EMOtion CLASSifier

PROJECT4 GROUP1

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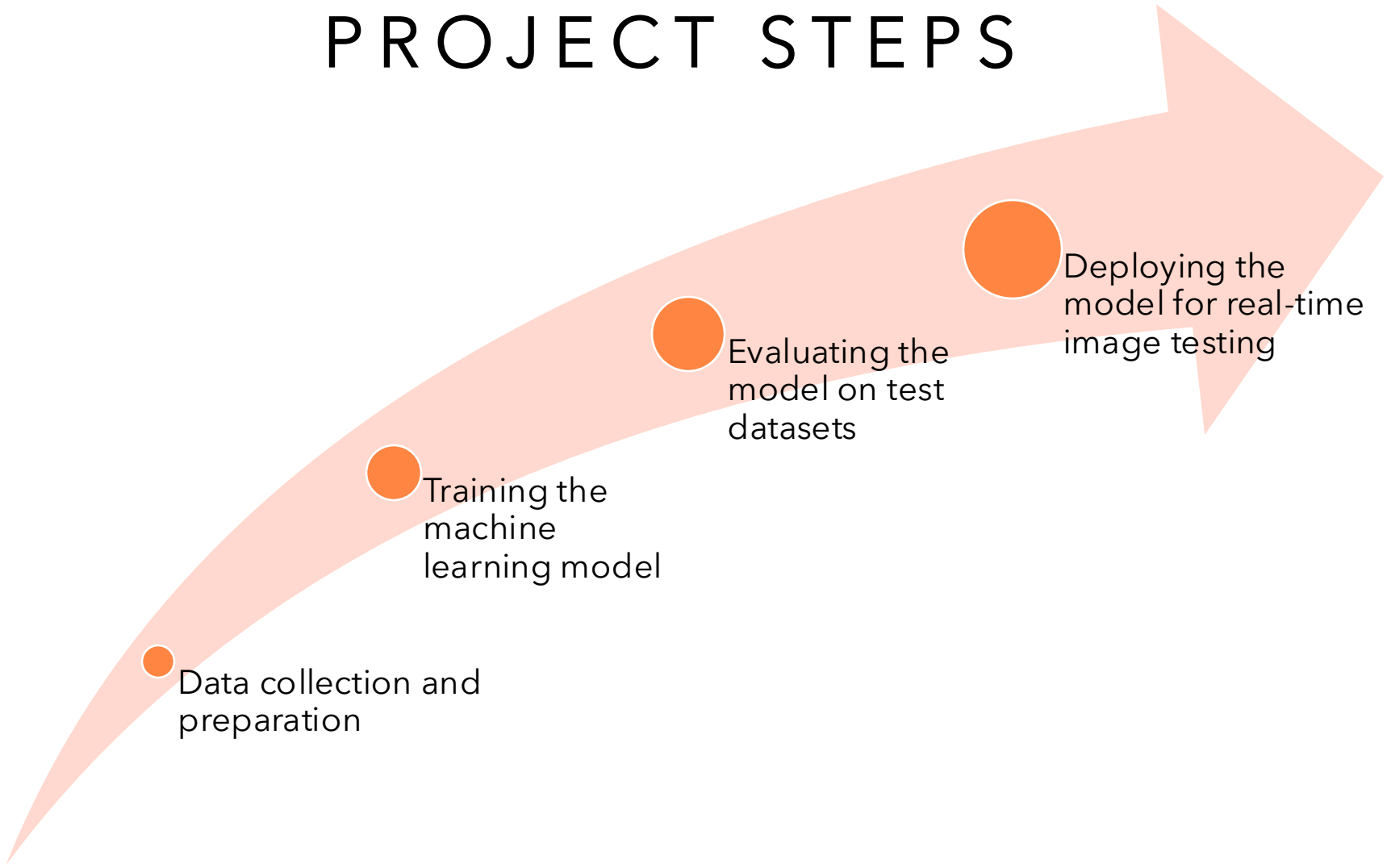
SCOPE

- **Goal**: Develop a machine learning model to detect and classify facial expressions as "happy" or "sad".
- **Dataset**: Downloaded 166 Happy photos and 100 Sad photos from various website.
- **Relevance**: The project is relevant in fields such as psychology, social sciences, and human-computer interaction.

