

# BUILDING A FACIAL EXPRESSION CLASSIFIER USING CNN

THINKFUL DATA SCIENCE FINAL CAPSTONE PRESENTATION

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# THE TASK

- **TO BUILD A FACIAL EXPRESSION CLASSIFIER TRAINED TO RECOGNIZE CERTAIN FACIAL CHARACTERISTICS USING CNN**
  - Determine the sex from a photo of the face
  - Distinguish the facial expression from a photo of the face

# THE BUSINESS VALUE

- **DEVELOP AN APP FOR HR/ WELLNESS PURPOSES**
  - Take a snapshot of subject's face, determine facial expression
  - Combine visual input with spoken/ typed responses to brief questionnaire
  - Pitch to Human Resources departments, care facilities as a supplement to wider wellness/ mental health initiatives
  - Effectiveness and commercial value dependent on predictive accuracy

# THE DATASET

- **10K US ADULT FACES DATABASE**
- **~ 300 SCRAPED IMAGES**

# ORIGINAL DATASET



- Muted facial expressions
- Neutral, Happy, Sad, Angry, Surprised, Disgusted
- Class imbalance in favor of neutral, happy

# THE WEB SCRAPER



- **BEAUTIFUL SOUP**

Use search strings in various languages

'<https://images.search.yahoo.com/search/images.....>'

sadness\_url =

miserable\_url =

surprise\_url =

visage\_surpris\_url =

angry\_url =

cara\_de\_enojado\_url =

# SCRAPED IMAGES



- More exaggerated facial expressions
- Large variation in image size, quality

# THE MODEL



- **VGG16**

- Built for Imagenet Competition 2014
- Employ Transfer Learning
- 1000 outcome classes
- Remove last layer and add layer for own output classes
- All layers 'trainable=False' except final layer
- Data Augmentation
- Dataset split into training, validation and test sets

# MALE VS FEMALE

**55%**



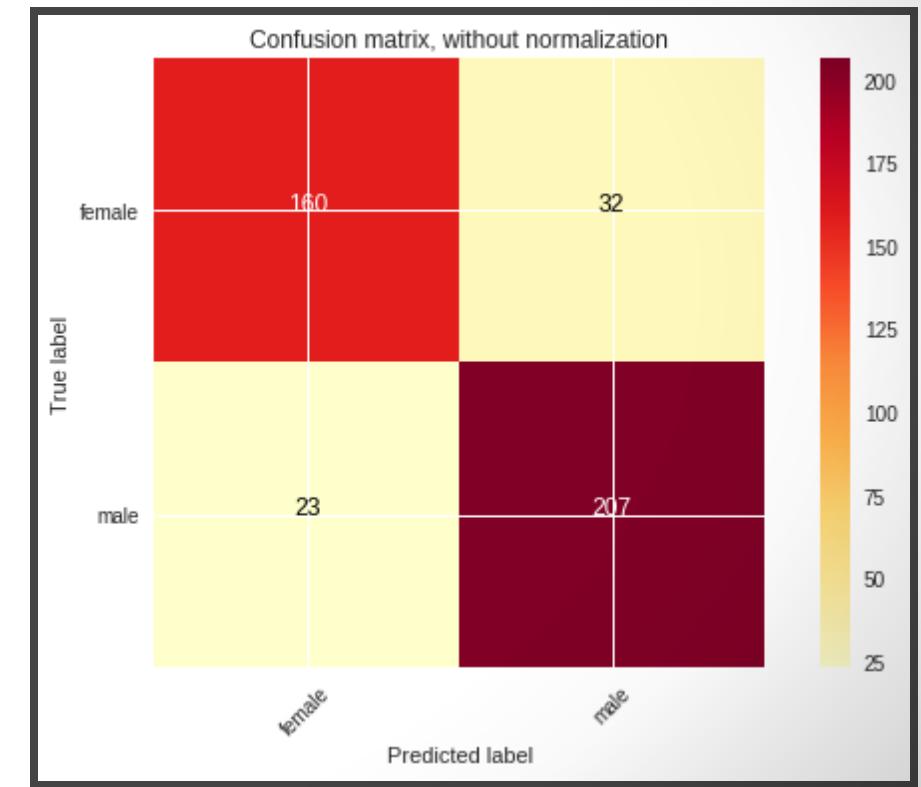
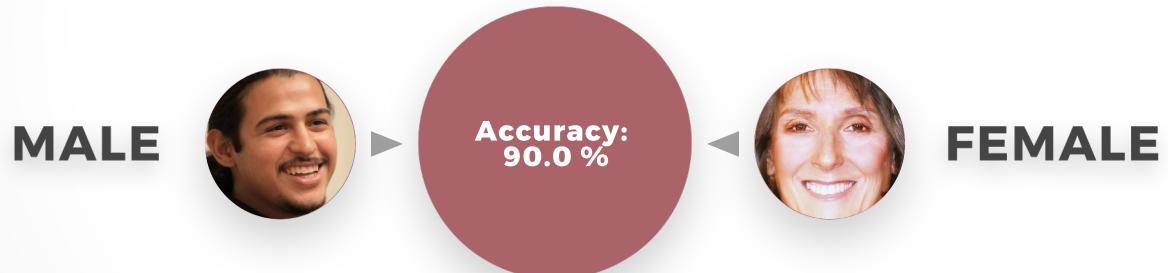
**MALE**

