
FACIAL
EMOTION
RECOGNITION
WEB APPLICATION

TABLE OF CONTENTS

BACKGROUND & PROBLEM STATEMENT

According to a study published on Forbes,

96%

of customers will leave you for bad customer service.

Source:
https://www.forbes.com/sites/shephyken/2020/07/12/ninety-six-percent-of-customers-will-leave-you-for-bad-customer-service/?sh=64bd471d30f8

CONSEQUENCES OF BAD CUSTOMER SERVICE

1) BAD REVIEWS

2) BAD REPUTATION

3) LOSS OF EXISTING & NEW CUSTOMERS

4) LOWER RETURN ON INVESTMENT

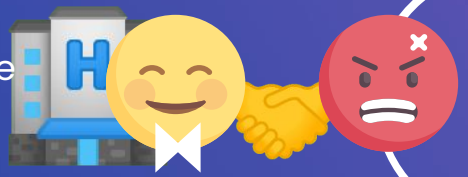
HOW TO DEAL WITH ANGRY CUSTOMERS

SERVICE RECOVERY PROCESS

1) Your happy customer

2) Customer is angry after encountering an issue

3) Perform Service Recovery



4) Customer is appeased and leaves happily

HOW WE CAN USE DATA SCIENCE IN SERVICE RECOVERY

We can use A.I. to **support identification of angry customers** so that businesses can **perform service recovery before it is too late**

1) Angry Customer

2) A.I. helps to identify angry customer and alerts staff

3) Staff performs service recovery to appease customer

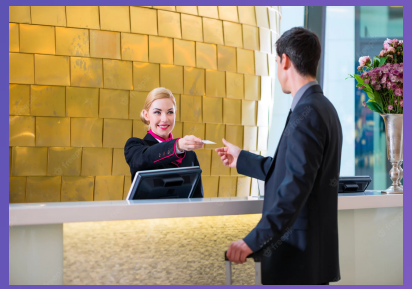
INDUSTRY USE CASES

SELF CHECK-IN KIOSKS

Identify customers who gets angry while using the self check-in kiosks

IN HOTELS

Support hotel staff with identifying angry guests



ON CUSTOMER SERVICE AGENTS

Help to remind agents to maintain their smile while on shift

PROBLEM STATEMENT

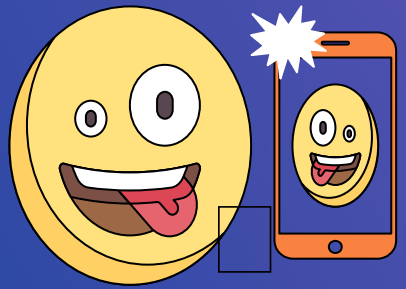
- **Build a model** that will **help identify angry customers** so that businesses will be able to provide service recovery before it is too late

PROJECT WORKFLOW OVERVIEW

DATA COLLECTION → PREPROCESSING & EDA → MODELING & EVALUATION → DEPLOYMENT

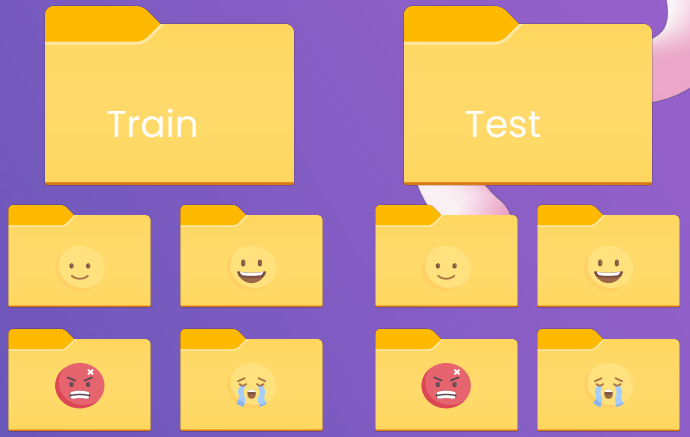
DATA COLLECTION

HOW DATA IS COLLECTED & STORED



- Images of 4 different facial expressions taken on iPhone.
- 150 images per facial expression

- Images are then stored on Google Drive



- Images are split into Train and Test folders
- Images are further separated into its respective emotion

