



FACIAL EMOTION RECOGNITION WEB APPLICATION



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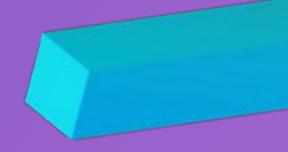
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BACKGROUND & PROBLEM STATEMENT



According to a study published on Forbes,

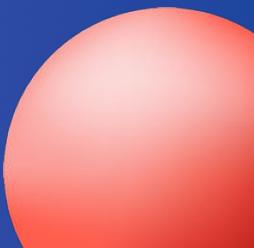
96%

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

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

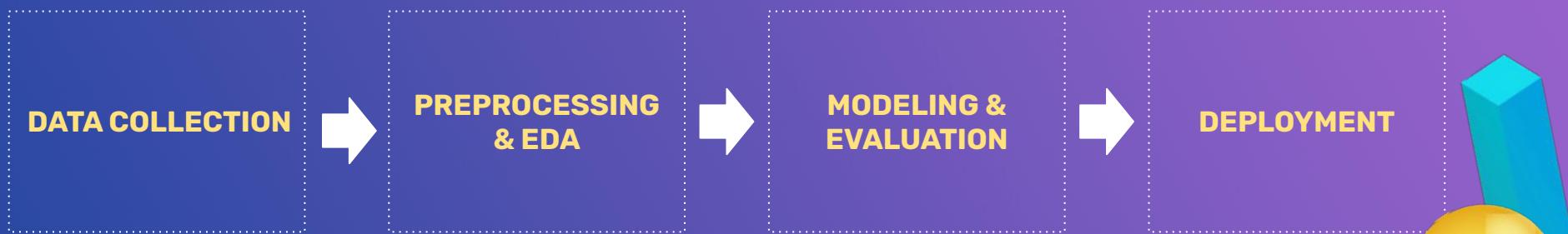


PROBLEM STATEMENT

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

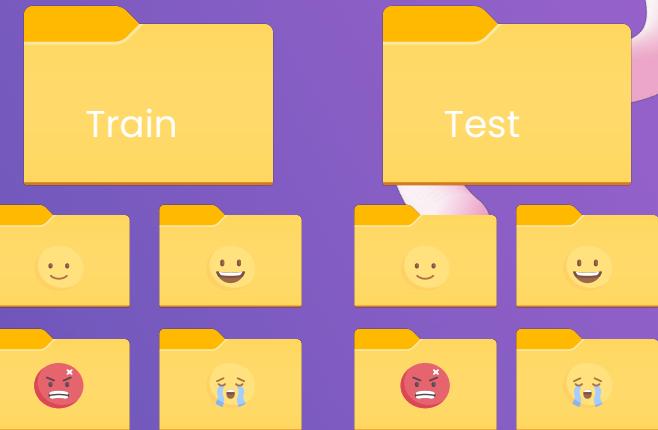
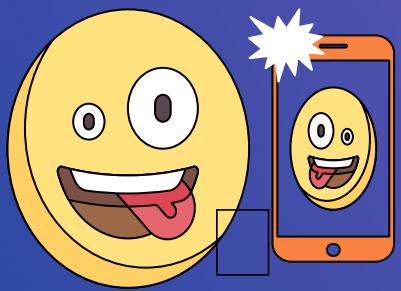


