FRUIT IMAGE CLASSIFICATION

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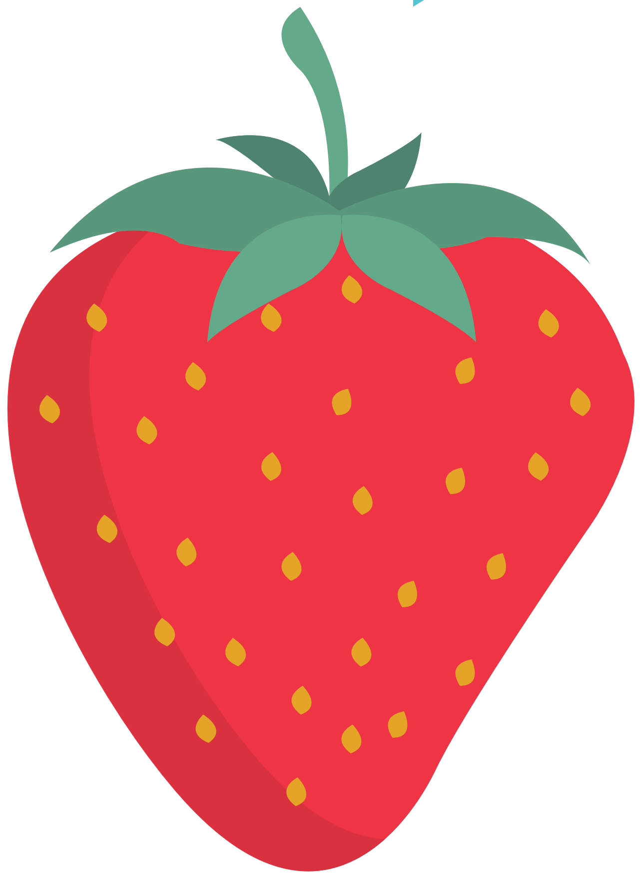
PROBLEM STATEMENT



- Imagine you're at grocery, trying to take a quick photo of a fruit — but the lighting is weird, there's plastic wrapping, and someone's hand is halfway in the frame.
- We want to build a model that can still tell it's a banana.
- So, our goal is to train a fruit classification model that doesn't just work in perfect lab conditions — but also handles messy, real-world photos.

METHODS

METHOD 01

- Collected data from Fruits-360 100 x100 dataset
- Applied image preprocessing (resize, normalize, augment)
- Compared CNN performance with **augmentation** and no augmentation
- Compared optimizers (adam, **RMSprop**, SGD)
- Compared our **CNN model** and MobileNetV2 (transfer learning)
- Tested on official test set → poor accuracy

METHOD 02

- Collected data from Fruits-360 original-size dataset
- Applied image preprocessing (resize, normalization, augment)
- Built a new CNN and trained it with RMSprop optimizer
- Compared performance between our CNN model and **MobileNetV2**
- Tested MobileNetV2 on the original test set
- Fine-tuned MobileNetV2
  - Added a new classifier layer for the 8 real-world fruit categories (images collected by us)
- Trained the model using an 80/20 per-class split on our own real-world fruit images

CHALLENGE 1

MAIN CHALLENGE

- Poor performance on the Fruits-360 100 x100 dataset
    - Model performed well on its training dataset but poorly on the test set
        - Close to 0 percent accuracy → overfitting, failed to generalize to new data

HOW WE SOLVED IT

- Identified the root cause
    - The training dataset was very clean compared to real-world conditions
- Retrained on a new dataset
    - Trained on the original-size branch of the Fruits-360 dataset
    - Also trained on even messier, self-collected fruit images

CHALLENGE 2

MAIN CHALLENGE

- Fruits-360 original size dataset includes 78 fruit classifications
  - We had limited time to take photos and collect 78 different fruits

HOW WE SOLVED IT

- Reduced the scope to 8 real-world different fruit classes
- Mapped detailed class names to broader categories
  - ex. Red cabbages and white cabbages → Cabbages
- Limitation : Reduced the number of fruit classes, small sample size → less reliable results, not fully representative of real world conditions