PREPROCESSING & EDA

PREPROCESSING STEPS

Read in image with OpenCV

↓

Grayscale

↓

Crop face

↓

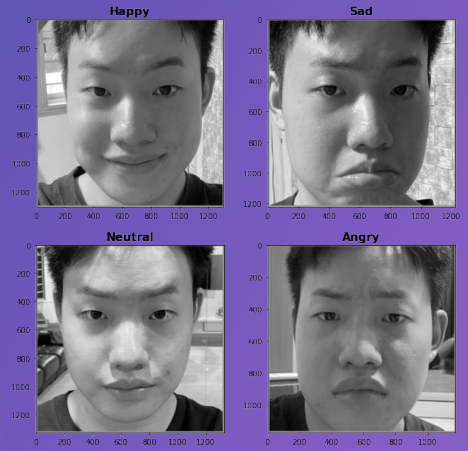
Train-Val Split

↓

Normalisation

↓

Image Augmentation



Normalisation converts values to range 0 to 1

IMAGE AUGMENTATION

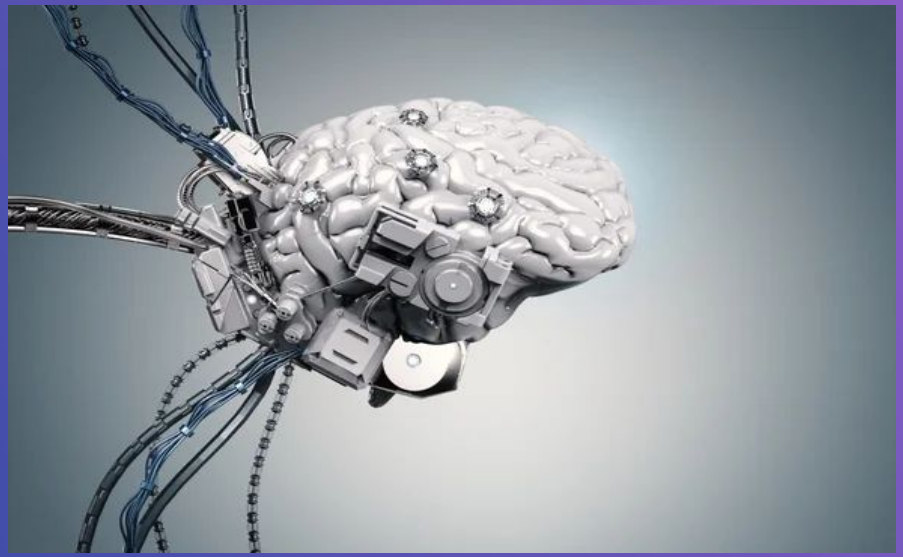




- Helps increase size of training dataset by flipping and tilting image
- Reduce overfitting
- **Helps model generalise better** to new unseen data

MODELING & EVALUATION

INTRODUCING CONVOLUTIONAL NEURAL NETWORKS



What if I told you we can train a model to have human cognitive abilities?