RESEARCH QUESTIONS

1. Can the model accurately classify facial expressions as happy or sad?
2. Does the model perform equally well across different demographic groups?
3. Can the model detect mixed emotions?

PROJECT STEPS



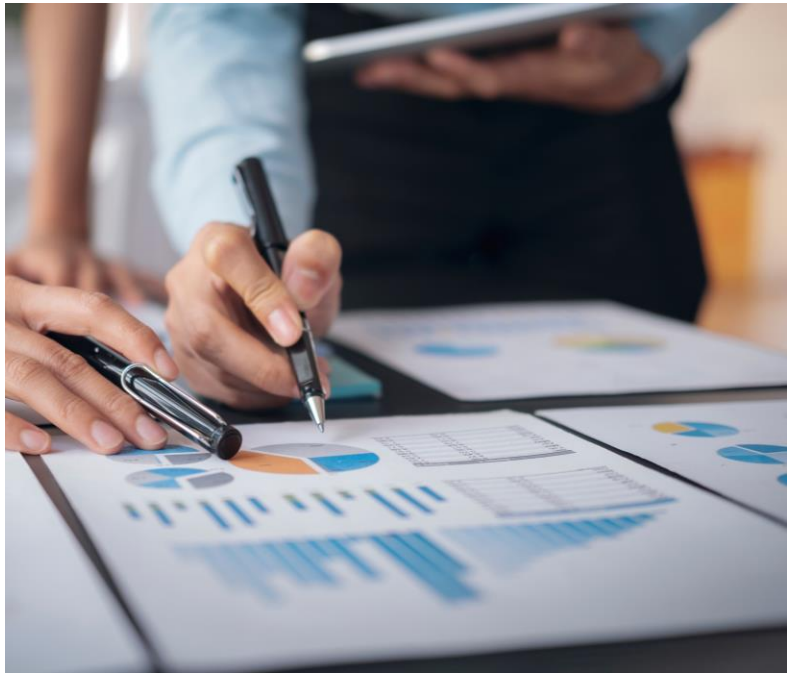
DATA SOURCE

Dataset Source: The dataset is sourced from gettyimages & istockphoto website.

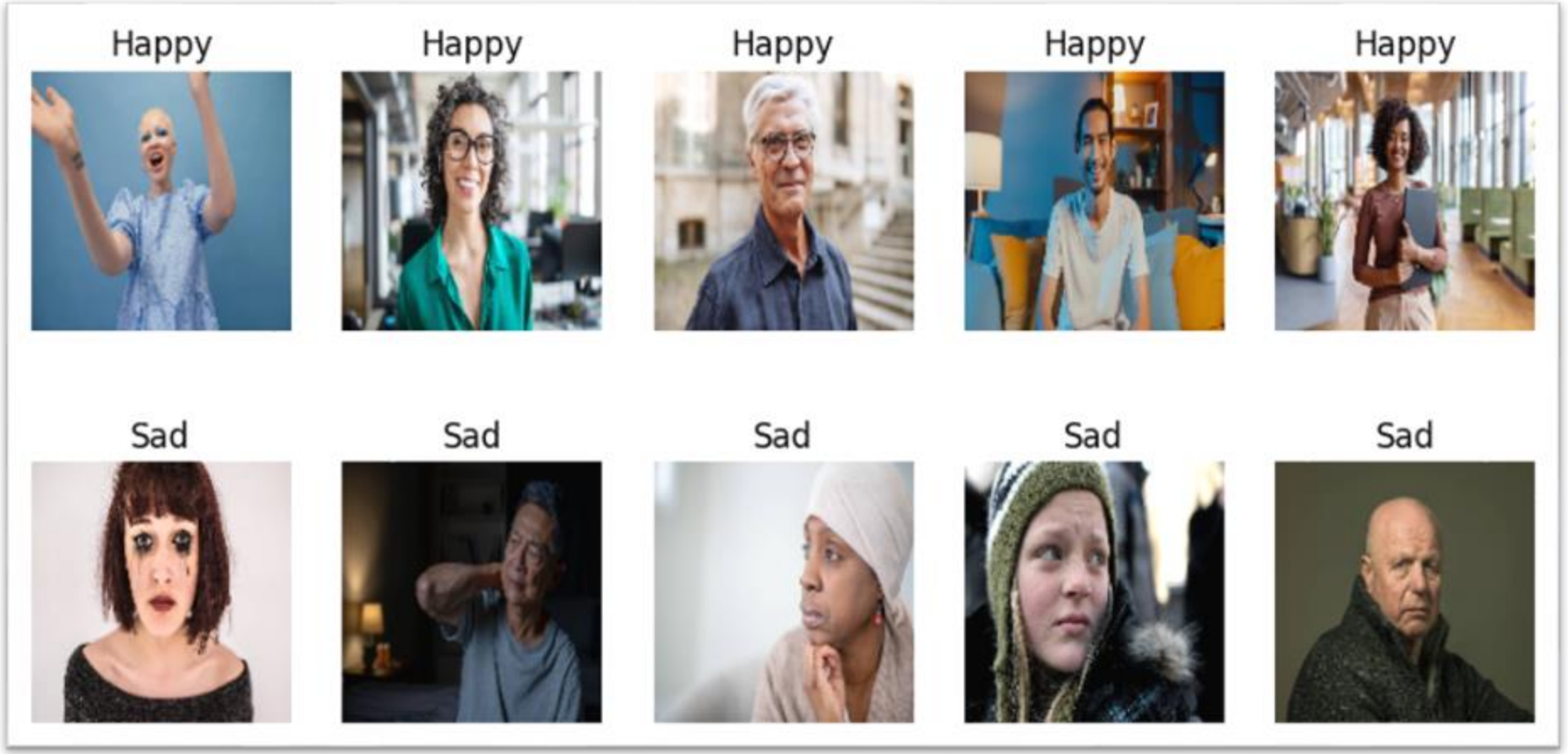
Links:

