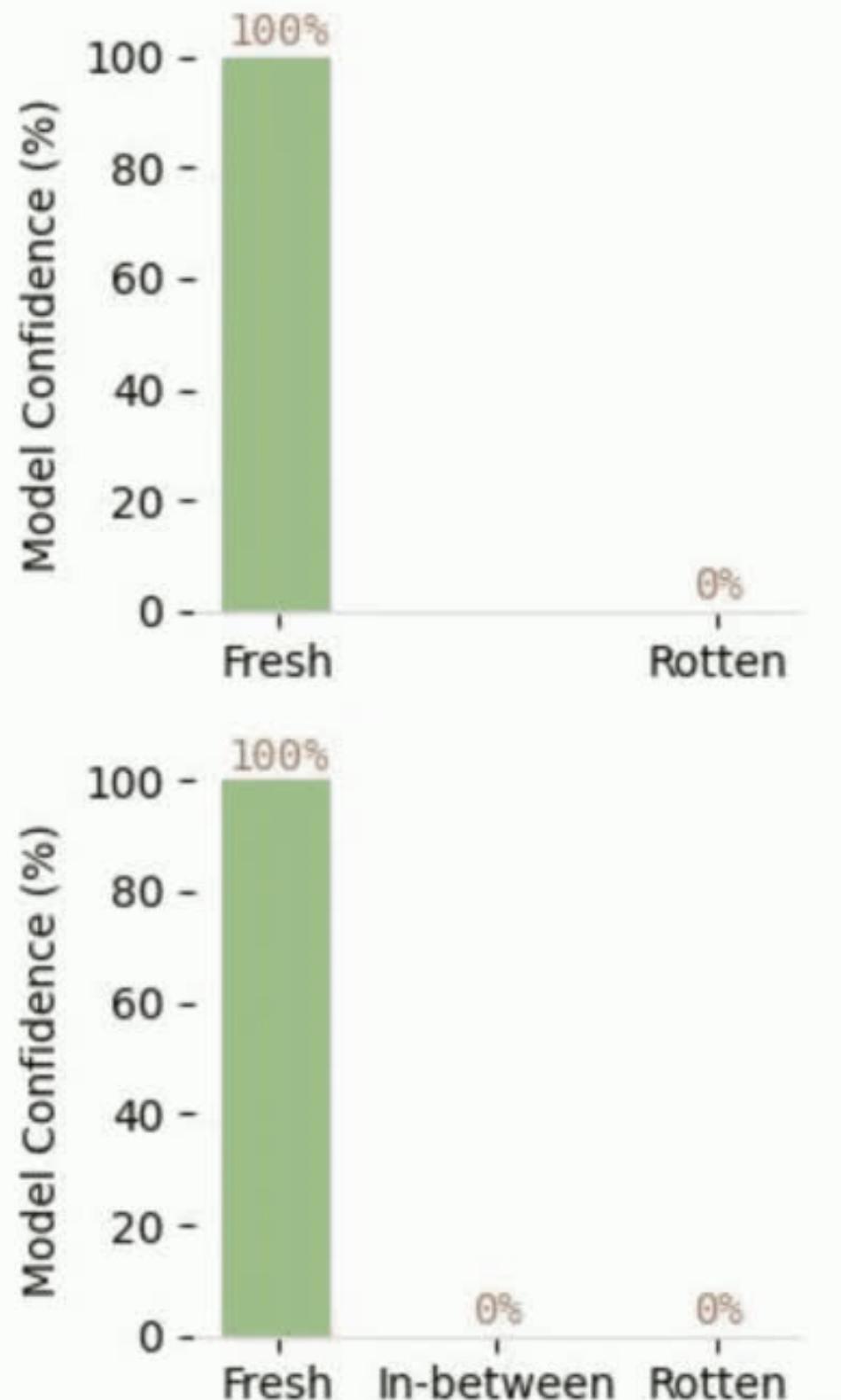