**45%**

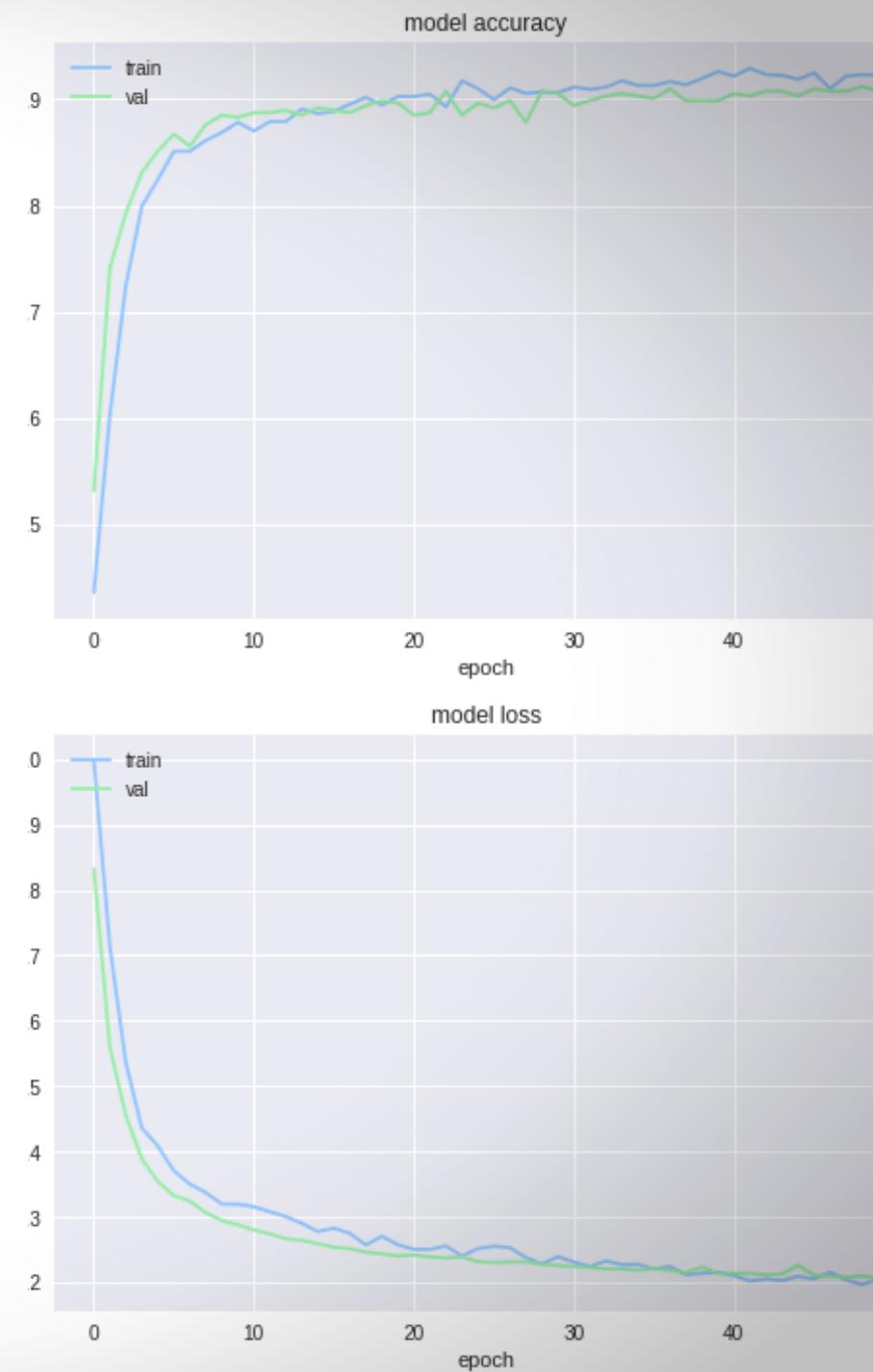
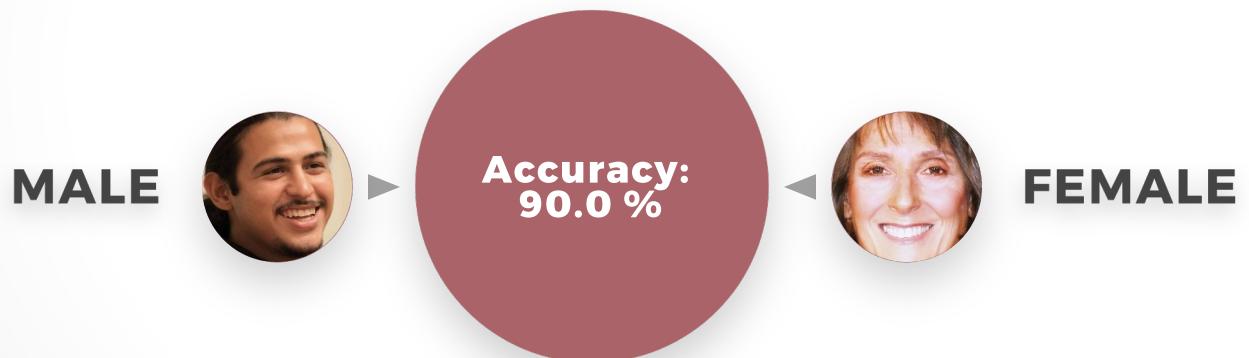