RESULTS

TESTED ON OFFICIAL TEST DATA

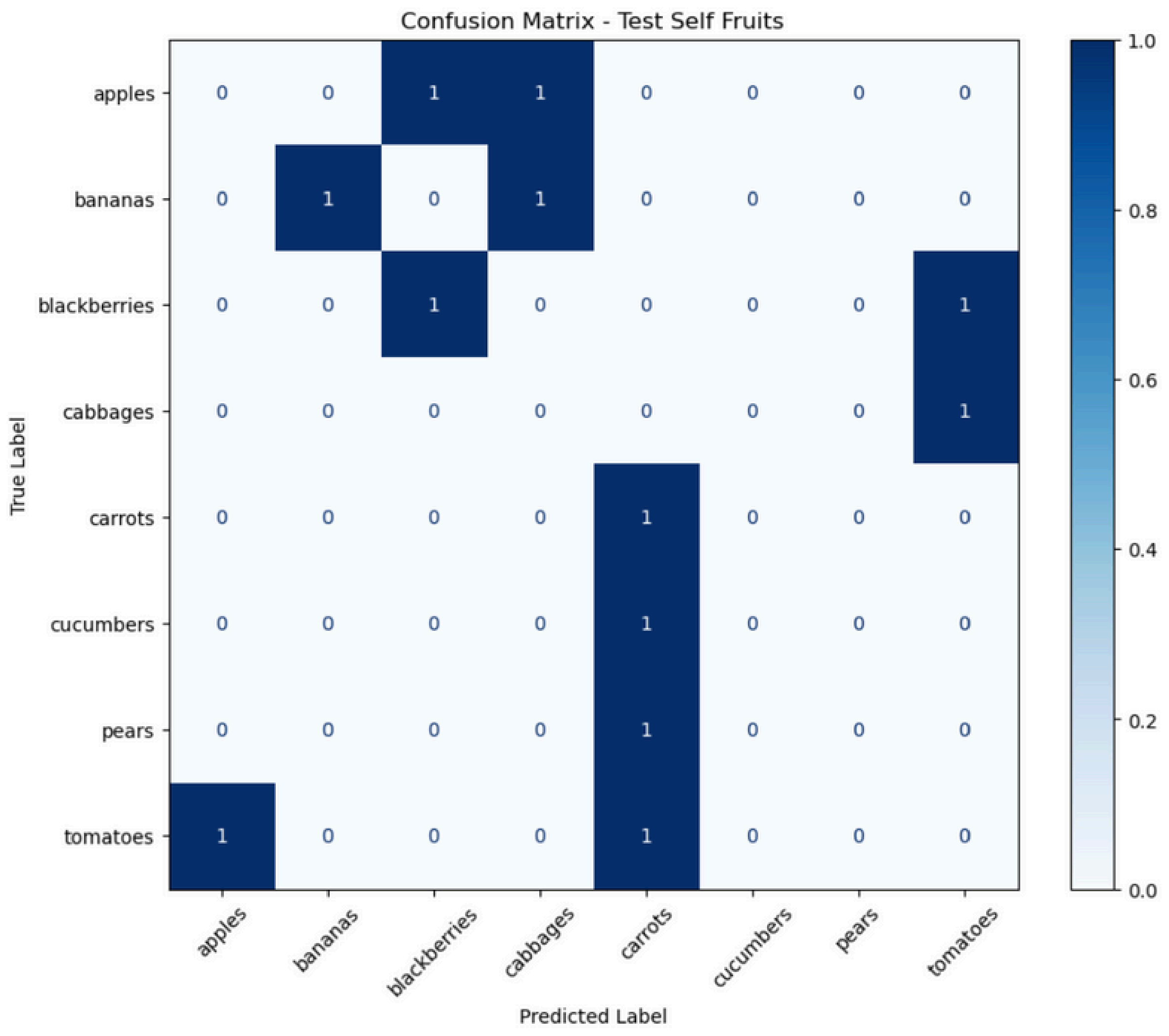
```
mobilenetv2_test = model_mobilenetv2.evaluate(test_ds)
✓ 1m 20.5s

408/408 ━━━━━━━━━━━━━━━━━━━━ 80s 197ms/step - accuracy: 0.9888 - loss: 0.0397
```

TESTED ON REAL-WORLD DATASET

Tested the same model (MobileNetV2) and fine-tuned) using our data.

- Total images tested: 12
- Correct predictions: 3
- Real-world testing accuracy: 25.00%




```
Classification Report:
              precision    recall  f1-score   support

      apples       0.00      0.00      0.00         2
     bananas       1.00      0.50      0.67         2
blackberries       0.50      0.50      0.50         2
    cabbages       0.00      0.00      0.00         1
...
    accuracy                           0.25        12
   macro avg       0.22      0.25      0.20        12
weighted avg       0.27      0.25      0.23        12
```

