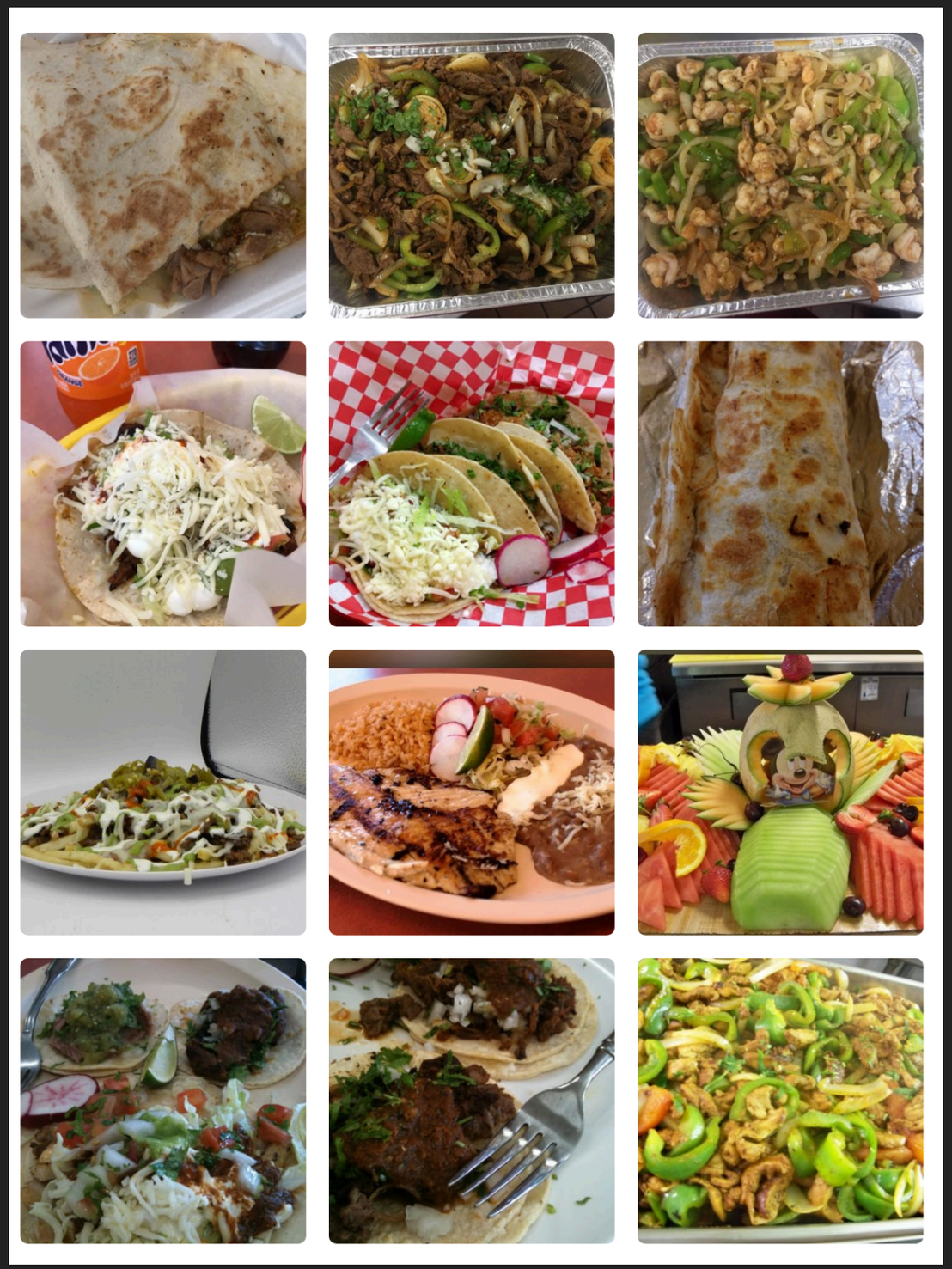
A BETTER SORT OF YELP PHOTOS

PROBLEM STATEMENT

Why are the photos in many Yelp restaurant galleries still poor quality? App users and owners deserve a better sort option.



BACKGROUND

Sources

METHODS

PHOTO CRITERIA

- Focus: Subject in focus.

Label: [good]

Label: [bad]

PHOTO CRITERIA

- Focus: Subject in focus.
- Exposure: Even

Label: [good]

Label: [bad]

PHOTO CRITERIA

- Focus
- Exposure
- Subject
-

Label: [good]

Label: [bad]

PHOTO CRITERIA

- Focus
- Exposure
- Subject
- Color

Label: [good]

Label: [bad]

PHOTO CRITERIA

- Focus
- Exposure
- Subject
- Color
- Pattern / Composition

Label: [good]

Label: [bad]

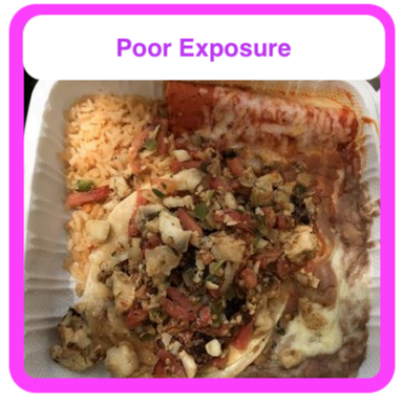
Photos for [redacted]

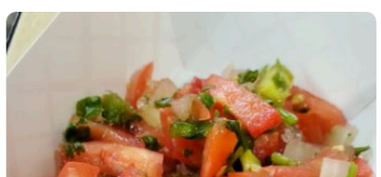
[redacted] 1211 reviews

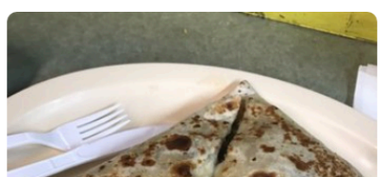
Add photos

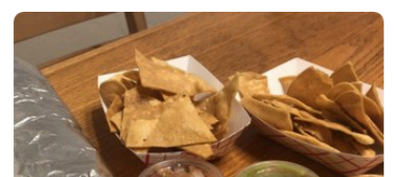
All (633) **All Food (454)** Tacos (190) Burritos & Wraps (111) Inside (89) Menu (26) O

Search photos...