PROJECT WORKFLOW OVERVIEW



DATA COLLECTION

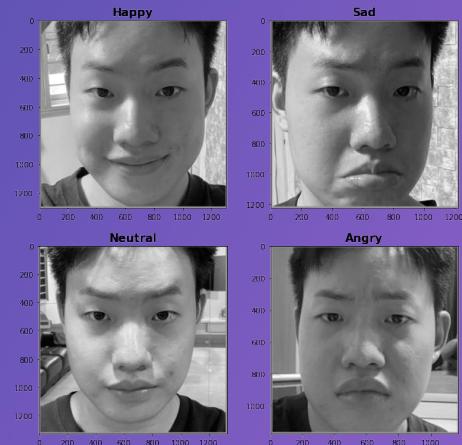
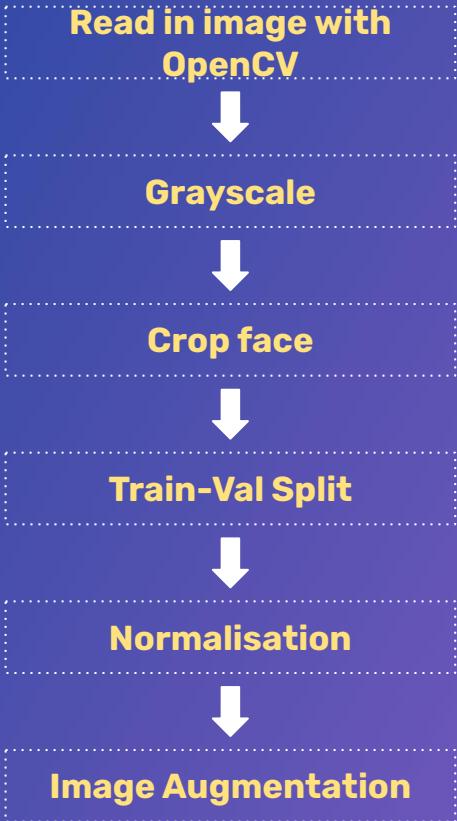
HOW DATA IS COLLECTED & STORED



- 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



Normalisation converts values to range 0 to 1

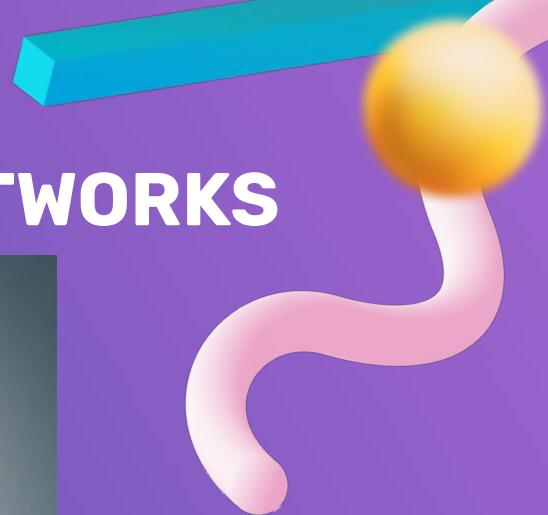
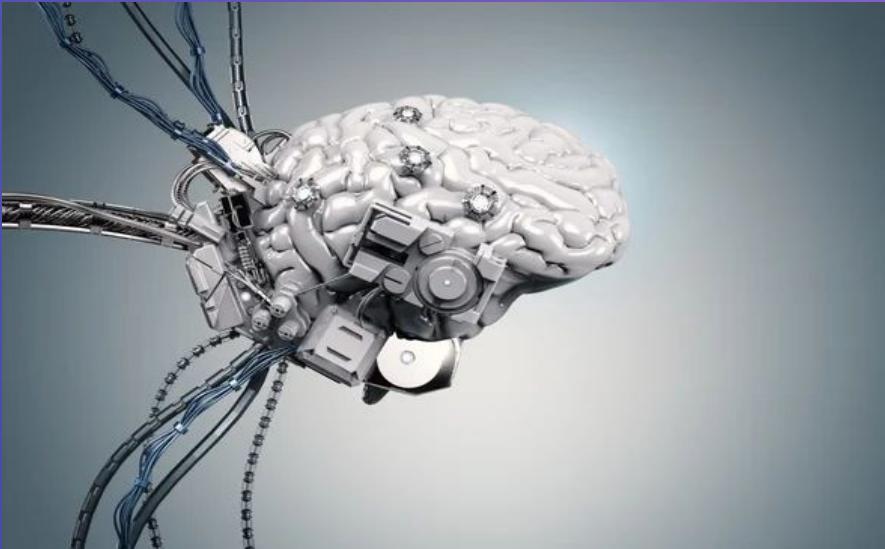
IMAGE AUGMENTATION