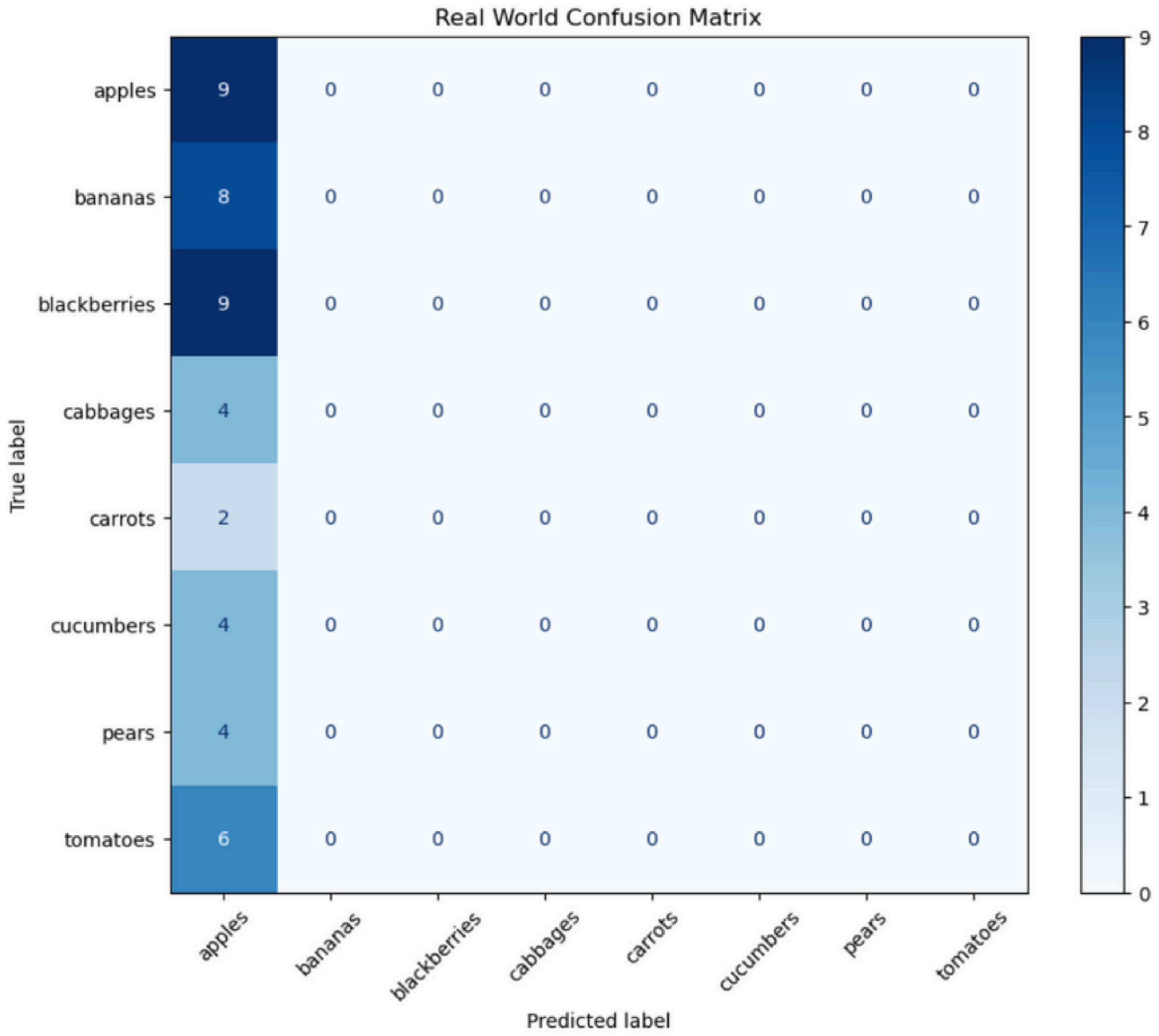
CONCLUSION

Although MobileNetV2 achieved a high accuracy score on the Fruits-360 original size dataset, it failed to generalize to messy real-world fruit photos. This suggests the limitation of models trained on studio-like data when applied to real-world data, highlighting the gap between clean versus real-world environments. Further work could involve collecting and training on even messier training data to improve its performance.

Classification Report:

	precision	recall	f1-score	support
apples	0.20	1.00	0.33	9
bananas	0.00	0.00	0.00	8
blackberries	0.00	0.00	0.00	9
cabbages	0.00	0.00	0.00	4
carrots	0.00	0.00	0.00	2
cucumbers	0.00	0.00	0.00	4
pears	0.00	0.00	0.00	4
tomatoes	0.00	0.00	0.00	6
accuracy			0.20	46
macro avg	0.02	0.12	0.04	46
weighted avg	0.04	0.20	0.06	46

FUN FACT



BEFORE FINE TUNING:

Final Results :

Total images tested: 46

Correct predictions: 9

Real-world testing accuracy: 19.57%

The MobileNetV2 model before fine tuning predicted 'apple' for everything no matter what fruit was given.

The accuracy was achieved by always guessing "apple"

THANK YOU