WHY CONVOLUTIONAL NEURAL NETWORKS

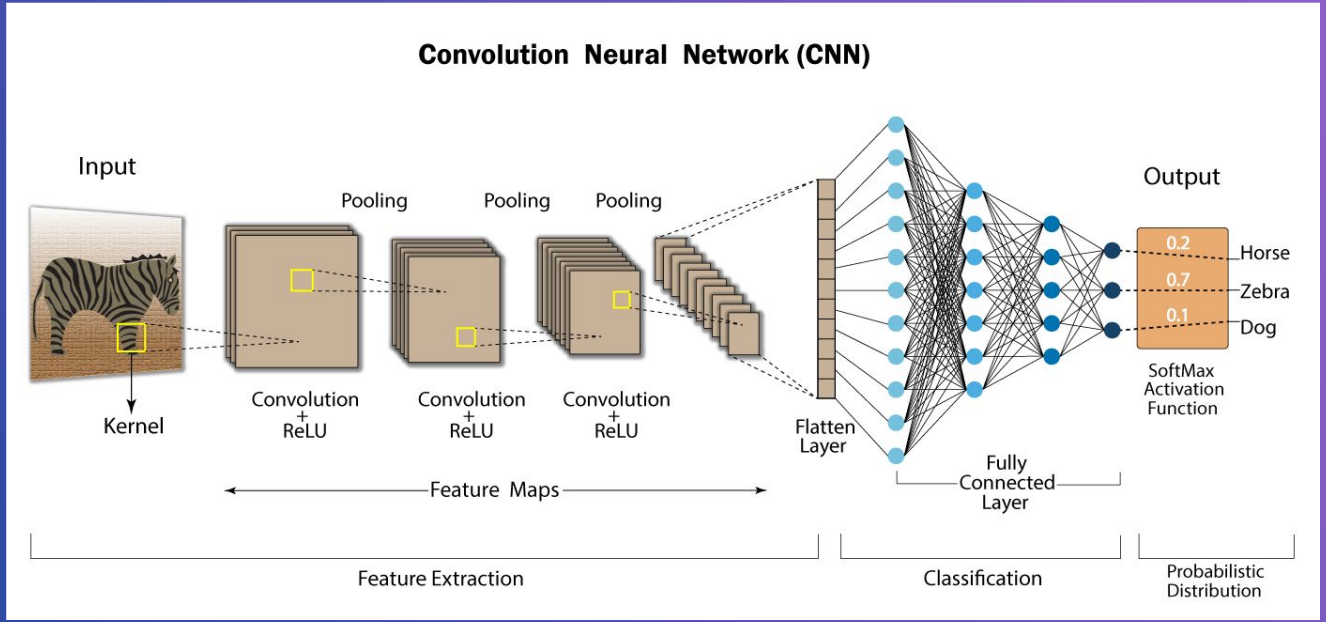
LEARN SPACIAL INVARIANCES

Ability to recognise objects in images **regardless of their location** within the image

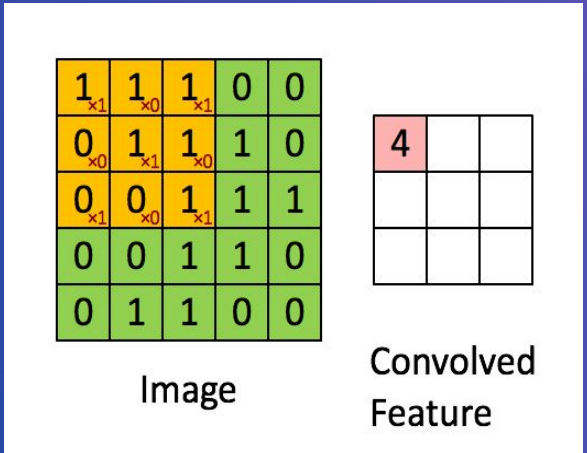
LEARN SPATIAL HIERARCHIES OF FEATURES

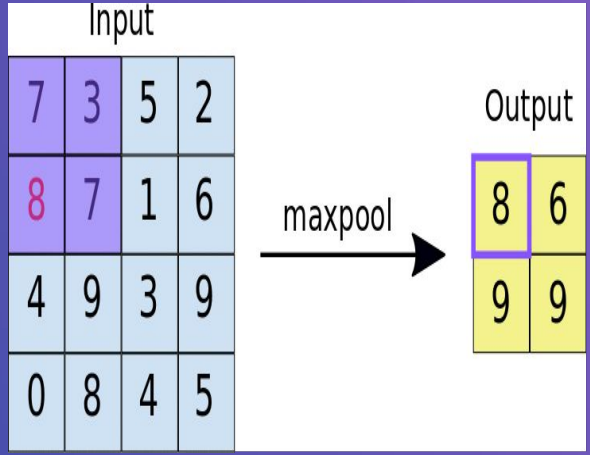
Ability to recognise simple features like **edges & textures** to complex features like **shapes and objects**

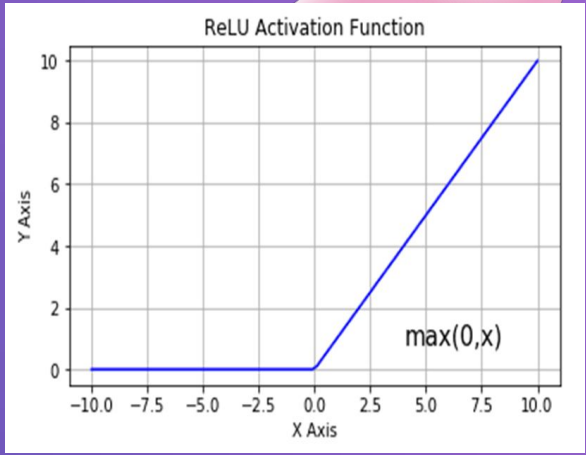
HOW CONVOLUTIONAL NEURAL NETWORKS WORK



CONVOLUTION, MAXPOOLING & ACTIVATION FUNCTION



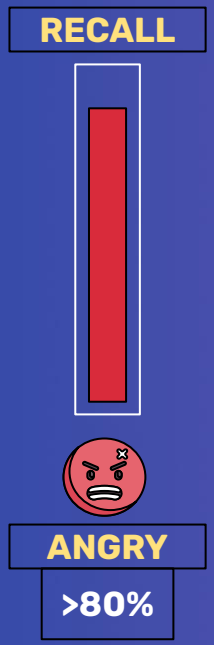




- Convolution is used to extract features from an image
- Max pooling is used to reduce the spatial dimensionality of the features and provide translation invariance