- https://www.gettyimages.com.au
- https://www.istockphoto.com

Details: The dataset contains a diverse collection of images labeled as "sad" and "happy," suitable for training and testing the emotion classification model



DATASET VALIDATION



DATA PREPARATION

Data Collection:

- Loaded 166 Happy and 100 Sad images from respective directories.

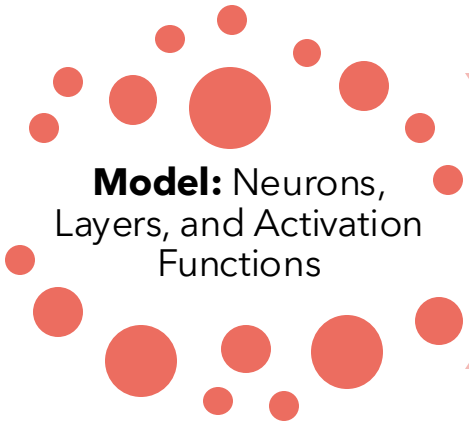
Preprocessing Steps:

- Resizing**:** Images resized to 150x150 pixels.
- Labeling**:** Assigned labels (Happy/Sad) to each image.
- Shuffling: Data shuffled for randomness.

Data Preparation:

- Splitting**:** Stratified split into training and testing sets.
- Normalization**:** Image pixels normalized to [0,1] range.
- One-Hot Encoding**:** Labels converted to one-hot format.

MODEL DEVELOPMENT



Model: Neurons, Layers, and Activation Functions

Input Layer: Pre-processed image data.

Hidden Layers: Multiple layers with ReLU to capture complex patterns.

Output Layer: Single neuron with Sigmoid for sad/happy classification.

KEY LAYERS IN THE MODEL

Conv2D (Convolutional Layer): Core of CNN, applies filters to detect features like edges and textures.

MaxPooling2D (Pooling Layer): Reduces feature map size, aiding in downsampling and overfitting control.

BatchNormalization: Normalizes layer output for faster training, better stability, and higher learning rates.