DATA VISUALIZATION

Good

Good

Good

Bad

Bad

Bad

DATA VISUALIZATION

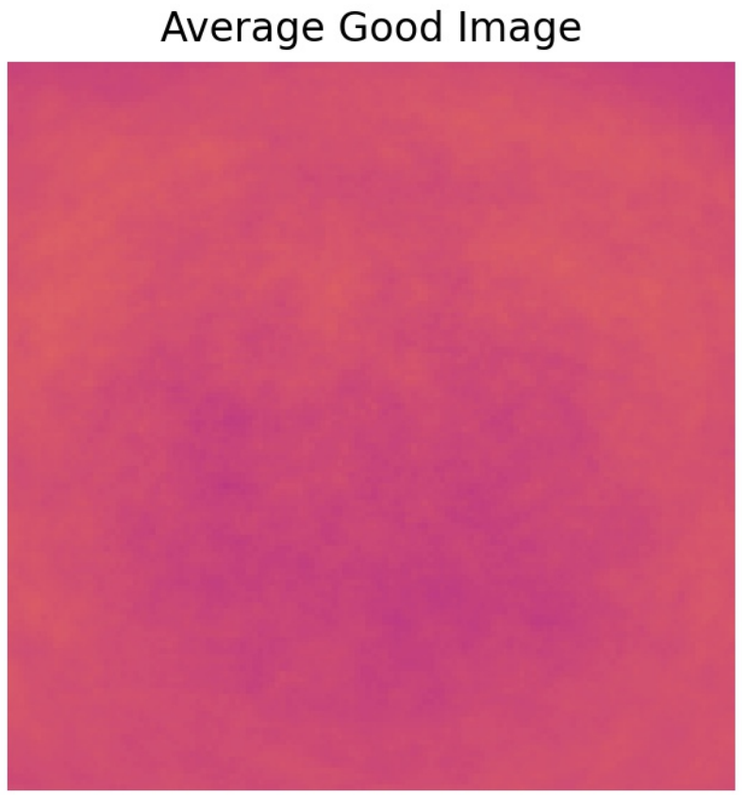
- Composite image for each class (mean values)

Composite "Good" Image
(Mean Values)

Composite "Bad" Image
(Mean Values)