- 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

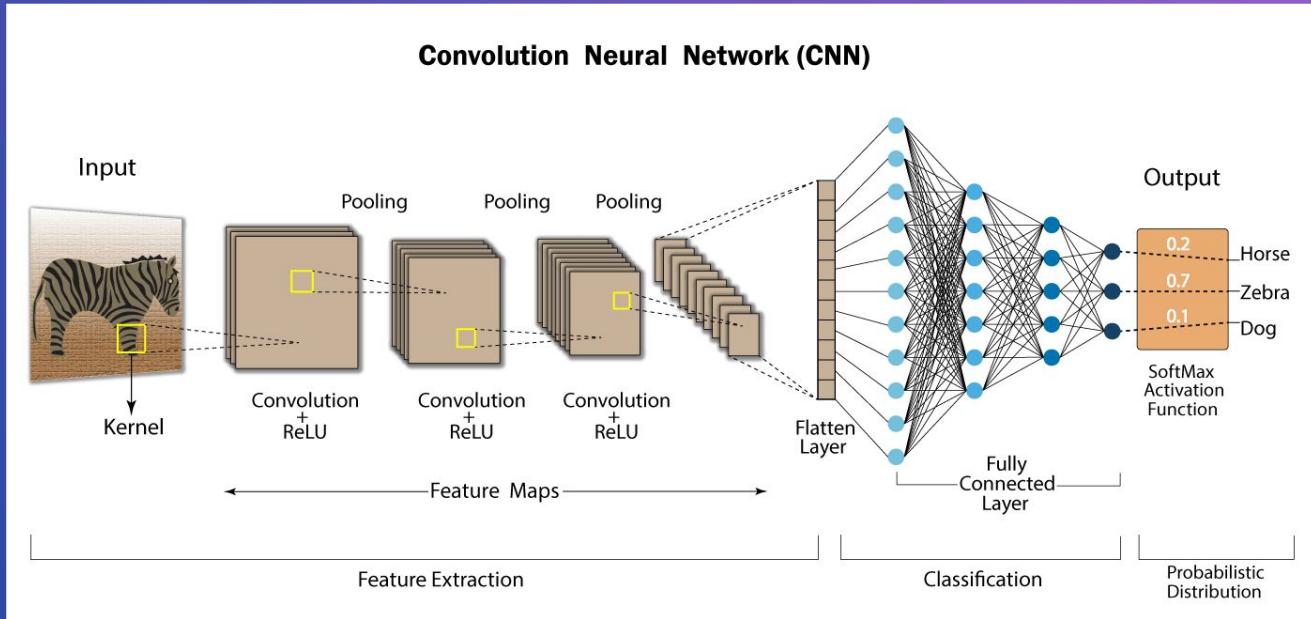
LEARN SPACIAL INVARIANCES

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



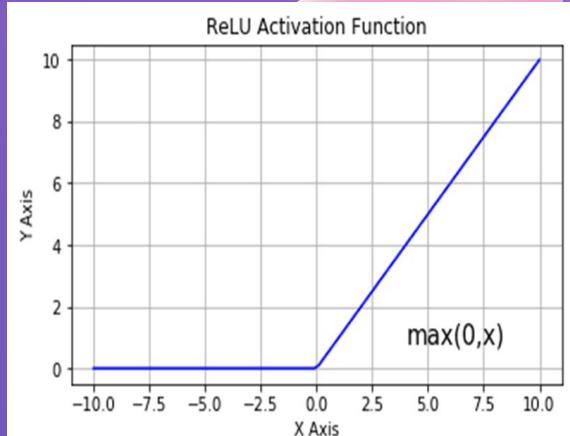
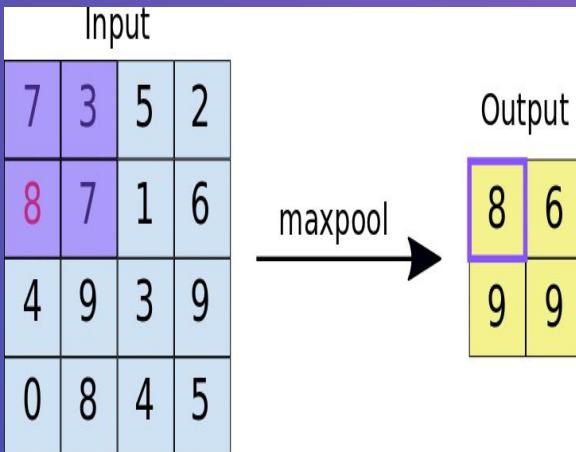
CONVOLUTION, MAXPOOLING & ACTIVATION FUNCTION