MODEL IMPROVEMENT ATTEMPTS

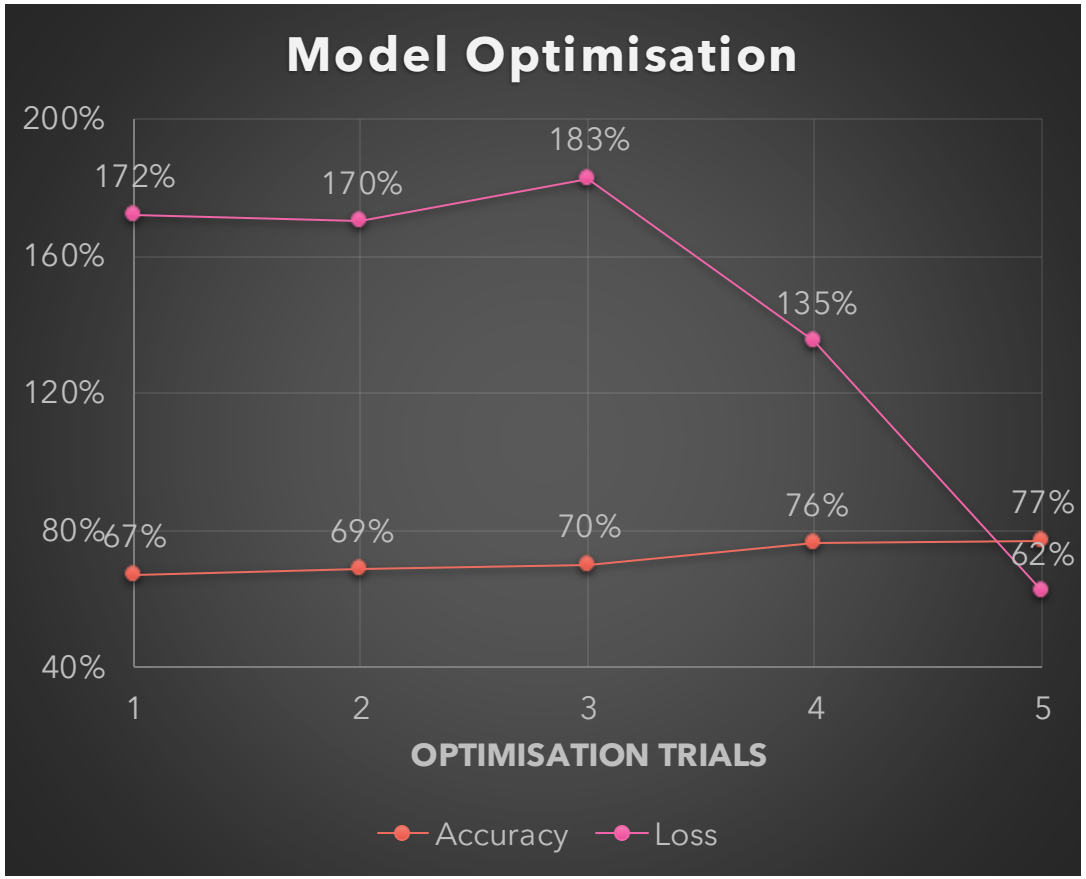
Attempt 1: Added more convolutional layers with increased filters.

Attempt 2: Further increased filter count in convolutional layers.

Attempt 3: Introduced an additional convolutional layer with 32 filters.

Attempt 4: Used Keras Tuner for hyperparameter optimization.