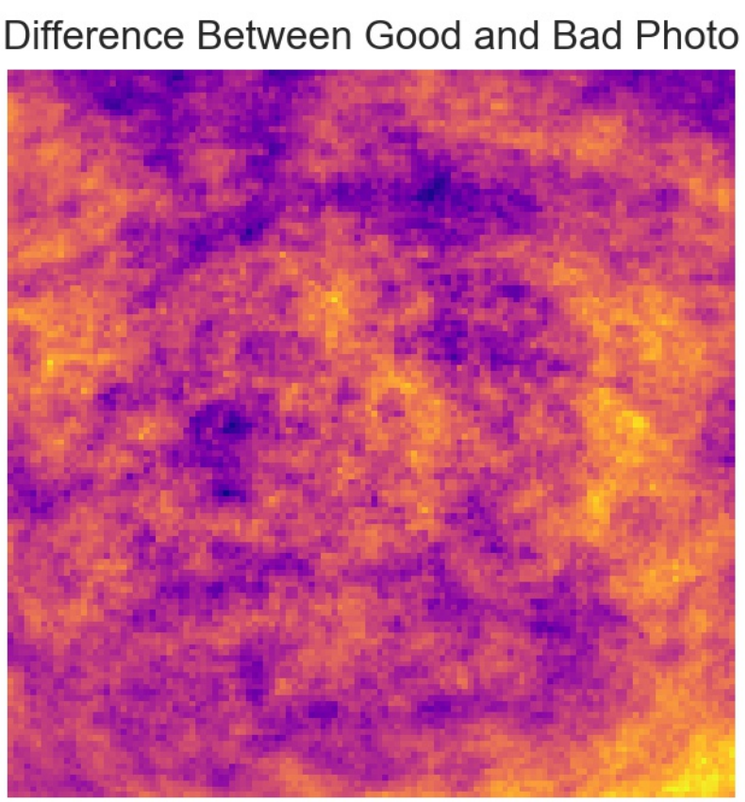
DATA VISUALIZATION

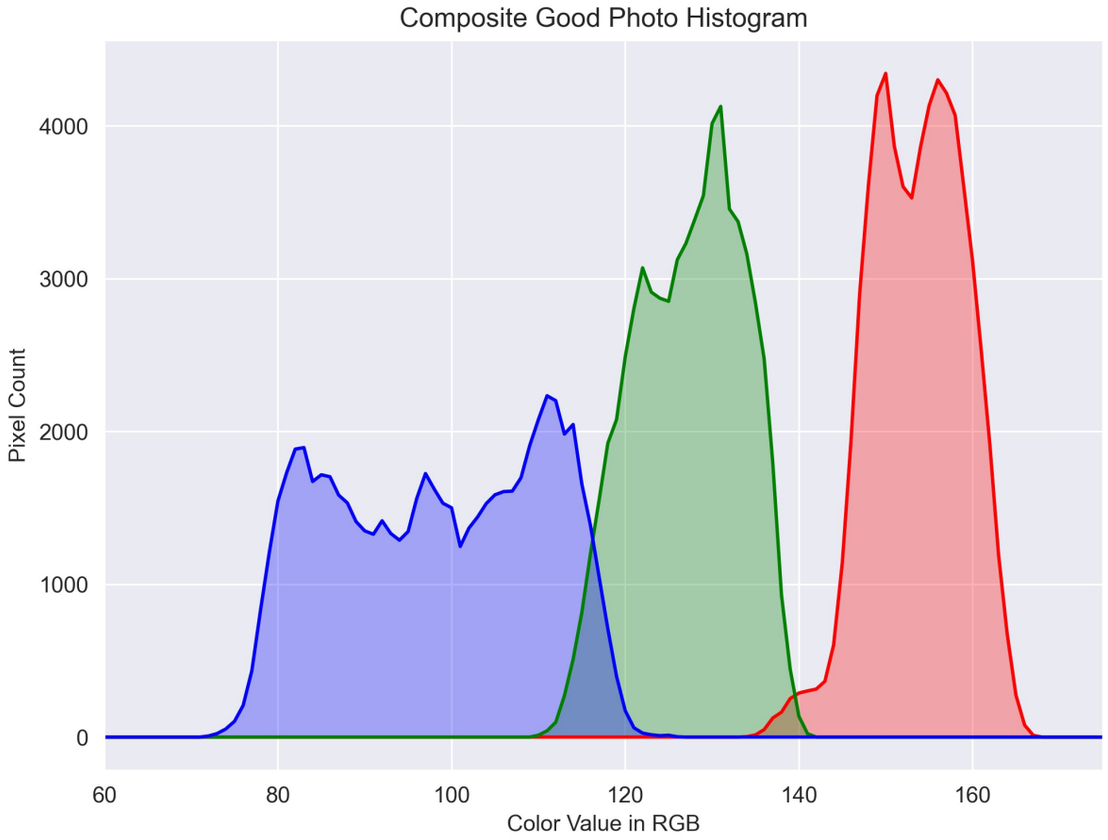
- Average Grayscale Image Per Class



DATA VISUALIZATION

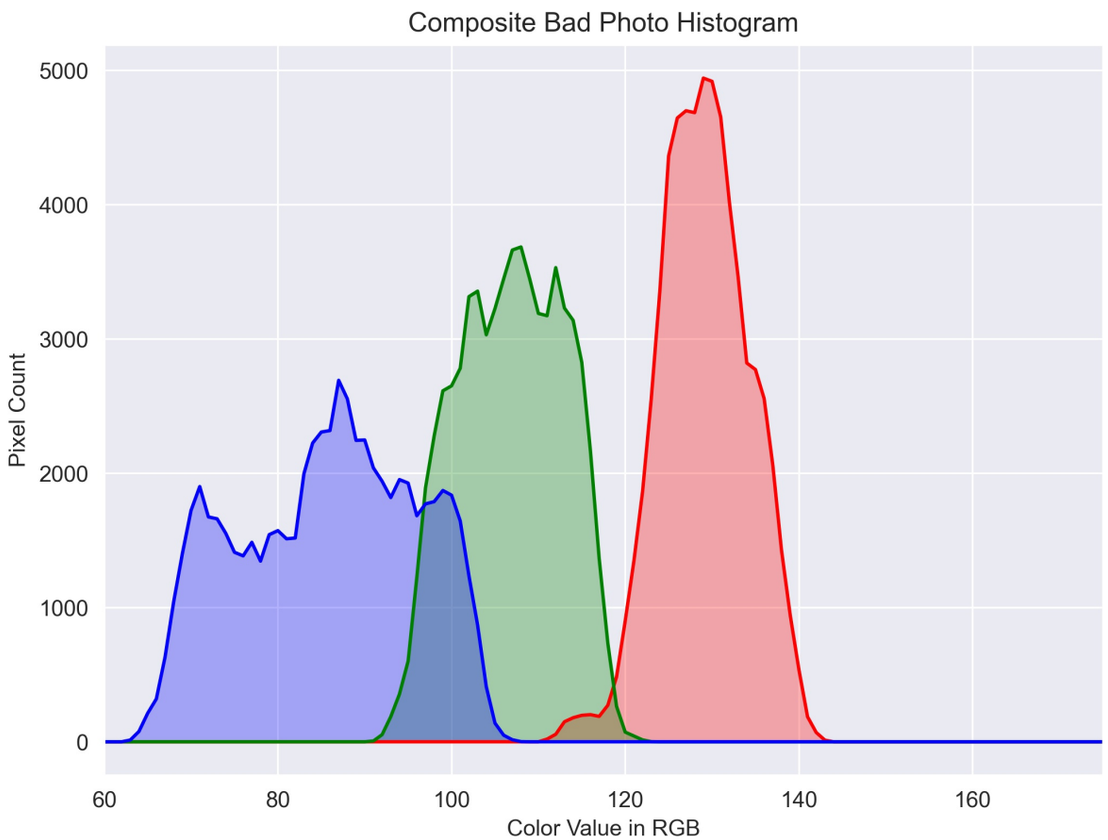
- Contrast Image (Difference Between Average “Good” Image And Average “Bad” Image)





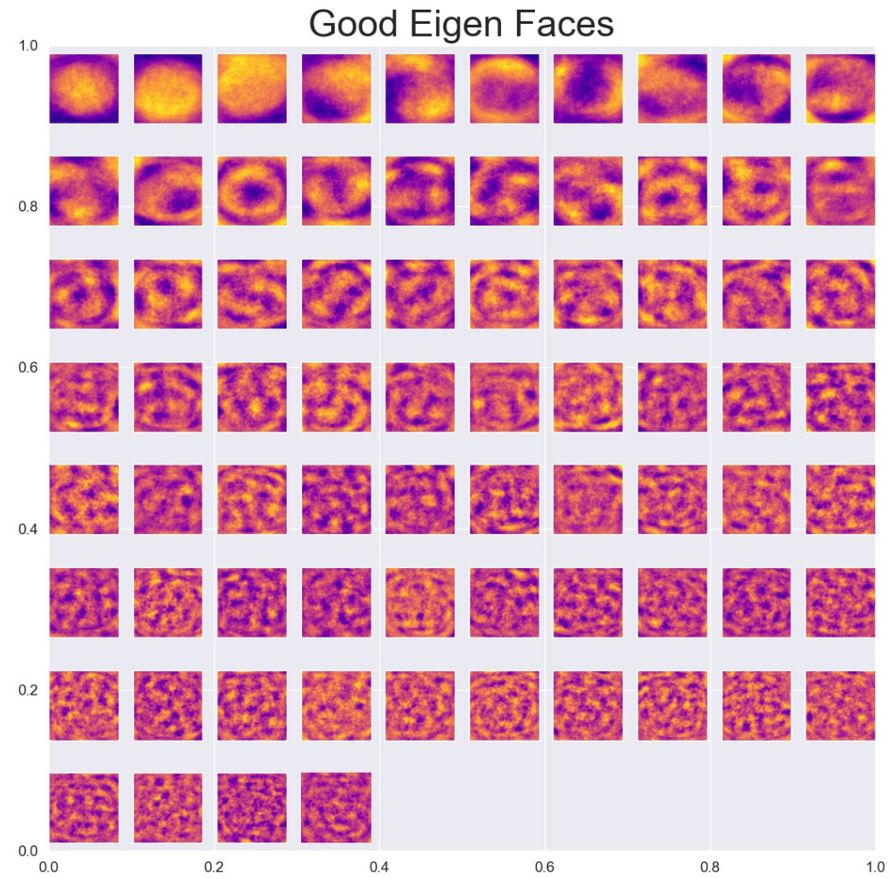