**FEMALE**

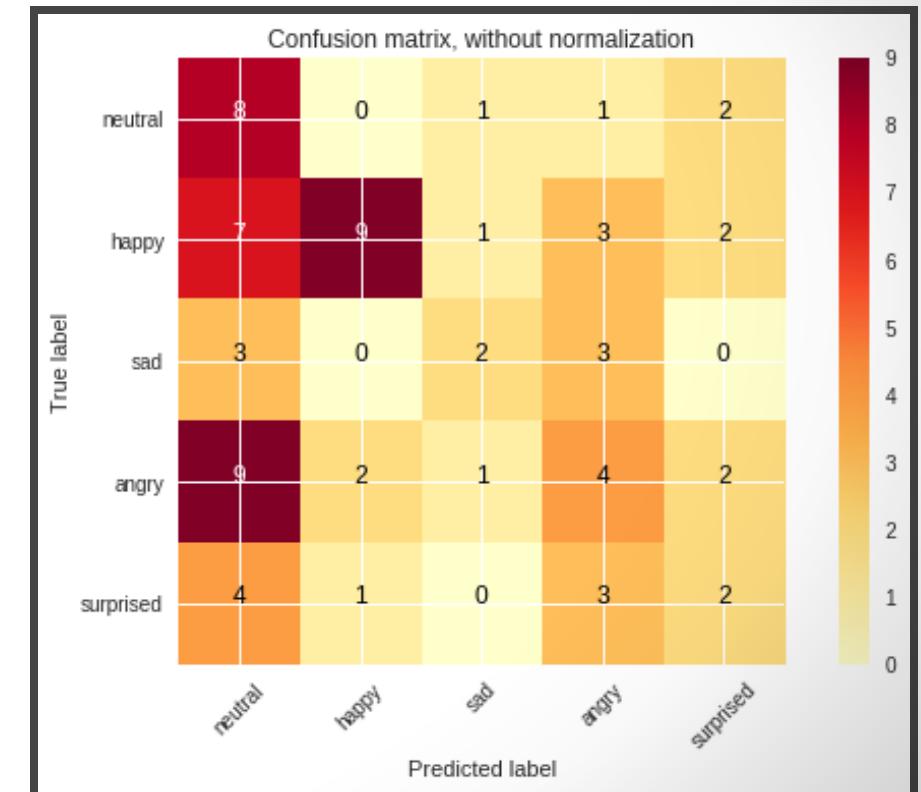