SUCCESS METRIC

- **HIGH RECALL FOR ANGRY FACES**



- **WHAT IS RECALL?**

$$\text{Recall} = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Negatives})}$$

Number of correct positive predictions out of all positive predictions that could have been made

- **WHY RECALL?**

- High importance to correctly classify as many angry customers as possible
- Low consequence with wrongly classifying non angry customers as angry customers

CALLBACKS

Callbacks help to ensure we are getting the best model during the **iterative training process of neural networks**

EARLY STOPPING

Terminates the training process when model performance stops improving

MODEL CHECKPOINT

Saves model when performance of current epoch is better than the previous saved

LEARNING RATE SCHEDULING

Adjust learning rate during training to help prevent model from "memorising"/overfitting to training dataset

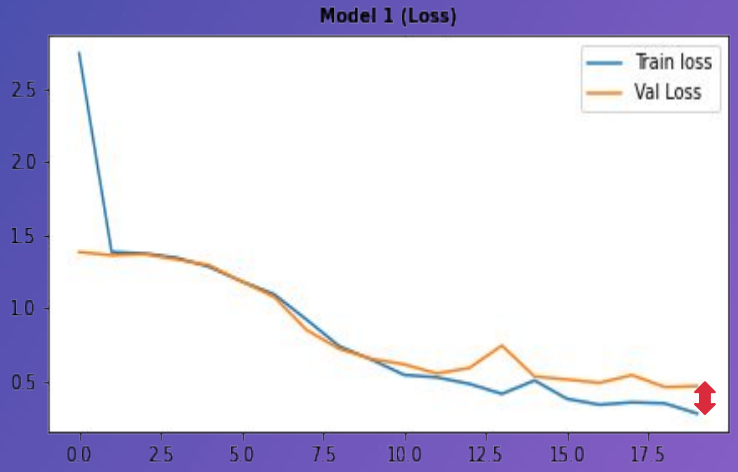
Epoch : An epoch refers to the training of the neural network with all the training data for one cycle

MODEL 1 (BASELINE)

MODEL ARCHITECTURE

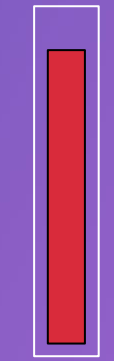
- 2 Layers of Convolution & MaxPooling

TRAINING LOSS CURVE



- Overfitting observed

RECALL



ANGRY

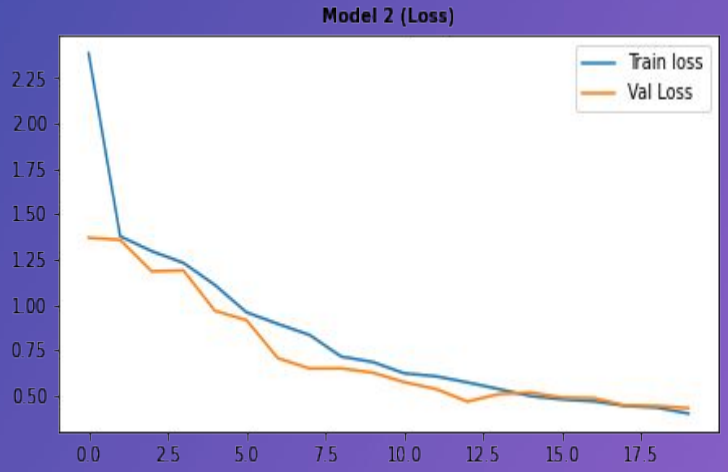
94%

MODEL 2 (MODEL 1 + DROPOUT LAYERS)

MODEL ARCHITECTURE

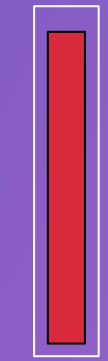
- 2 Layers of Convolution & MaxPooling
- Added Dropout layers to reduce overfitting