1	1	1	0	0
0	1	1	1	0
0	0	1	1	1
0	0	1	1	0
0	1	1	0	0

Image

4		

Convolved Feature

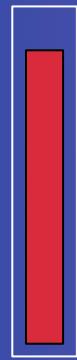


- Convolution is used to extract features from an image
- Max pooling is used to reduce the spatial dimensionality of the features and provide translation invariance

SUCCESS METRIC

- HIGH RECALL FOR ANGRY FACES

RECALL



ANGRY

>80%

- 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

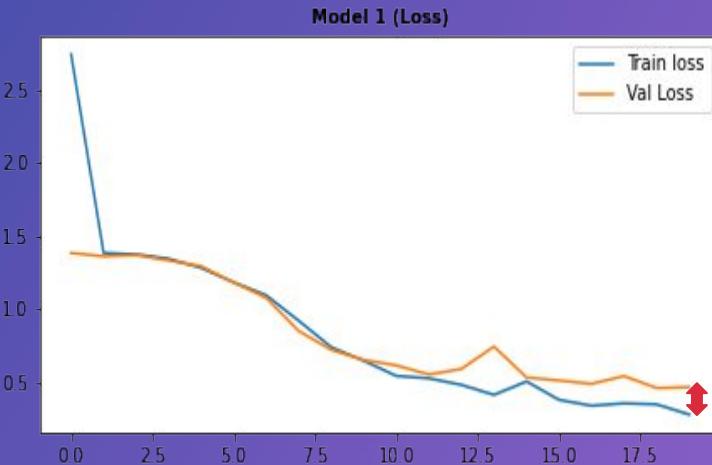
Adjust learning rate during training to help prevent model from “memorising”/overfitting to training dataset

MODEL 1(BASELINE)