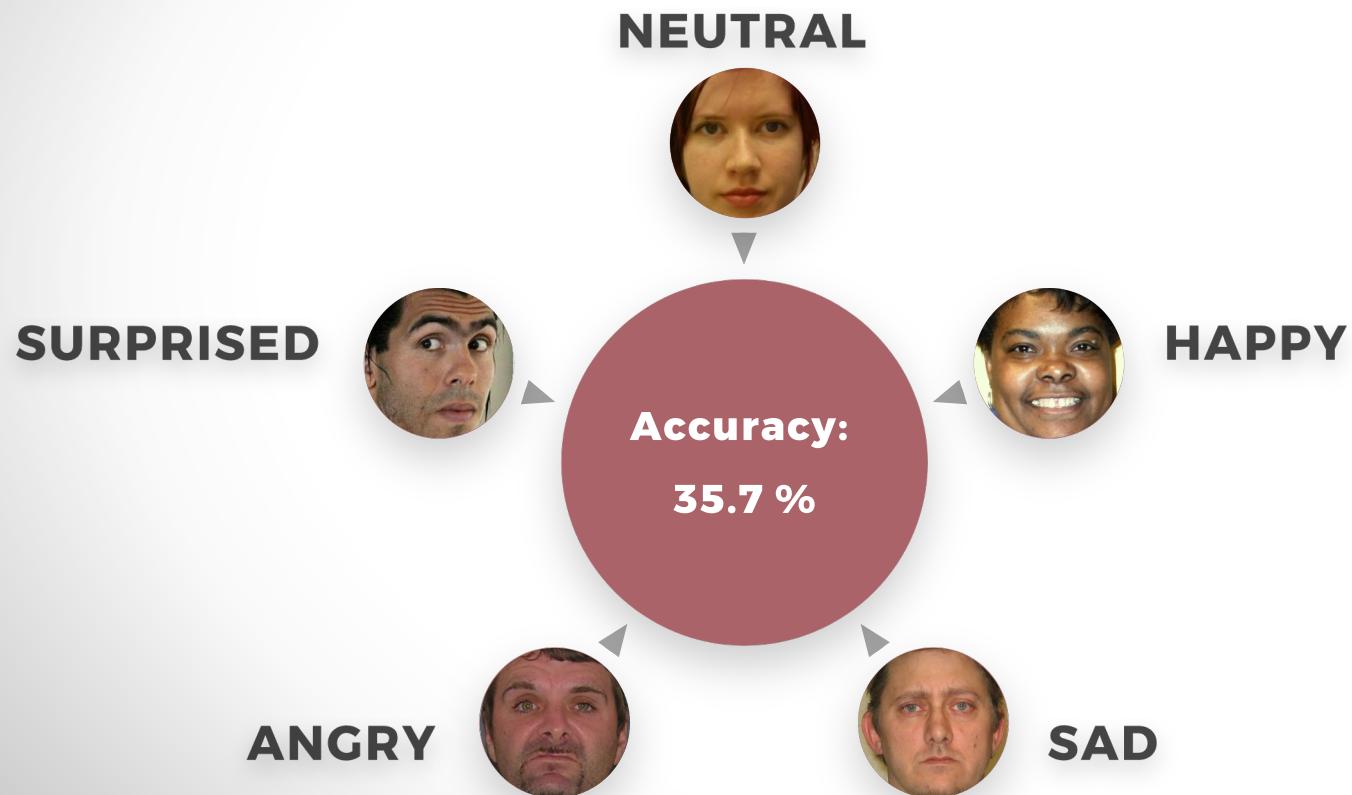
# FACIAL EXPRESSION