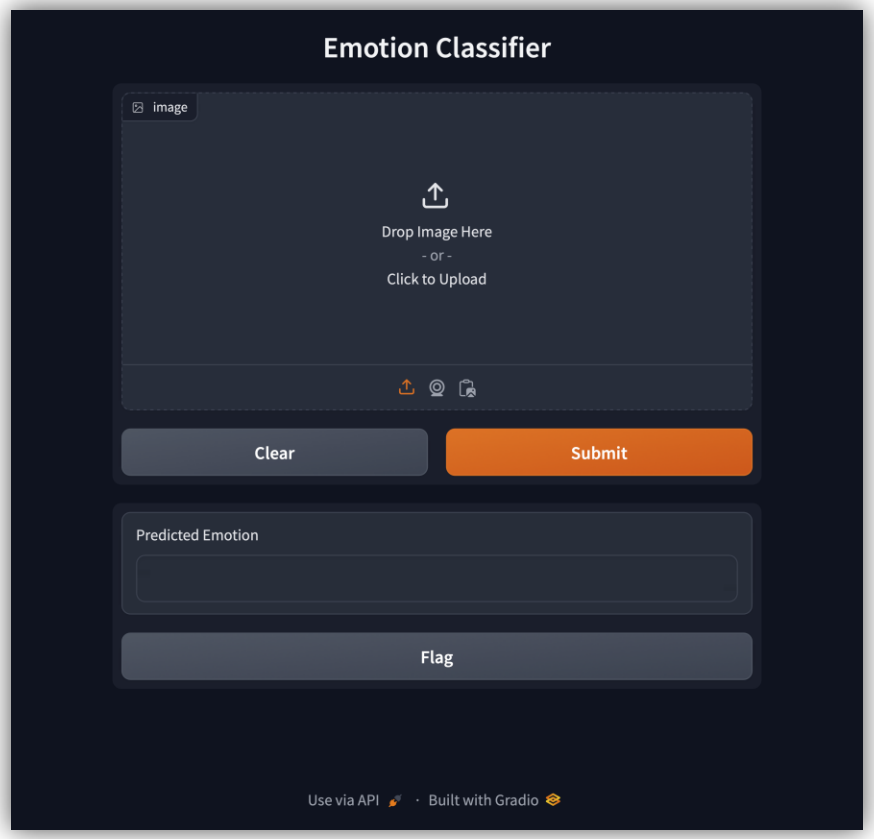
Attempt 5: Added batch normalization to optimized model for better stability and accuracy.



DEPLOYING THE MODEL

Deploying the model for real-time image testing using Gradio.

The model is designed to be deployed as a platform where users can upload photos, and the model automatically classifies them into happy or sad categories.




```
# Load trained model
model = tf.keras.models.load_model('Models/EmotionClassifierOptimize3.h5')
```

```
(dev) yaushuwong@MacBook-Pro Emotion_Classifier % python app.py
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be built. `model.compile_metrics`
Running on local URL:  http://127.0.0.1:7860
Running on public URL: https://9ac0ce12fef586b10a.gradio.live
```

CAN THE MODEL ACCURATELY CLASSIFY FACIAL EXPRESSIONS AS HAPPY OR SAD?

```
1  # Evaluate the model on the normalized test data and encoded test labels, returning the accuracy
2
3  accuracy = model.evaluate(X_test_normalized, y_test_encoded, verbose=2)
```

```
3/3 - 1s - 375ms/step - accuracy: 0.7761 - loss: 0.6248
```

DOES THE MODEL PERFORM EQUALLY WELL ACROSS DIFFERENT DEMOGRAPHIC GROUPS?

Test Scope:

- Gather 5 off pictures of each age groups:
  - Toddler | Children | Teenager | Adult | Seniors
- Gather 5 off pictures of each human diversity:
  - Hispanic | South Asians | East Asians | Caucasian | African
- Find the prediction accuracy for each category.

AGE GROUP

Age Category	Result 1	Result 2	Result 3	Result 4	Result 5	Success Rate
Children	wrong	correct	wrong	wrong	correct	40%
Toddler	correct	correct	correct	wrong	wrong	60%
Teenager	wrong	wrong	correct	correct	correct	60%
Senior	correct	wrong	correct	correct	wrong	60%
Adult	wrong	correct	correct	wrong	correct	60%

HUMAN DIVERSITY

Race	Result 1	Result 2	Result 3	Result 4	Result 5	Success Rate
South Asians	wrong	correct	wrong	wrong	correct	40%
Caucasian	wrong	wrong	correct	correct	correct	60%
Hispanic	wrong	correct	correct	wrong	correct	60%
East Asian	correct	correct	correct	correct	wrong	80%
African	wrong	wrong	correct	correct	correct	80%