DATA VISUALIZATION

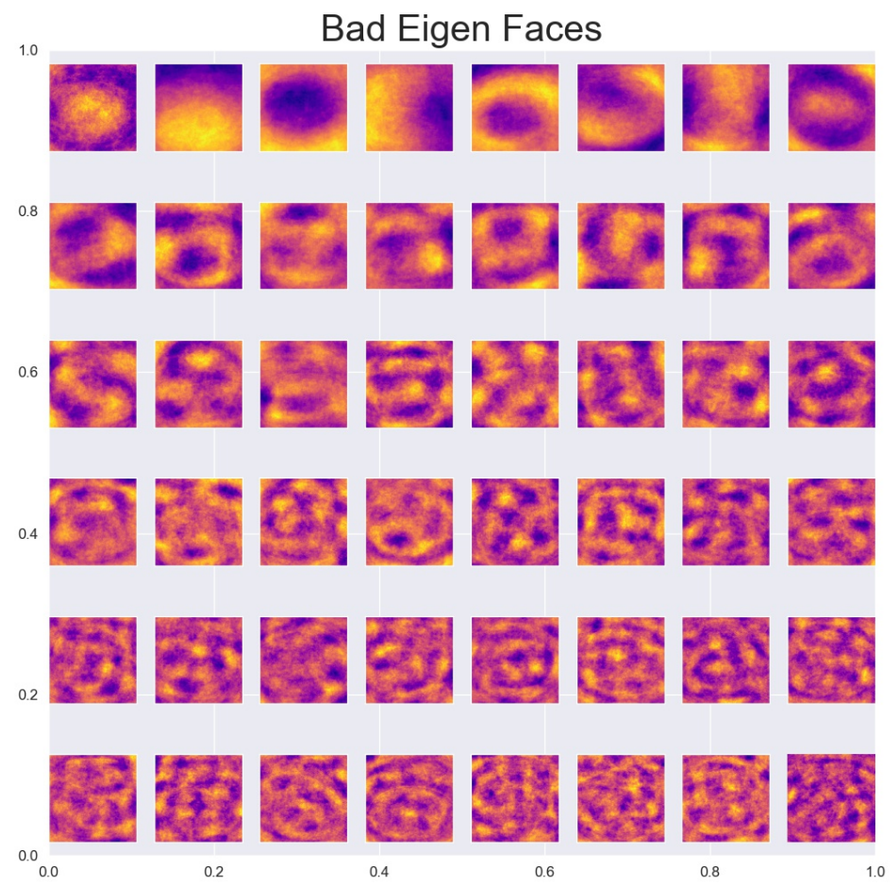
- Composite Histograms for Each Class



DATA VISUALIZATION

- Principle Components Analysis
- Makes Composites of Each Class That Explain 70% of the Variance
- Sometimes Called “Eigen Faces”; used in facial recognition research.