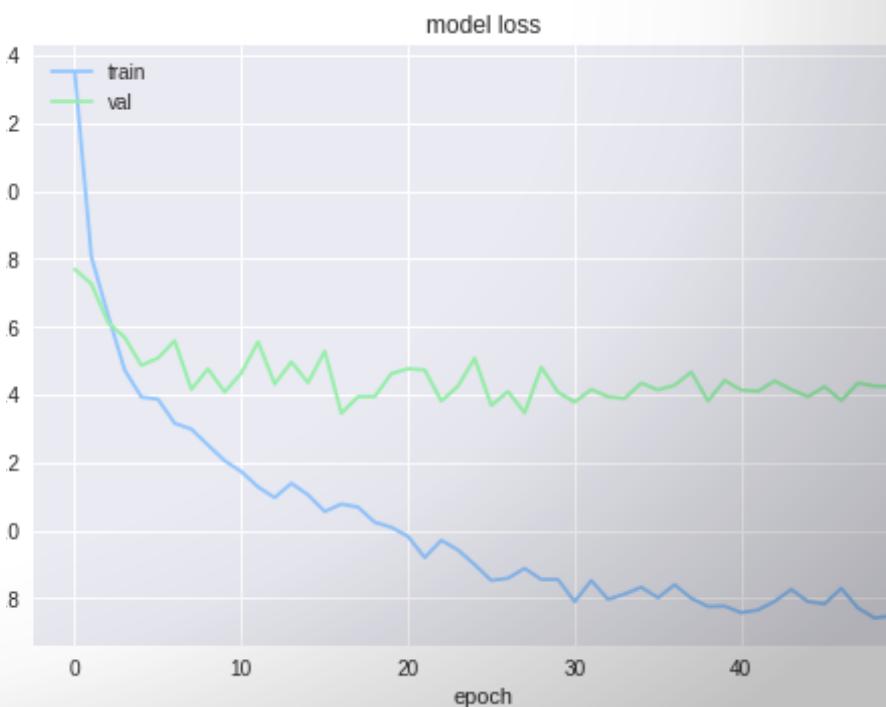
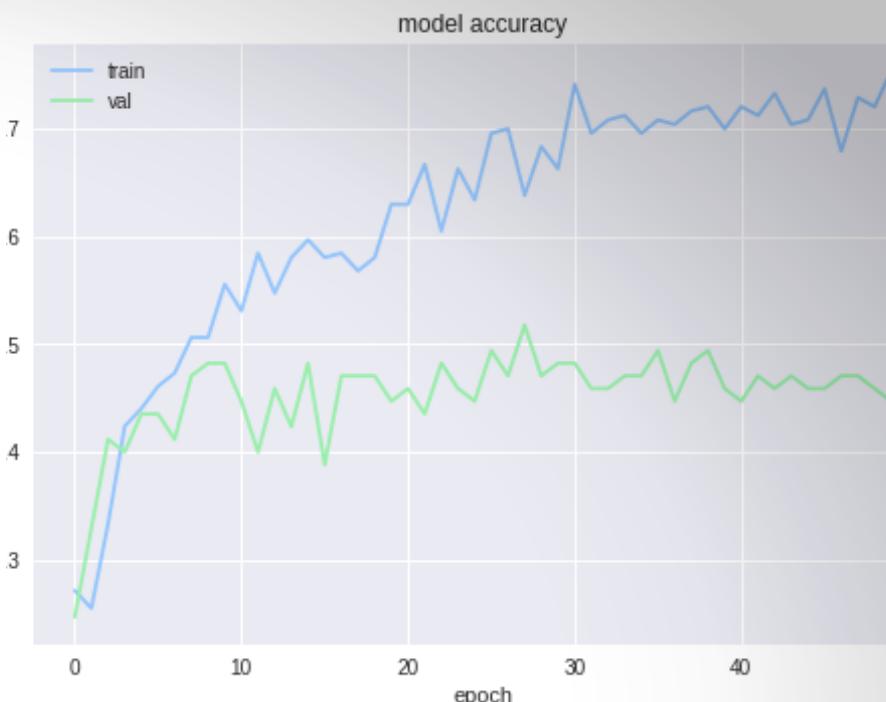