TRAINING LOSS CURVE



- Reduction in overfitting

RECALL



ANGRY

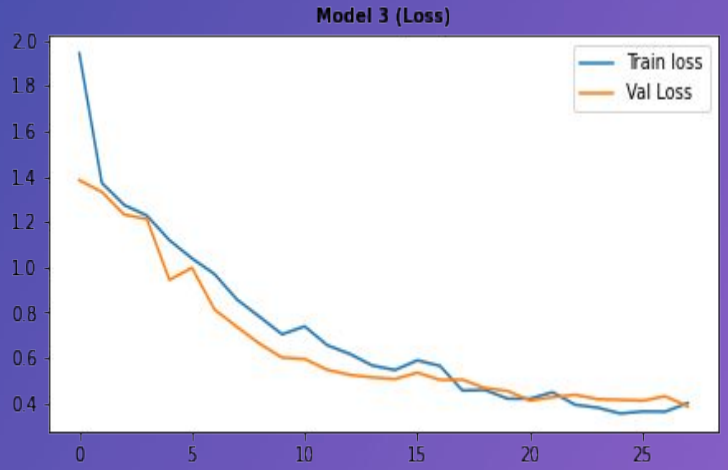
97%

MODEL 3 (MODEL 2 + TUNING)

MODEL ARCHITECTURE

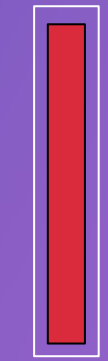
- 2 Layers of Convolution & MaxPooling
- Added Dropout layers to reduce overfitting
- Used KerasTuner to tune model architecture