MODEL ARCHITECTURE

- 2 Layers of Convolution & MaxPooling

TRAINING LOSS CURVE



- Overfitting observed

RECALL



ANGRY

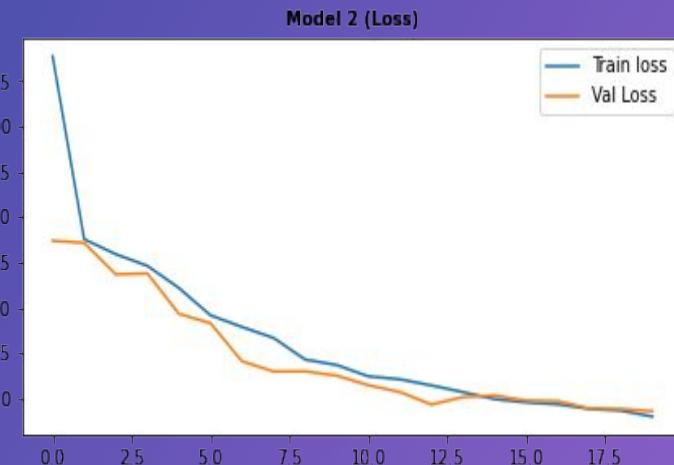
94%

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

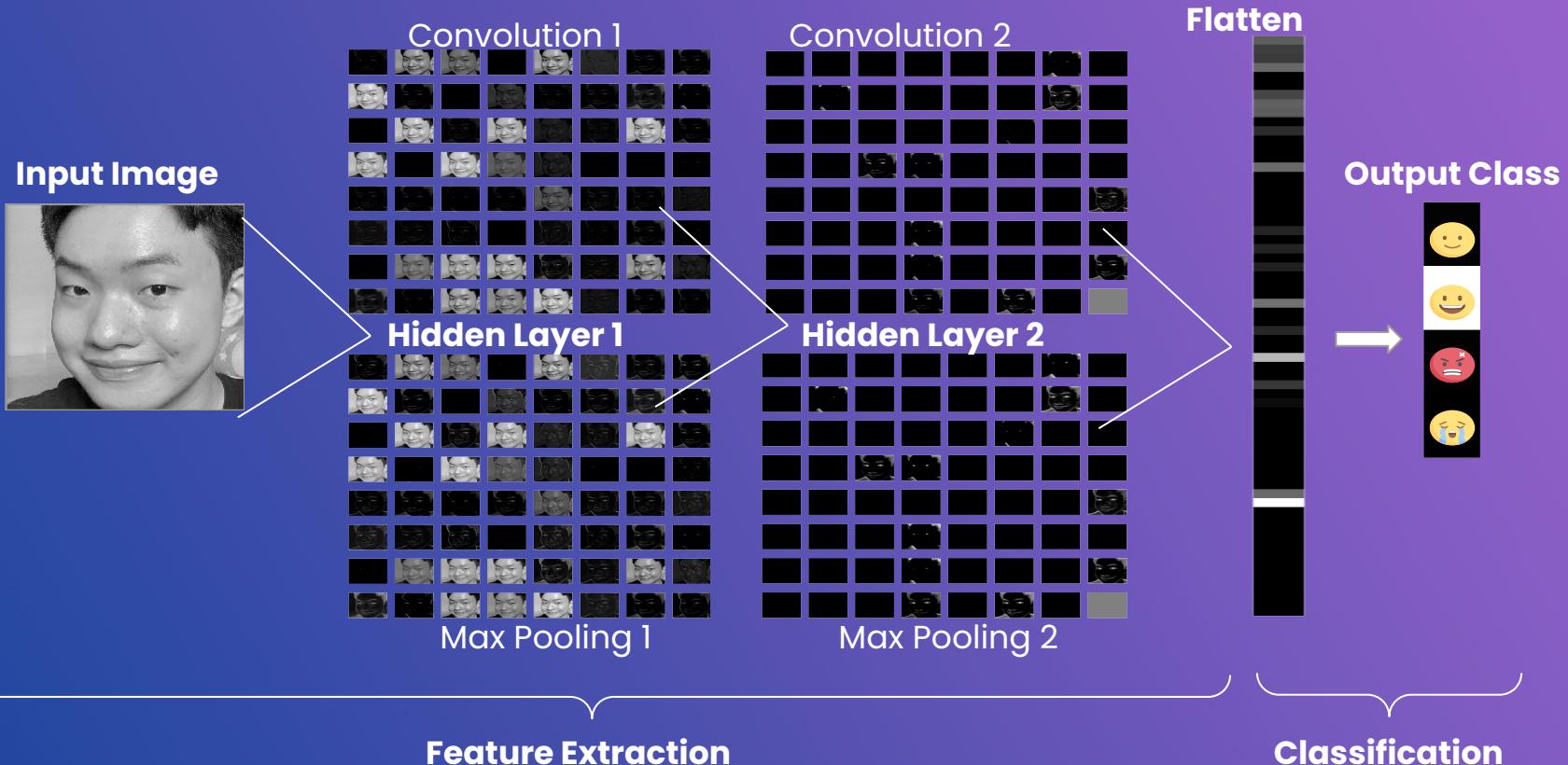
RECALL



ANGRY

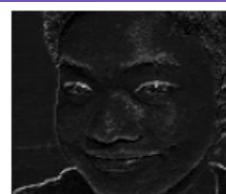
100%

VISUALISING THE FINAL MODEL

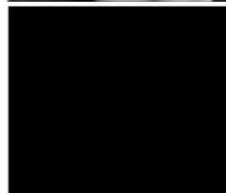


TAKING A CLOSER LOOK

Convolution 1



Max Pooling 1



Convolution 2



Max Pooling 2



Model extracted
features such as
eyebrows, eyes
and lips

DEPLOYMENT

STREAMLIT.IO LIVE DEMO

The image displays four separate Streamlit app interfaces, each showing a live video feed from a webcam and identifying the detected emotion.