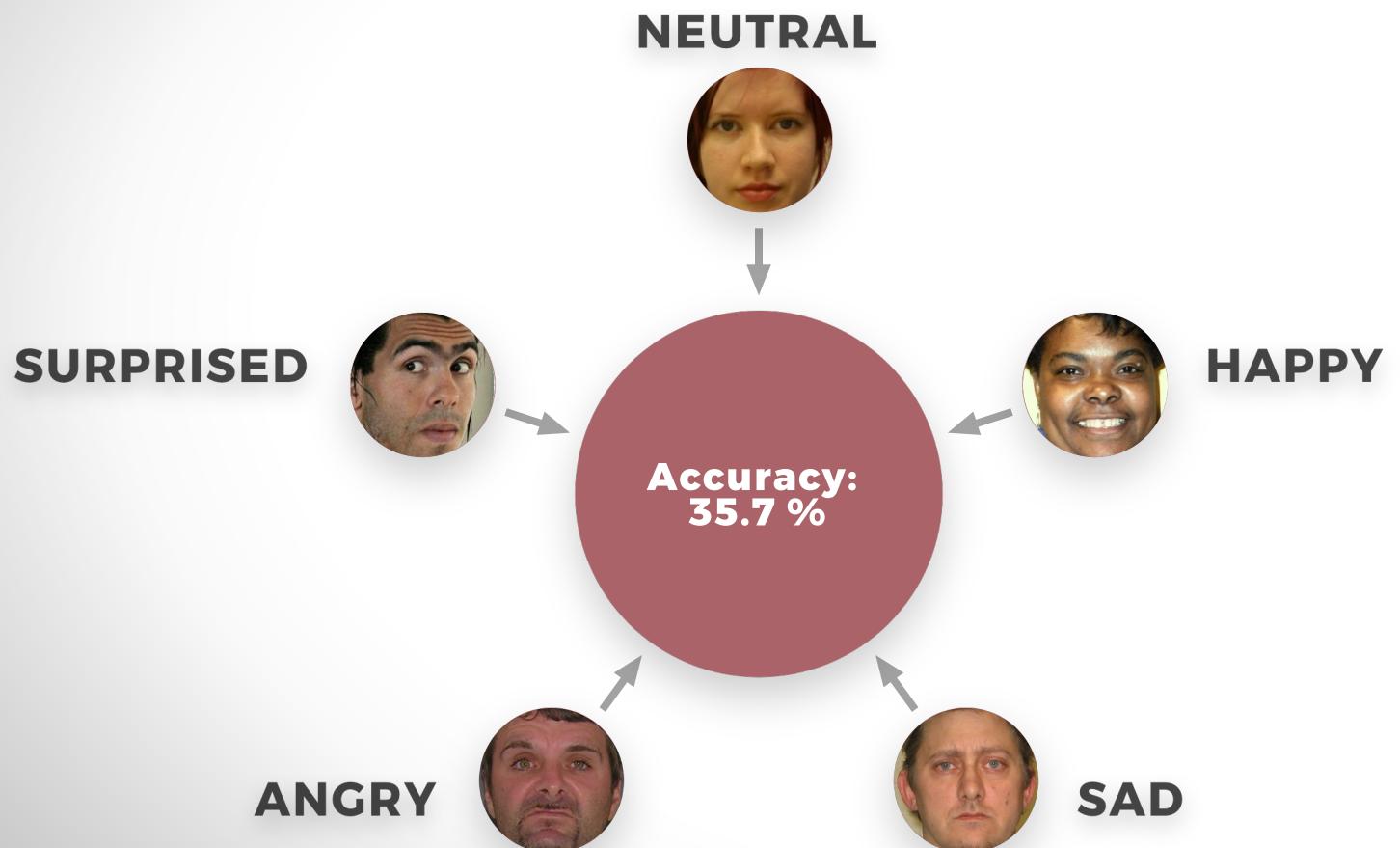
# FACIAL EXPRESSION



