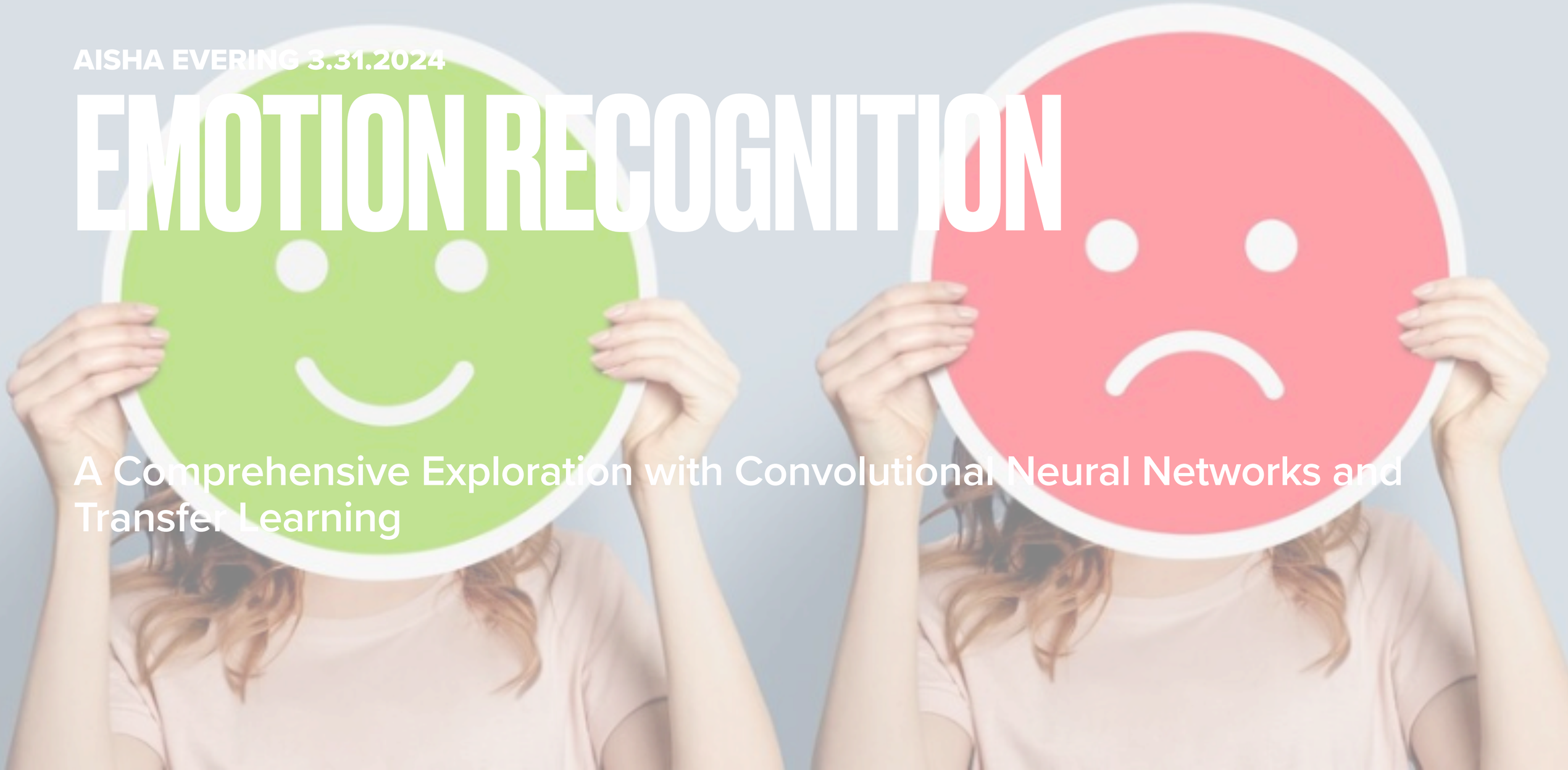
AISHA EVERING 3.31.2024

# EMOTION RECOGNITION



## A Comprehensive Exploration with Convolutional Neural Networks and Transfer Learning

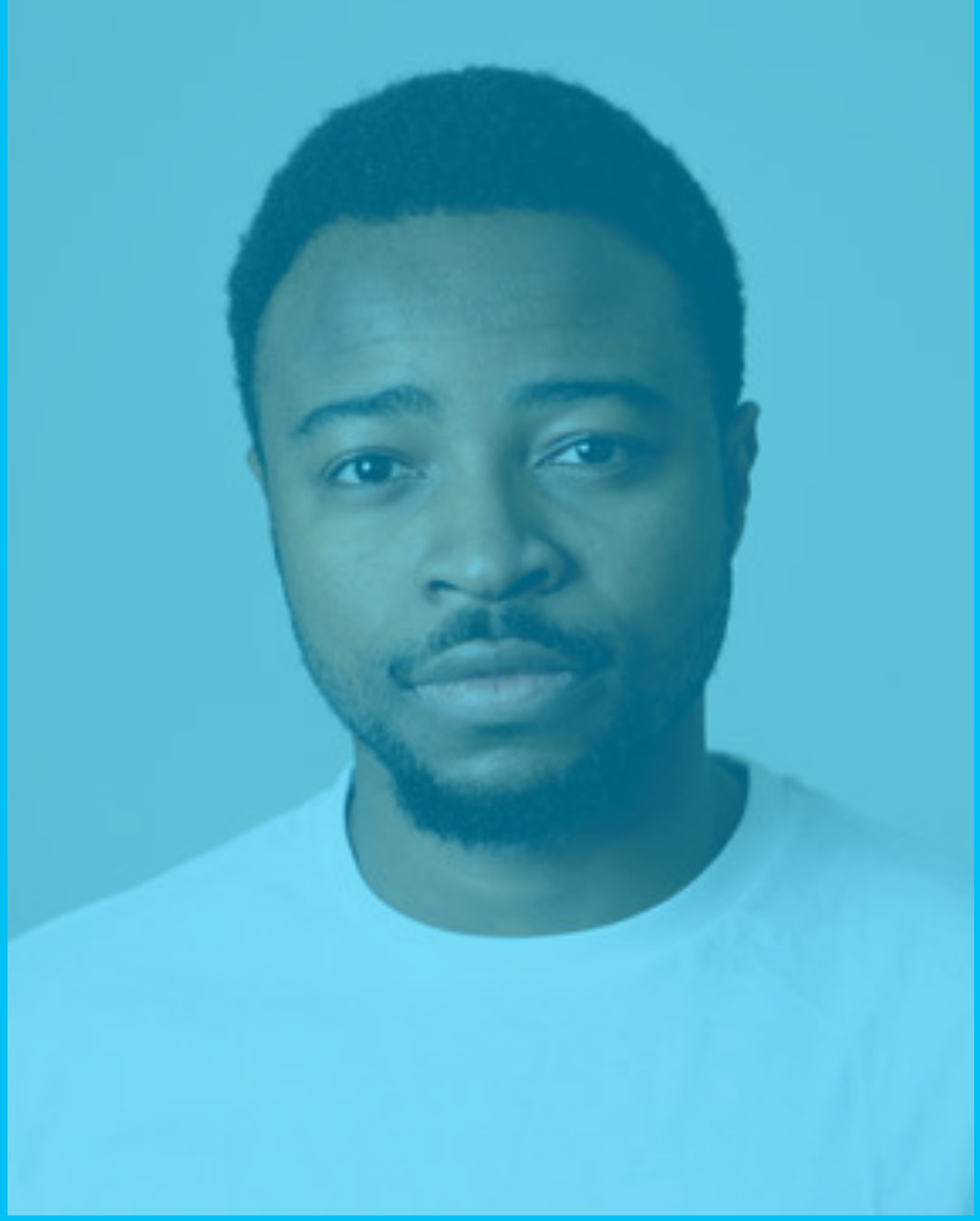
# PROBLEM DEFINITION

Currently, shopping experiences lack adaptation to customers' emotional states.

Is it possible to detect customers' emotional states and tailor their shopping experiences accordingly?

# PROBLEMS TO SOLVE

- Within the data what are the key nuances that distinguish one emotion from another?
- Can we use Convolutional Neural Networks perform well when detecting these nuances?
- Will using transfer learning techniques with pre-trained models give us better results?
- Will the black and white images be easier to detect than colored images?




# DATA EXPLORATION

- After viewing the data, it appears the neutral emotions are the most subtle. This means they could easily be mistaken for sadness or perhaps happiness.
- In the surprise emotion dataset, a significant number of individuals were observed with their mouths open, reminiscent of an expression of astonishment or awe. I was concerned the models would zone in on that visual cue.
- Like the surprise emotion, the happy emotion had a significant visual cue of smiling.
- I hoped that the models would not only focus on the obvious cues, such as open or smiling mouths, but also take into account the expressions of the eyes.