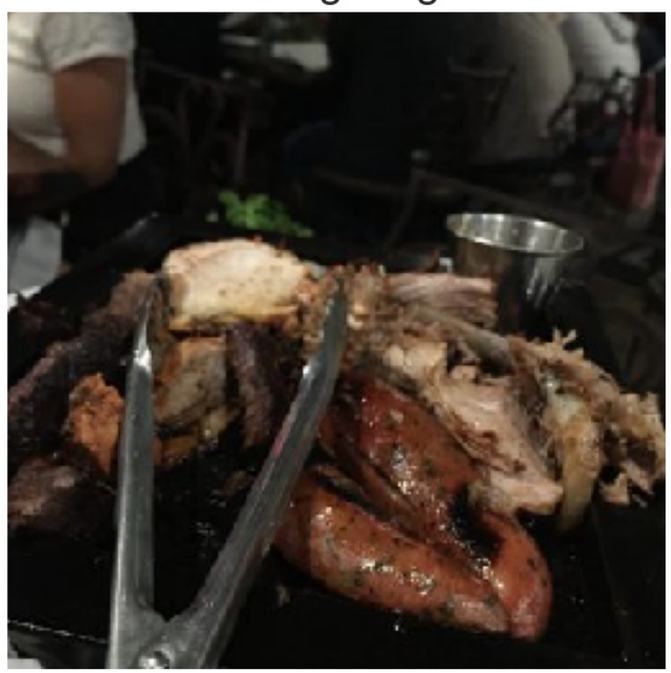
Good Photo High Eigen Value

Good Photo High Eigen Value

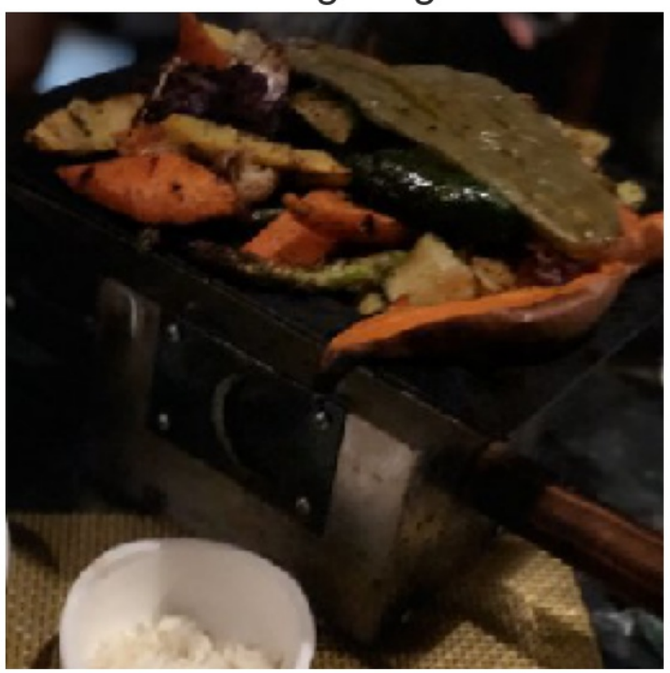
Good Photo High Eigen Value

Bad Photo High Eigen Value

Bad Photo High Eigen Value



Bad Photo High Eigen Value



MODELING

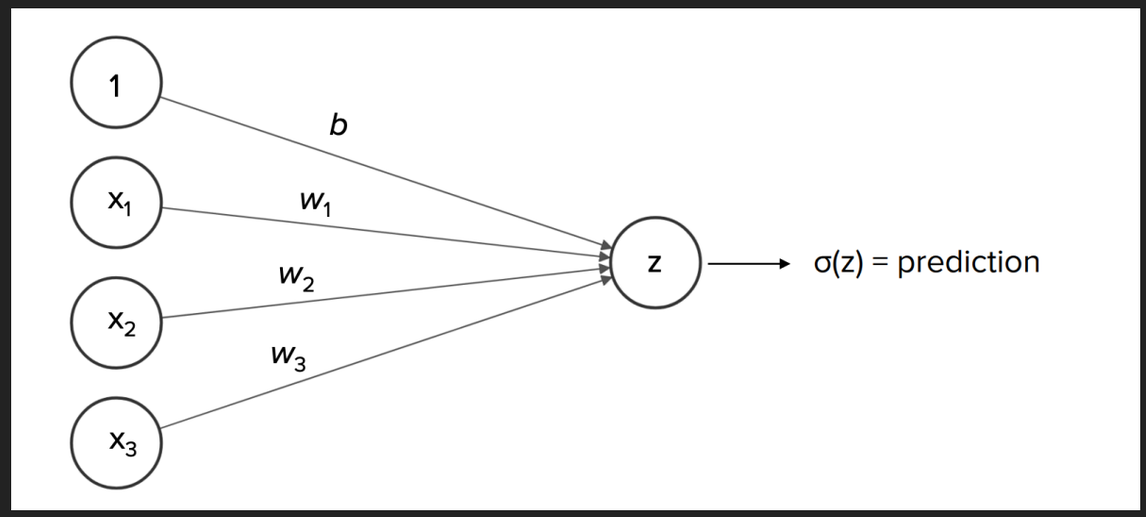
CONVOLUTIONAL NEURAL NETS (CNN)

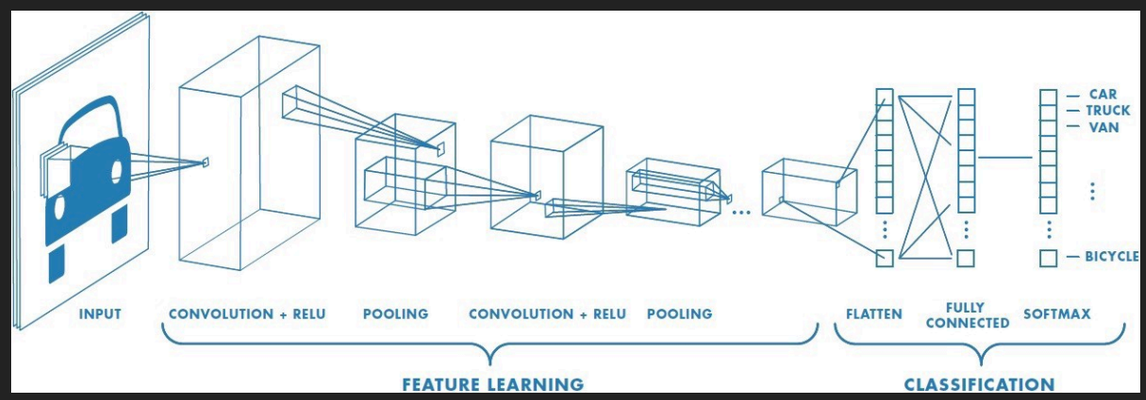
- What are they?
- CNNs are some of the best classifiers for images
- Two Methods Used. Two Models for EACH:
  - CNN from Scratch (Model 1, Model 2)
  - CNN with Transfer Learning (Model 3, Model 4)