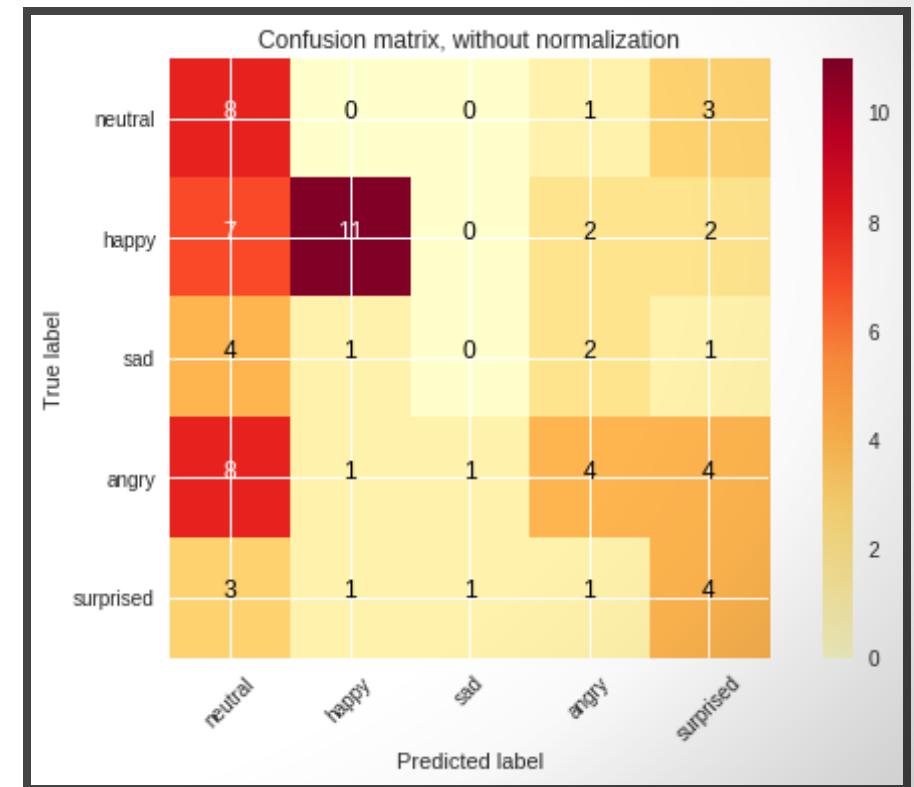
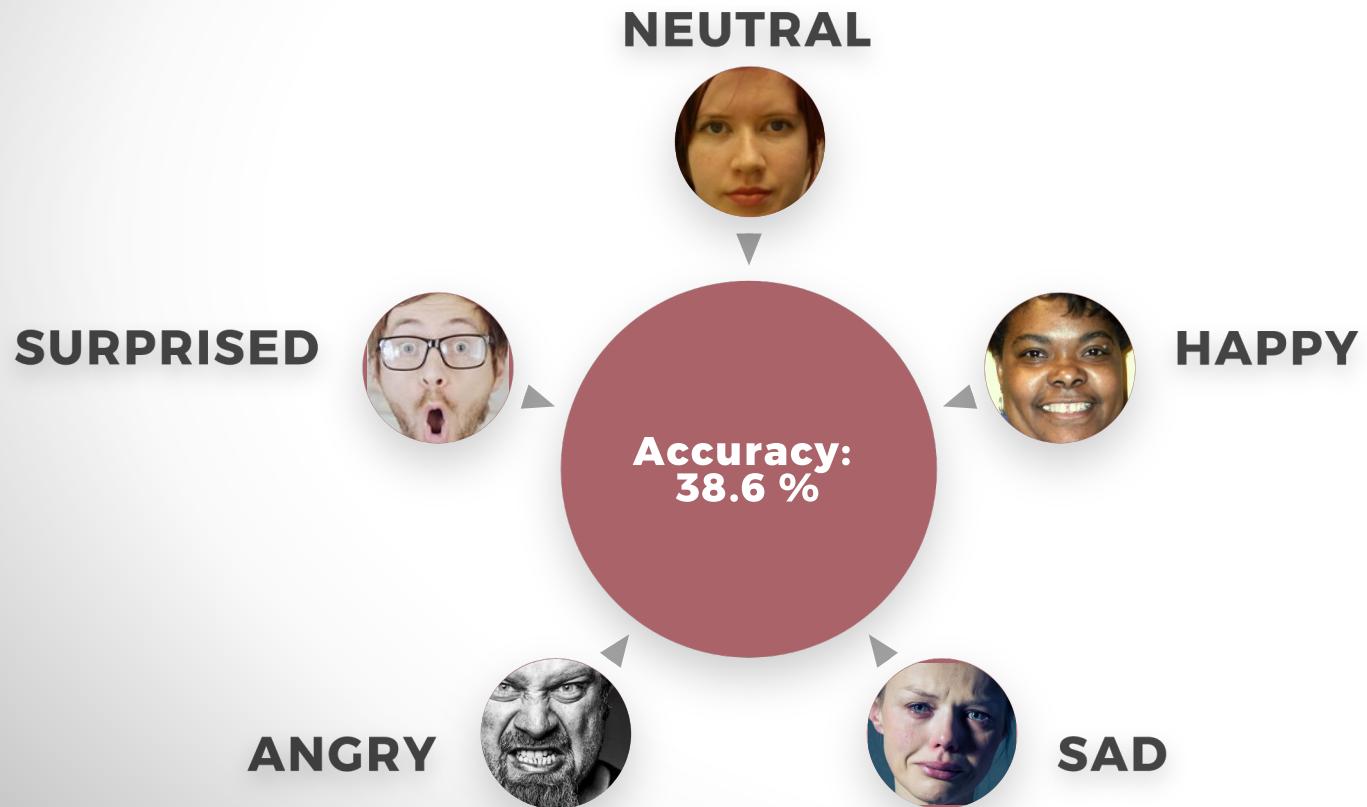
# FACIAL EXPRESSION