TRAINING LOSS CURVE



- Reduction in overfitting

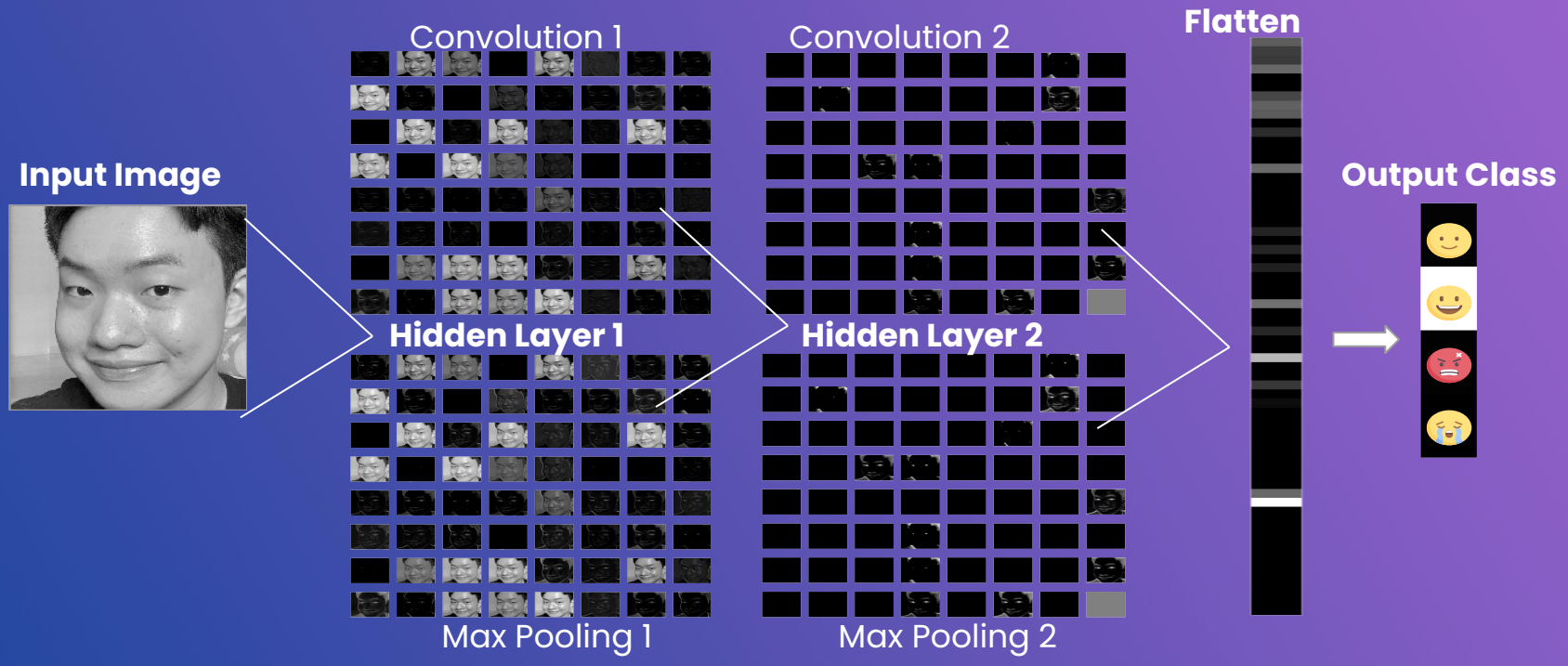
RECALL



ANGRY

100%

VISUALISING THE FINAL MODEL



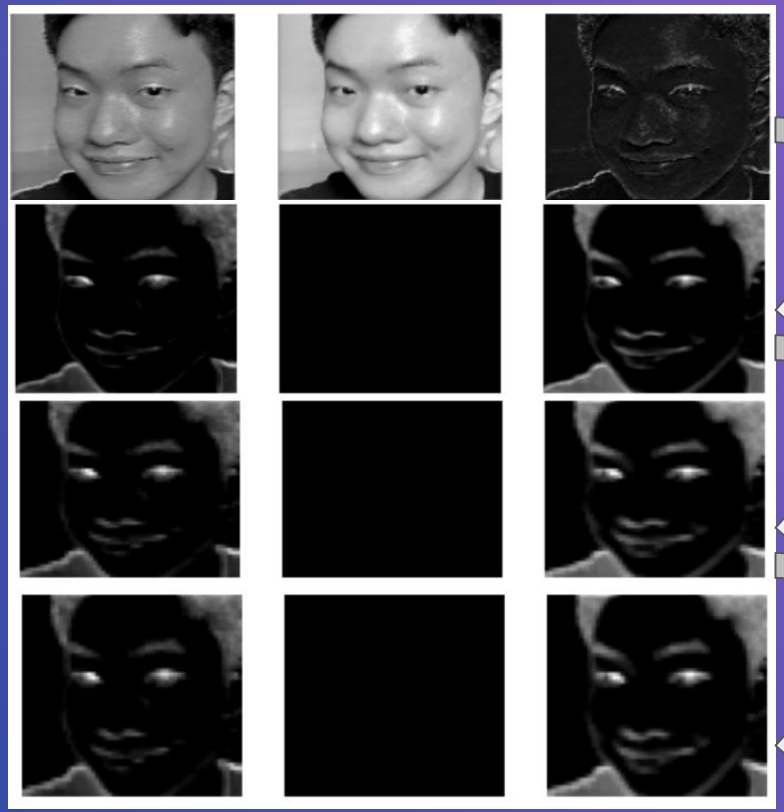
TAKING A CLOSER LOOK

Convolution 1

Max Pooling 1

Convolution 2

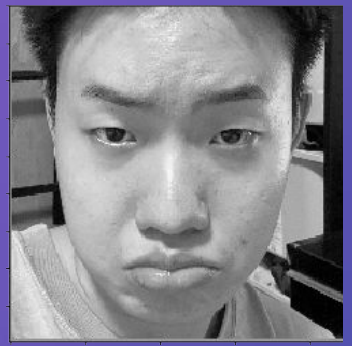
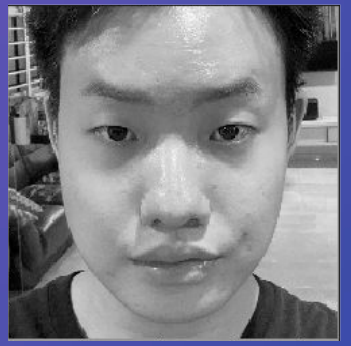
Max Pooling 2