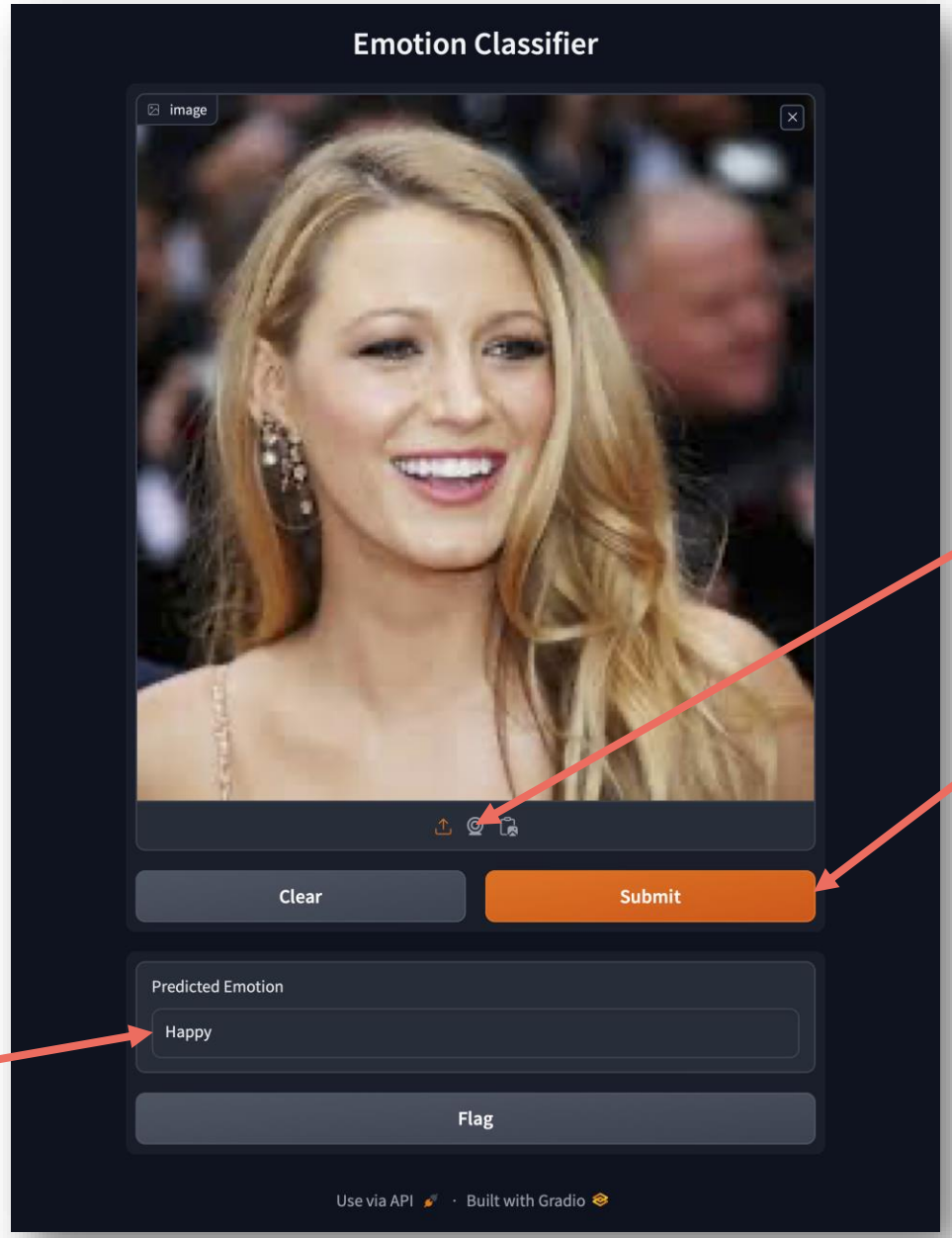
CAN THE MODEL DETECT MIXED EMOTIONS?

Detection of Mixed Emotions:

The model, in its current form, is a binary classifier that distinguishes between happy and sad expressions. It does not detect mixed emotions or provide nuanced classifications like "slightly happy" or "neutral."

DEMO

Try it out!