$$p = \sigma\left(b + w_1 x_1 + w_2 x_2 + w_3 x_3\right)$$

Curvy part

Linear part





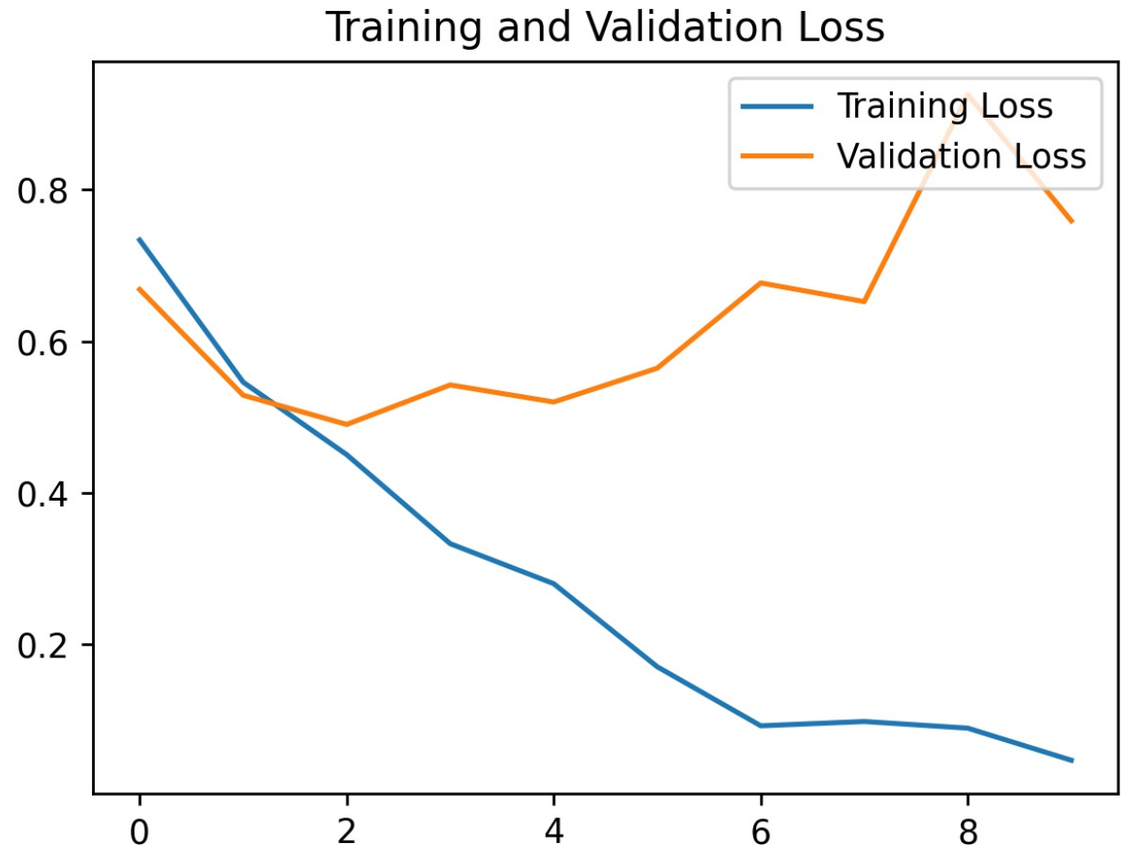
Source

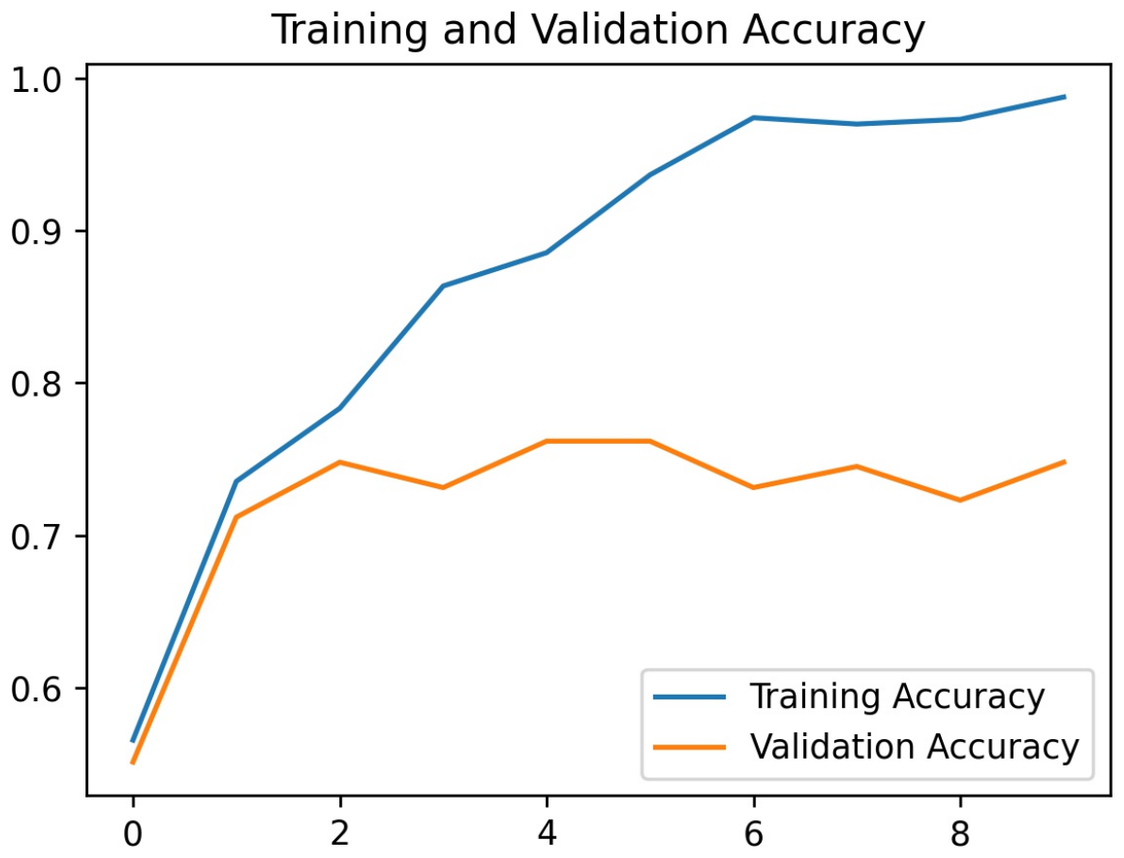
CNN IMAGE CLASSIFIER FROM SCRATCH

MODEL 1: 76% ACC

Batch size: 16, Image size: 256x256

```
Model: "sequential_5"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 rescaling_8 (Rescaling)     (None, 256, 256, 3)       0

 conv2d_15 (Conv2D)          (None, 256, 256, 16)      448

 max_pooling2d_15 (MaxPoolin  (None, 128, 128, 16)     0
 g2D)

 conv2d_16 (Conv2D)          (None, 128, 128, 32)      4640

 max_pooling2d_16 (MaxPoolin  (None, 64, 64, 32)       0
 g2D)

 conv2d_17 (Conv2D)          (None, 64, 64, 64)        18496

 max_pooling2d_17 (MaxPoolin  (None, 32, 32, 64)       0
 g2D)

 flatten_5 (Flatten)         (None, 65536)             0

 dense_10 (Dense)            (None, 128)               8388736

 dense_11 (Dense)            (None, 1)                 129

=================================================================
Total params: 8,412,449
Trainable params: 8,412,449
Non-trainable params: 0
```