- Sad Emotion:** The app title is "Facial Emotion Recognition 😢😢😢😢". The video feed shows a person with the text "Emotion: Sad" overlaid. A red "STOP" button is at the bottom left.
- Neutral Emotion:** The app title is "Facial Emotion Recognition 😊😊😊😊". The video feed shows a person with the text "Emotion: Neutral" overlaid. A red "STOP" button is at the bottom left.
- Angry Emotion:** The app title is "Facial Emotion Recognition 😠😠😠😠". The video feed shows a person with the text "Emotion: Angry" overlaid. A red "STOP" button is at the bottom left. At the bottom of the screen, there is a red banner with the text "Please Send Assistance".
- Happy Emotion:** The app title is "Facial Emotion Recognition 😃😃😃😃". The video feed shows a person with the text "Emotion: Happy" overlaid. A red "STOP" button is at the bottom left.

Each Streamlit app interface includes a sidebar on the left with a "Select" dropdown set to "Live Webcam" and a "By Tan Ming Jie" link. A "Manage app" button is located at the top right of each window.

CONCLUSION & RECOMMENDATIONS

CONCLUSION



01

BUILT A MODEL
THAT CAN HELP IDENTIFY
ANGRY CUSTOMERS

03

SUCCESSFULLY DEPLOYED
MODEL ON STREAMLIT.IO

02

100% RECALL FOR ANGRY
FACES





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



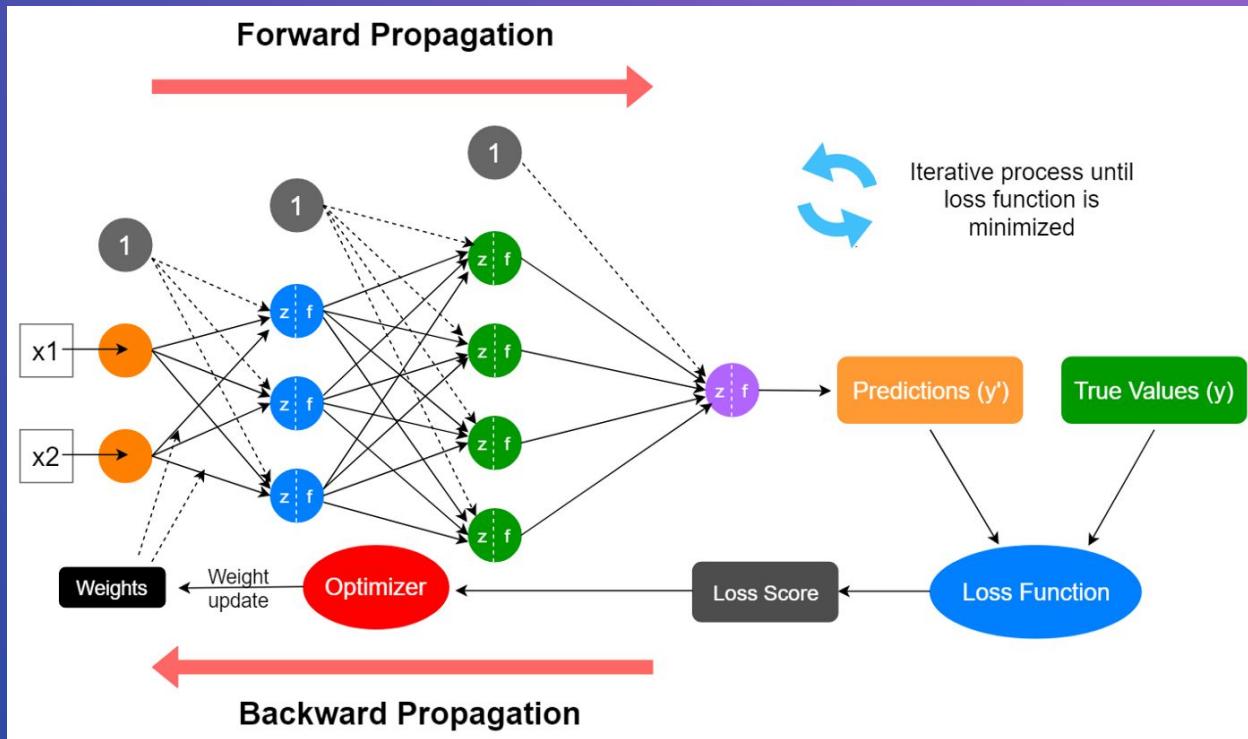
THANK YOU!



APPENDIX



WHAT IS A NEURAL NETWORK



DROPOUT LAYER