Model extracted features such as eyebrows, eyes and lips

DIAGNOSING MODEL PREDICTIONS

PREDICTED EMOTION

Angry	Angry	Angry
		
Happy	Sad	Neutral

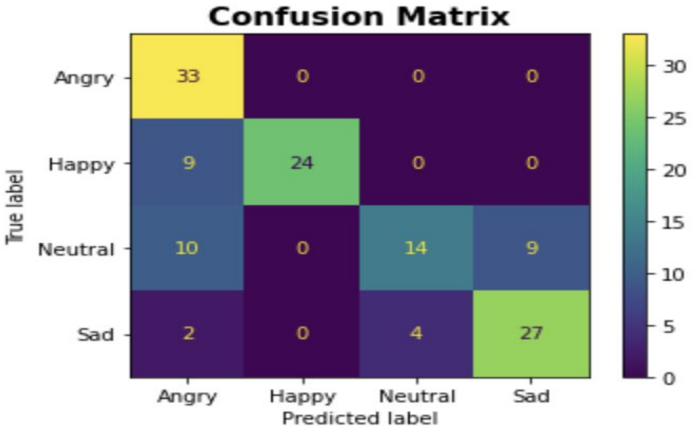
ACTUAL EMOTION

Suspected cause for misclassification : My arched eyebrows

OVERALL MODEL PERFORMANCE

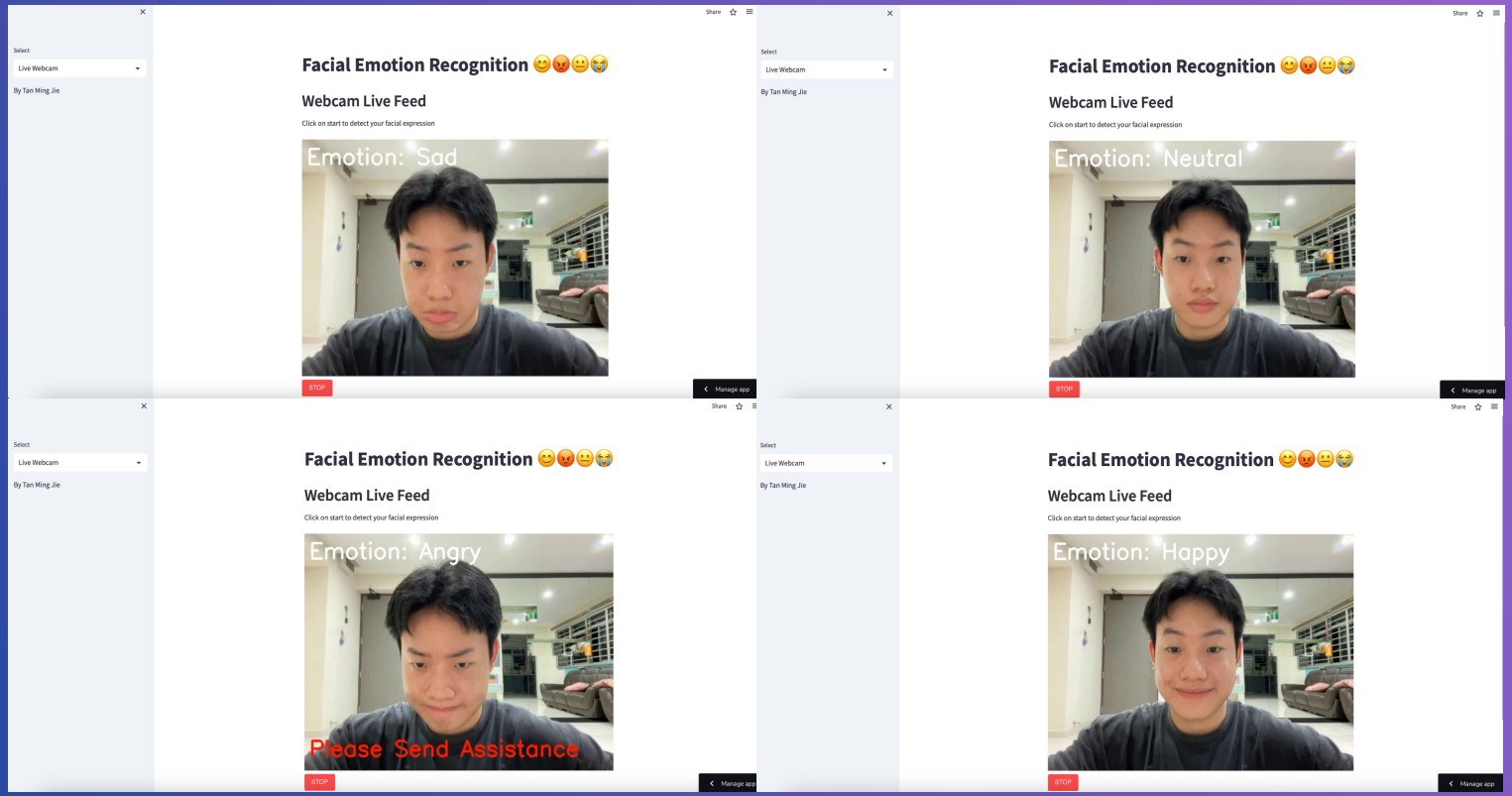
Classification Report:

	precision	recall	f1-score	support
Angry	0.61	1.00	0.76	33
Happy	1.00	0.73	0.84	33
Neutral	0.78	0.42	0.55	33
Sad	0.75	0.82	0.78	33
accuracy			0.74	132
macro avg	0.78	0.74	0.73	132
weighted avg	0.78	0.74	0.73	132