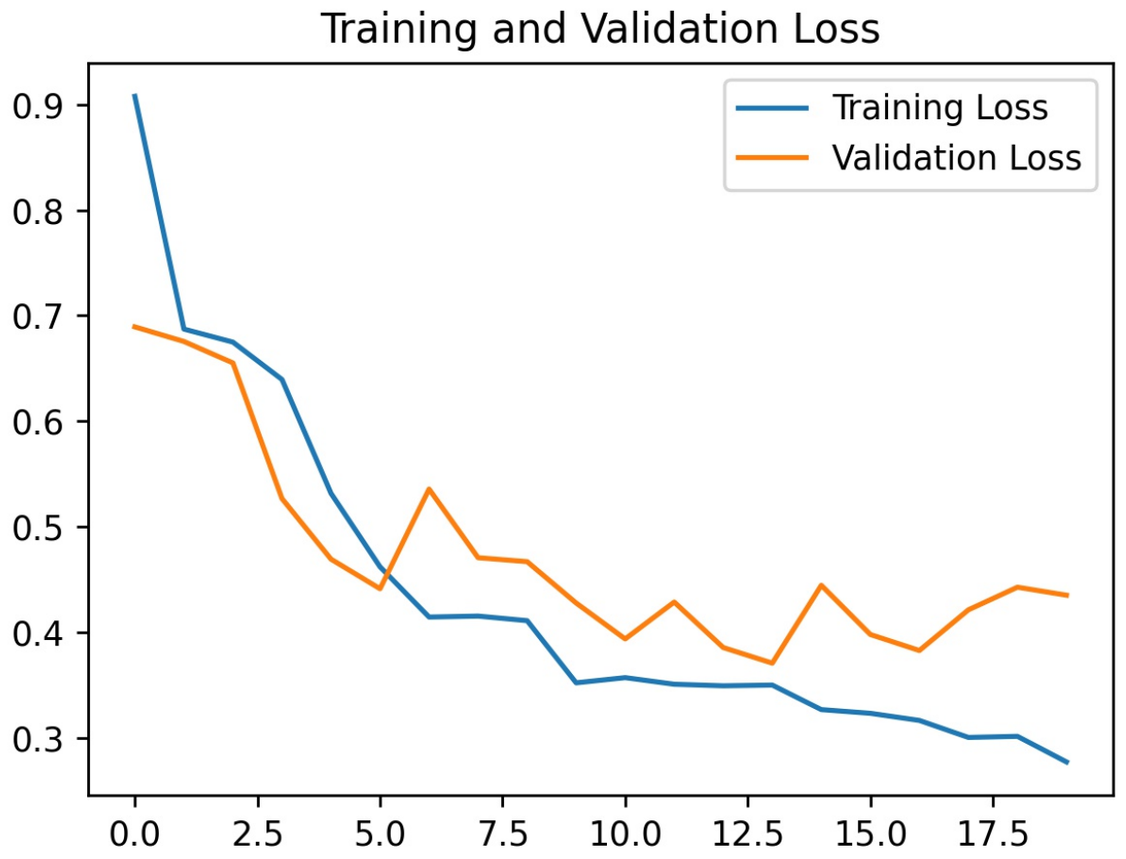
CNN IMAGE CLASSIFIER FROM SCRATCH

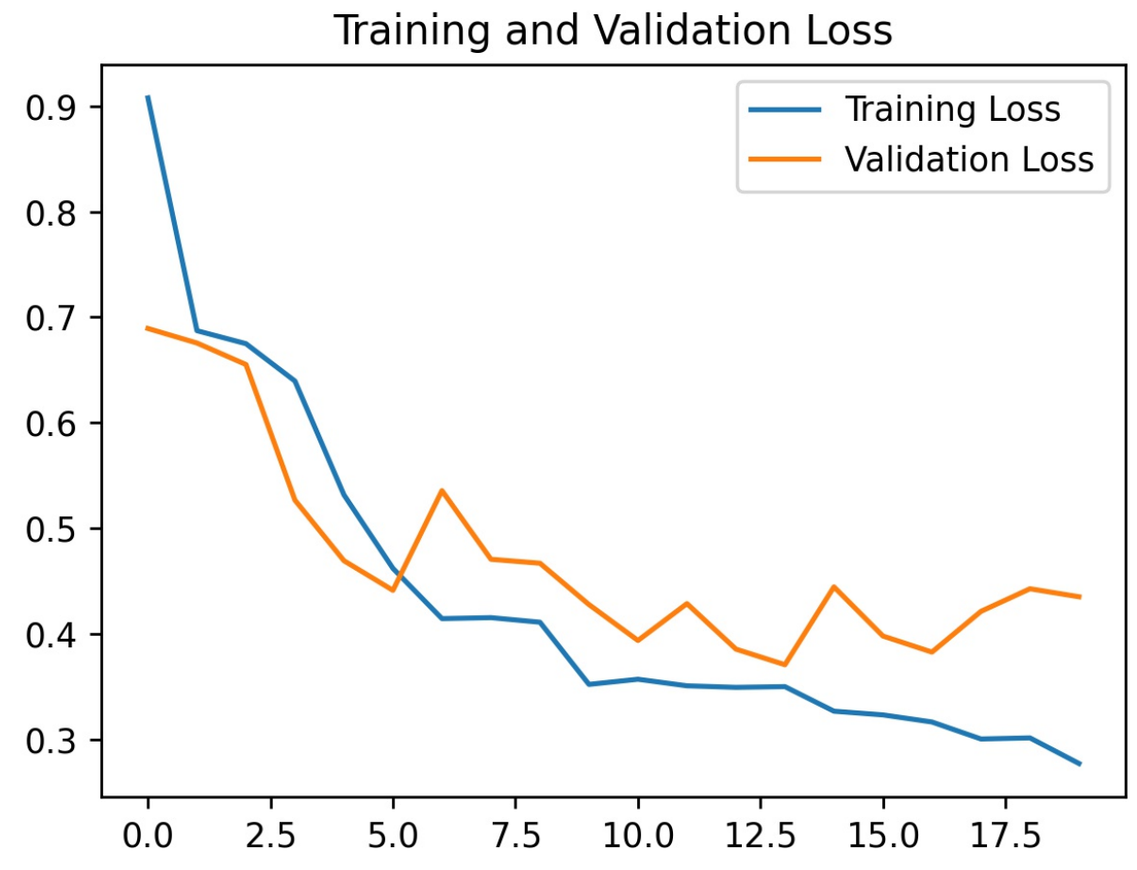
MODEL 2: 82% ACC

Batch size: 16, Image size: 256x256

Adds Image Augmentation & Dropout

```
Model: "sequential_8"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 sequential_7 (Sequential)   (None, 256, 256, 3)       0

 rescaling_9 (Rescaling)     (None, 256, 256, 3)       0

 conv2d_18 (Conv2D)          (None, 256, 256, 16)      448

 max_pooling2d_18 (MaxPoolin  (None, 128, 128, 16)     0
 g2D)

 conv2d_19 (Conv2D)          (None, 128, 128, 32)      4640

 max_pooling2d_19 (MaxPoolin  (None, 64, 64, 32)       0
 g2D)

 conv2d_20 (Conv2D)          (None, 64, 64, 64)        18496

 max_pooling2d_20 (MaxPoolin  (None, 32, 32, 64)       0
 g2D)

 dropout (Dropout)           (None, 32, 32, 64)        0

 flatten_6 (Flatten)         (None, 65536)             0

 dense_12 (Dense)            (None, 128)               8388736

 dense_13 (Dense)            (None, 1)                 129

=================================================================
Total params: 8,412,449
Trainable params: 8,412,449
Non-trainable params: 0
_________________________________________________________________
```

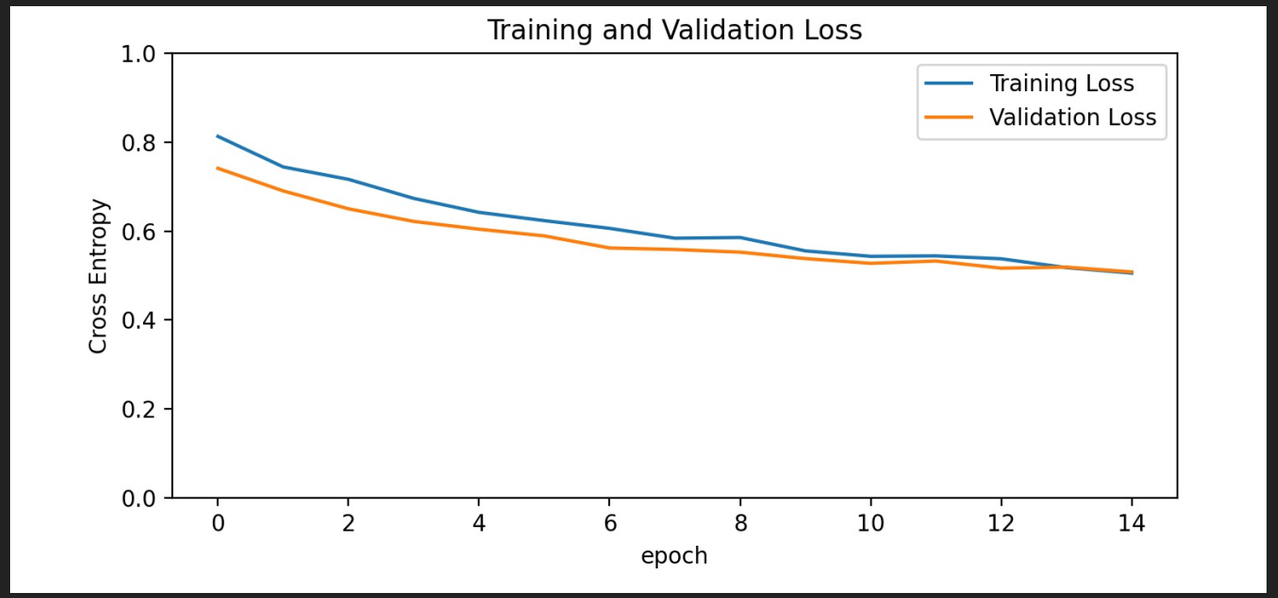


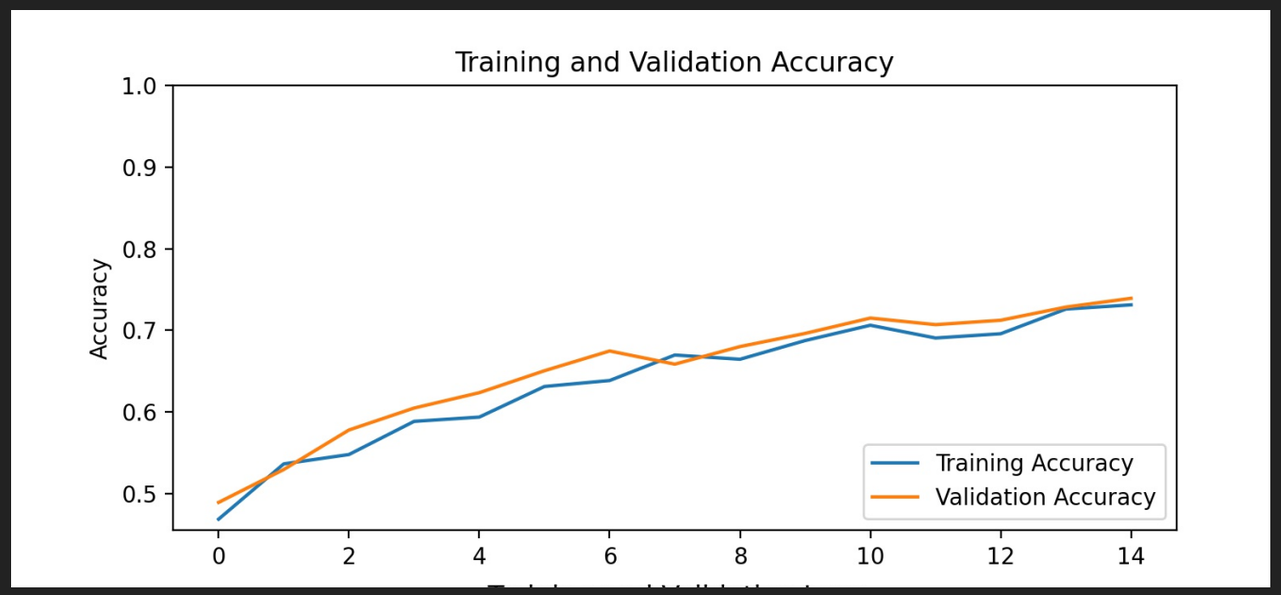


MODEL 3: ~73% ACC

~73% on Validation Data after 15 epochs

- A feature extraction transfer learning model
- Uses MobileNet V2 from Google (1.4 M photos, 1000 classes)
- Takes the top off and applies to this data.