# FEATURE IMPORTANCE

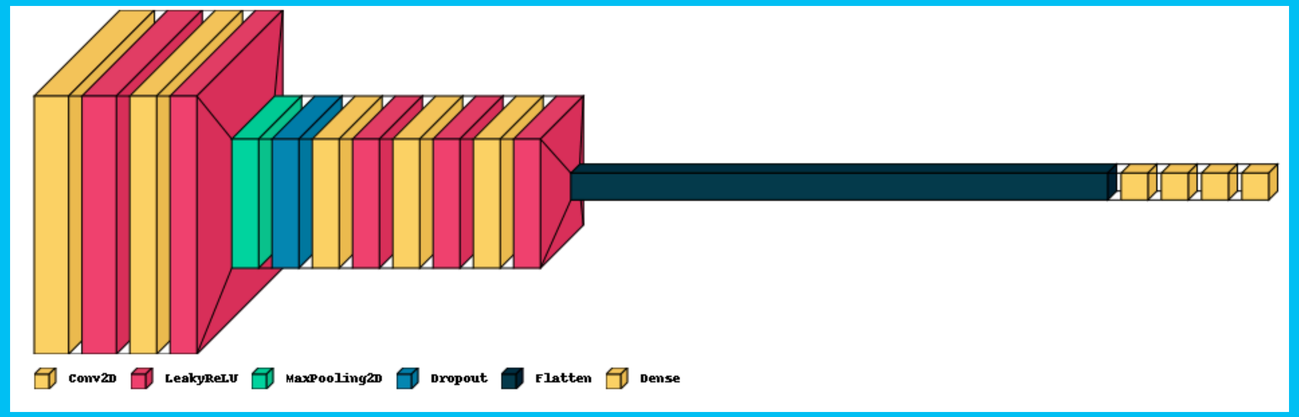
## From Multiple Models




- The images show highlighted areas where the models found the most significant when categorizing the images.
- Most models focused on the mouth area as expected.
- But also a lot of the models focused on other areas like the eyes, hands, and the cheek area.

# PROPOSED MODEL SOLUTION

- Convolutional Neural Network model with at minimum 1,401,716 trainable parameters.
- It has given the best performance on unseen data.
- It performs slightly better on RGB images vs grayscale.
- It doesn’t indicate any overfitting on the training data.
- It focuses not only on the mouth but also the eyes in order to categorize the images.
- It made very few errors on the validation data.  The lowest f1-score was 59% on the sad emotion.



# PROPOSED BUSINESS SOLUTION

- Improving customer experience leads to enhance sales and brand loyalty. Integrating emotion recognition into recommendation systems to provide personalized product recommendations will achieve this.
- Implement systems that detect customers' emotions in real-time during their shopping experience, allowing the business to adapt their offerings.
- Invest in larger datasets of colored diverse images with noisier backgrounds to make the models more robust.

# CHALLENGES

- What ethical considerations need to be taken into account regarding the use of computer vision technology?
- How will privacy concerns be addressed, particularly regarding the collection and use of facial data?
- What are the implications of using facial images of minors?
- Obtaining informed consent from individuals whose facial data is being collected and analyzed is essential.
- Emotions and facial expressions can vary across cultures, and what may be considered a normative expression in one culture may not be in another.  It's crucial to ensure diversity in the data collected, encompassing a range of races and cultures.


THANK YOU

# APPENDIX

# MODEL COMPARISON

| Model | Training Data Accuracy | Validation Data Accuracy | Test Data Accuracy |
|---|---|---|---|
| CNN Model 3 | 69% | 73% | 73% |
| VGG16 Model 2 | 42% | 47% | 70% |
| RGB Model | 60% | 68% | 68% |
| Grayscale Model | 63% | 71% | 66% |
| CNN Model 2 | 62% | 68% | 66% |
| ResNet V2 Model | 52% | 57% | 55% |
| VGG16 Model 1 | 48% | 52% | 51% |
| EfficientNet Model | 27% | 37% | 25% |

# PREDICTIONS ON TEST AND TRAIN DATA

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Maximum Training Accuracy Score: 68.97%
Maximum Validation Accuracy Score: 72.92%
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