DEPLOYMENT

STREAMLIT.IO LIVE DEMO



CONCLUSION & RECOMMENDATIONS

CONCLUSION

01

BUILT A MODEL
THAT CAN HELP IDENTIFY
ANGRY CUSTOMERS

02

100% RECALL FOR ANGRY
FACES

03

SUCCESSFULLY DEPLOYED
MODEL ON STREAMLIT.IO

LIMITATIONS & RECOMMENDATIONS

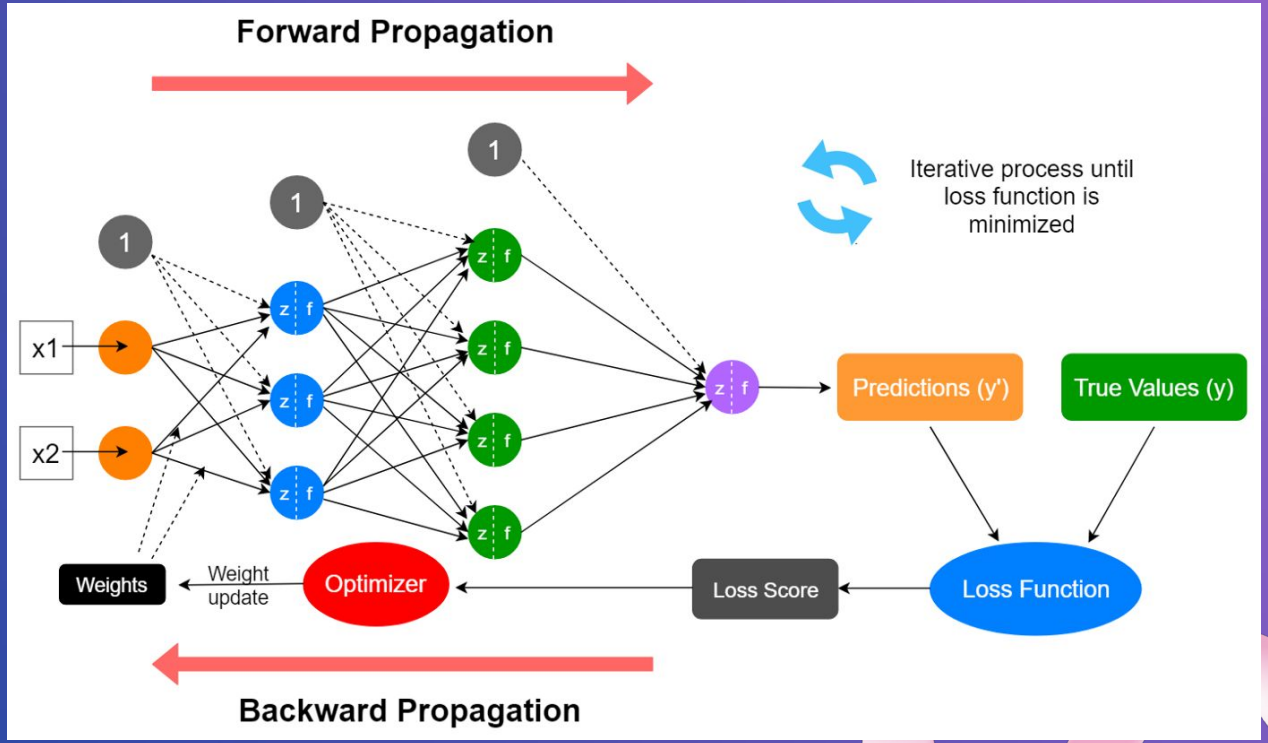
SMALL DATASET		Collect more images to improve model scores
ONLY 4 FACIAL EXPRESSIONS		Collect images of more facial expressions
ONLY TRAINED ON MY FACE		Collect images of other people's facial expressions
TIME		Can train more models with different architectures

Q & A


THANK
YOU!

APPENDIX

WHAT IS A NEURAL NETWORK



DROPOUT LAYER