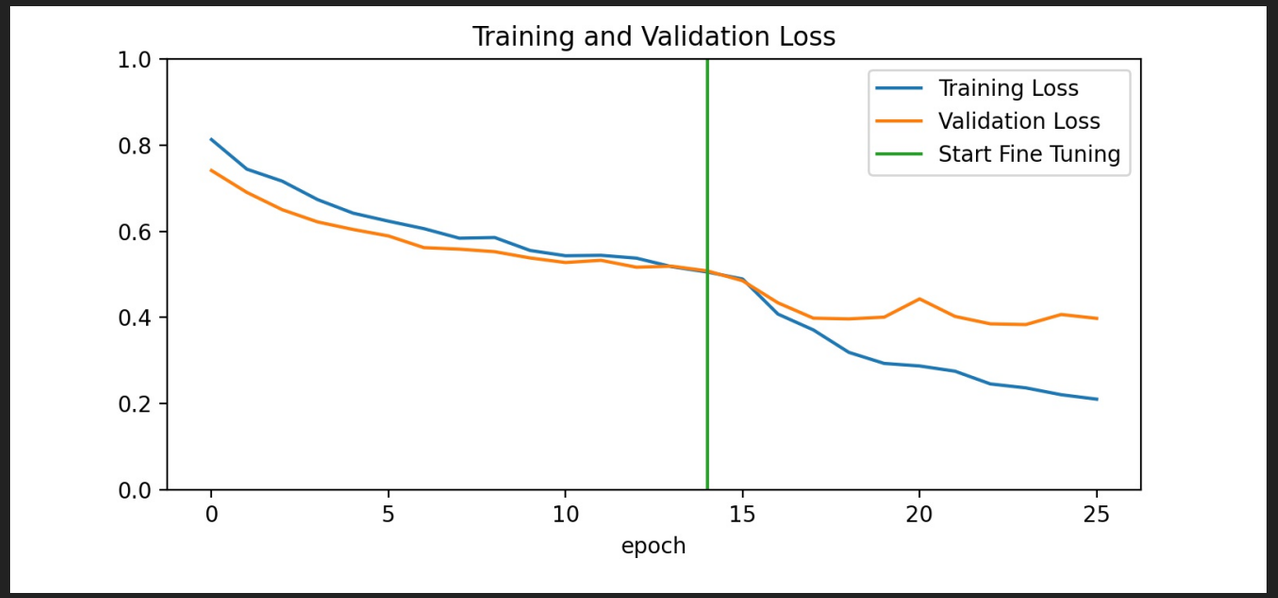


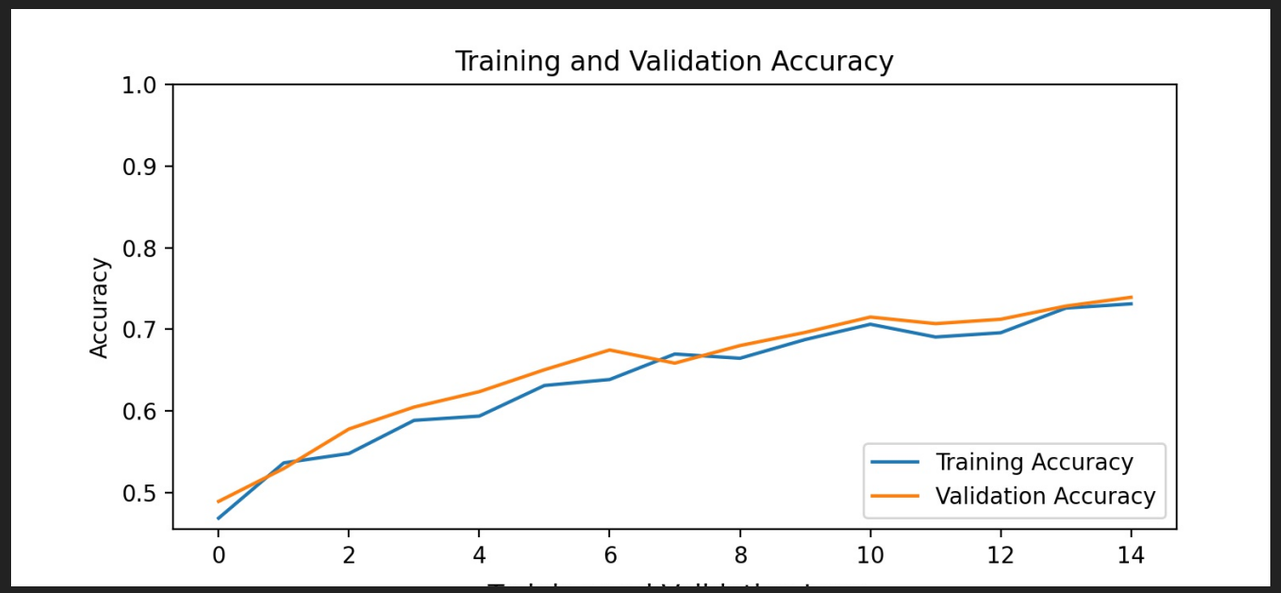


MODEL 4: ~83% ACC

~83% on Validation Data after 10 epochs

- A fine-tuning transfer learning model
- Unfreezes a few of the top layers from the MobileNet V2
- Lets you take advantage of basic features in lower part of pre-train, then get more specific for your data.





Label: good Predicted: good

Label: good Predicted: good

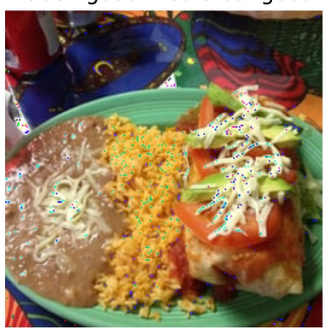
Label: good Predicted: good

Label: bad Predicted: bad

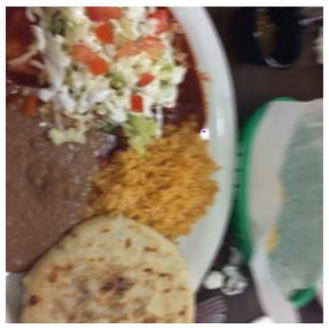
Label: good Predicted: good

Label: bad Predicted: bad

Label: good Predicted: good



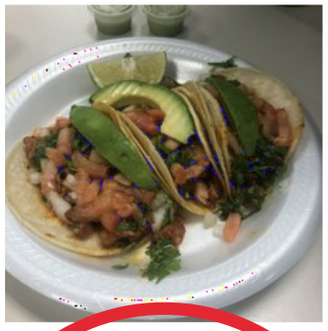
Label: bad Predicted: bad



Label: bad Predicted: bad

Label: bad Predicted: bad

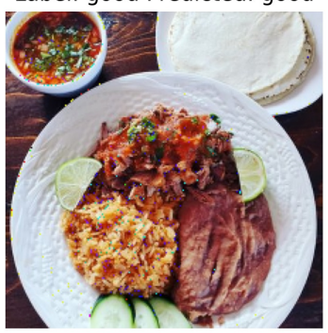
Label: bad Predicted: bad



Label: bad Predicted: bad

Label: good Predicted: good

Label: good Predicted: good



Label: good Predicted: bad

Label: good Predicted: good

CONCLUSIONS

CONCLUSIONS

- More difficult to evaluate subjective labels.
- Sometimes CNNs with transfer learning don’t perform better than those without.
- CNNs: are like poker.
- Try limiting down the dataset to more specific shapes(e.g. sushi).
- Try a CNN w/ specific architecture for color patterns.

Source

RECOMMENDATIONS

RECOMMENDATIONS

- Review platforms with user generated photo galleries should consider implementing AI-based photo-quality sorting.
- This idea has other applications beyond food; probably many like this photo website are already in production: www.pickpik.com