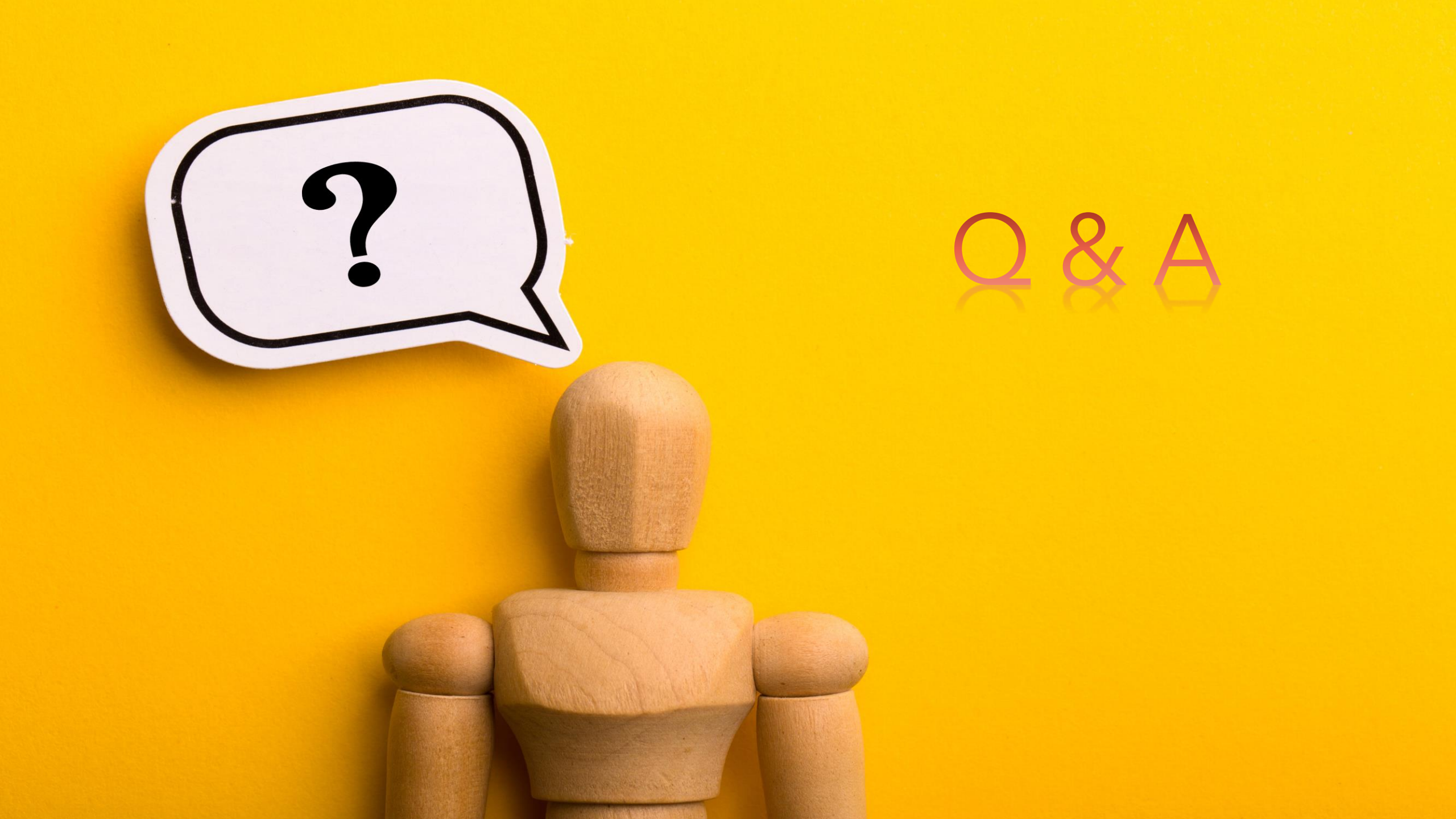
CONCLUSION

- **Recap:** The emotion detection model developed provides a foundational approach to identifying emotional states from facial images. While it achieved moderate success, there is room for further improvement.
- **Significance:** This project highlights the potential of machine learning in emotion detection, with future enhancements possibly leading to more accurate and refined models, benefiting fields like psychology and human-computer interaction.

RECOMMENDATIONS

- **Ensemble Methods:** Consider exploring ensemble methods such as Random Forest or Gradient Boosting for potentially better performance.
- **Feature Engineering:** Invest in feature engineering techniques to extract more informative features from the image data.
- **Hyperparameter Tuning:** Continue experimenting with different hyperparameters and model architectures to enhance performance.
- **Datasets:** Find better quality portraits with more variety and categories. Increase the number of datasets from 200+ to 2,000+ or more.


THANK YOU
Special thanks to Camilo & Jeff for carrying us through!
Congrats to everyone for finishing the course!


?
Q & A