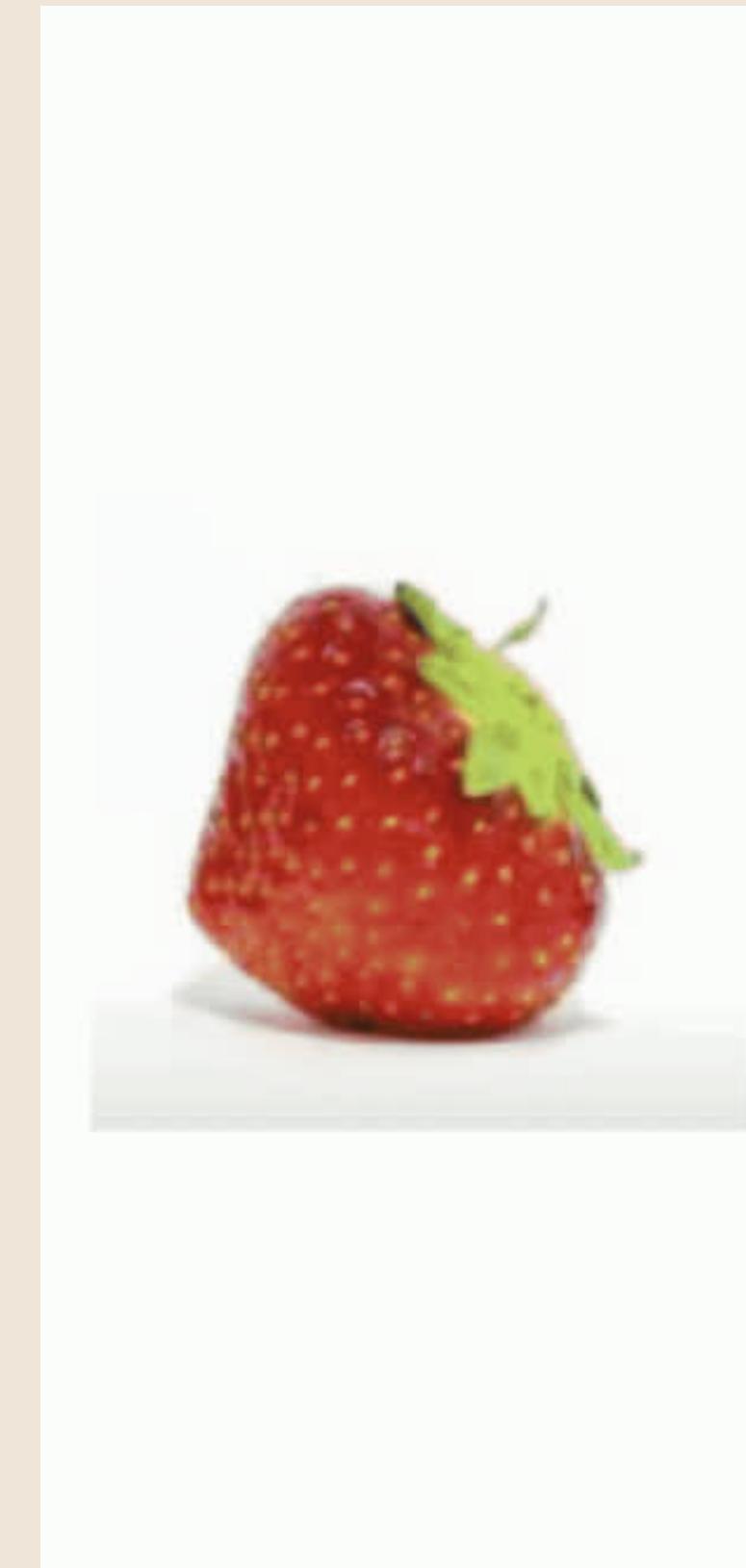
ResNet 18 depicted in 5 blocks

Experiments and Hyper-Parameters

- Data Split: We split the data into 70%, 15%, and 15% for training, validation, and testing respectively.
- Experimentation: We utilized two variants of ResNet – one with 18 layers and another with 50 layers.
- Hyper-Parameter Tuning: To optimize our model, we conducted tests using various combinations of learning rates, batch sizes, and epochs.
- Optimal Settings: After thorough experimentation, we determined the following hyper-parameter values to work best for our model: learning rate of 3e-4, batch size of 128, and 100 epochs.
- Accuracy Comparison: Our findings revealed that ResNet-18 had slightly better accuracy on the test set.
 - ResNet-18 Freshness Classification Accuracy: 80.85%
 - ResNet-50 Freshness Classification Accuracy: 80.52%
 - ResNet-18 Type Classification Accuracy: 95.41%
 - ResNet-50 Type Classification Accuracy: 94.74%

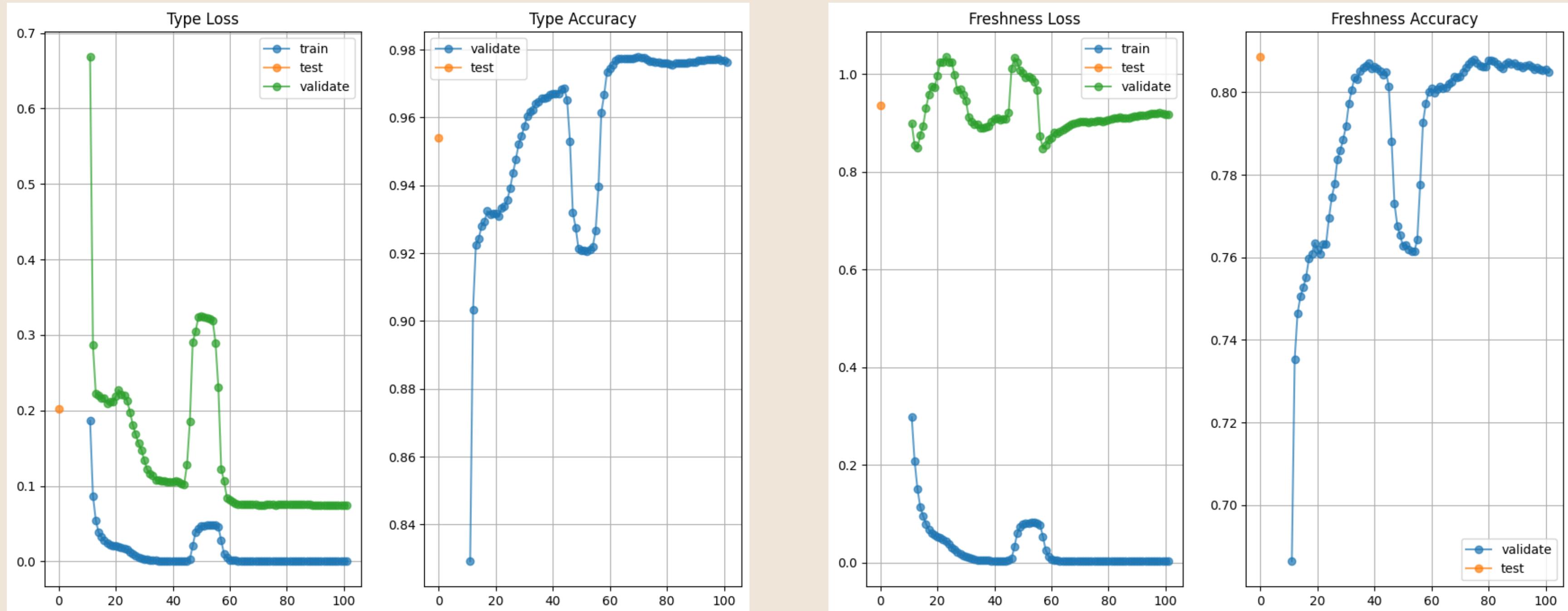
Comparison of ResNet for 2 Label vs 3 Label Classification

- Can only perform visual comparison for now
- Better interpolation is observed with 3-label classification



Freshness score from 2-label classifier (above) vs 3-label classifier (below) as the banana ages.
Images taken from a [youtube video](#) showing rotting strawberry time lapse

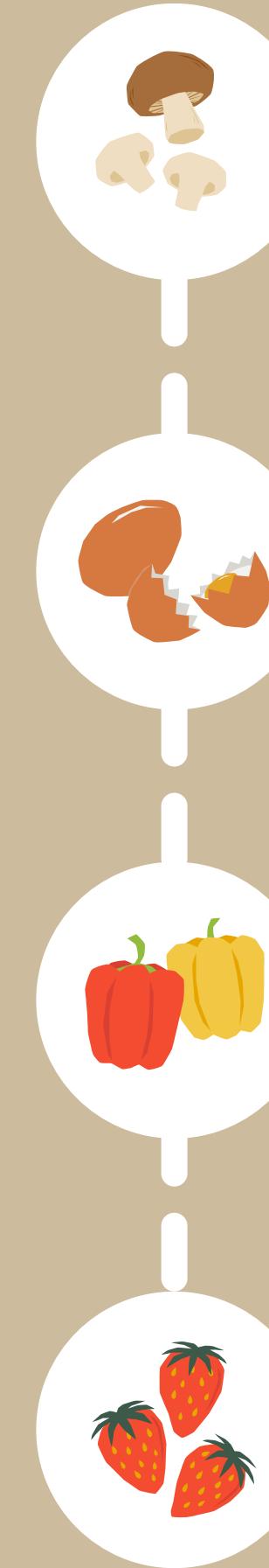
Some Unexplainable Results



Validation Loss and Accuracy Trends with Epochs for type and freshness classification for ResNet-18

While the validation of type classification gradually decreases like its supposed to, the validation loss of freshness classification is increasing. Although the validation accuracy increases for both.

Limitations & Next Steps



Data availability

No previously available dataset with daily snapshots of fruits and vegetables as they decay.

Manual labelling

Subjective and very difficult for certain fruits and vegetables with blurry boundaries of decay.

Uncovered features

Other features like odour, texture, and byproduct liquids can also be significant indicators.

If we had more time...

We would compile our own dataset, include unseeable features, and erase the background of our images

Our Mentor & TA



Marc Lanctot
Google DeepMind



Jake Tuero
UofA PhD Candidate

Our Team



Abeer Waheed

UofA
Computing Science



Ananya Rao

UofA
Computing Science



Claudia Wu

UBC Cognitive
Systems



Melody Lo

UBC Economics
and Statistics



**Tatianna
MacKenzie**

MacEwan
Computer Science

Thank you!

Litreature

- Mukhiddinov, M. (2022, December 21). Fruits and vegetables dataset. Kaggle.
<https://www.kaggle.com/datasets/muhriddinmuxiddinov/fruits-and-vegetables-dataset?resource=download>
- Mukhiddinov, M., Muminov, A., & Cho, J. (2022, October 26). Improved classification approach for fruits and vegetables freshness based on deep learning. MDPI. <https://www.mdpi.com/1424-8220/22/21/8192> Suryawanshi, Y. (2022, September 21).
- VegNet: Vegetable dataset with quality (unripe, ripe, old, dried, and damaged). Mendeley Data.
<https://data.mendeley.com/datasets/6nxnjbn9w6>