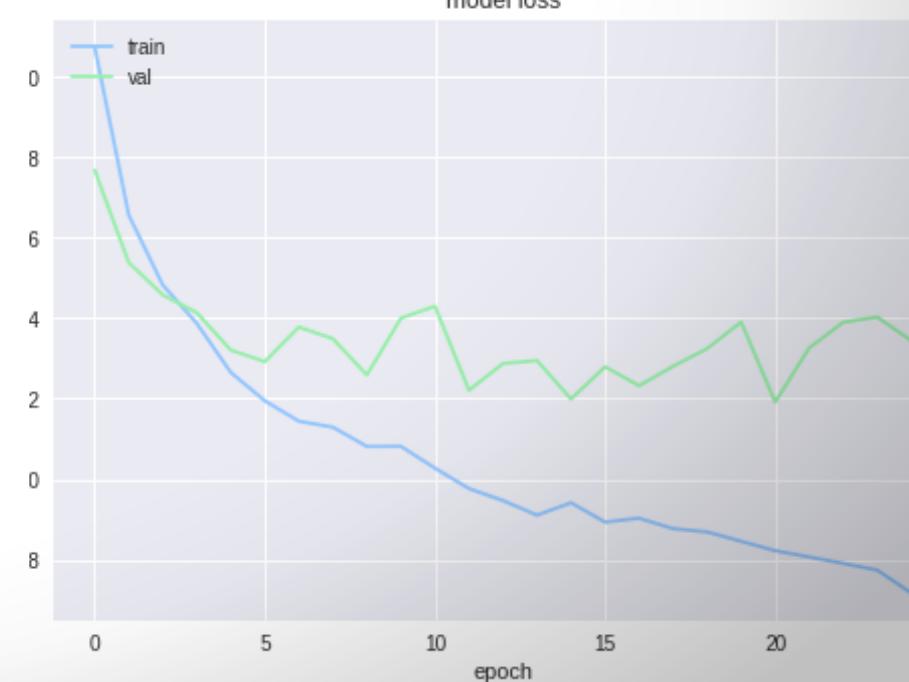
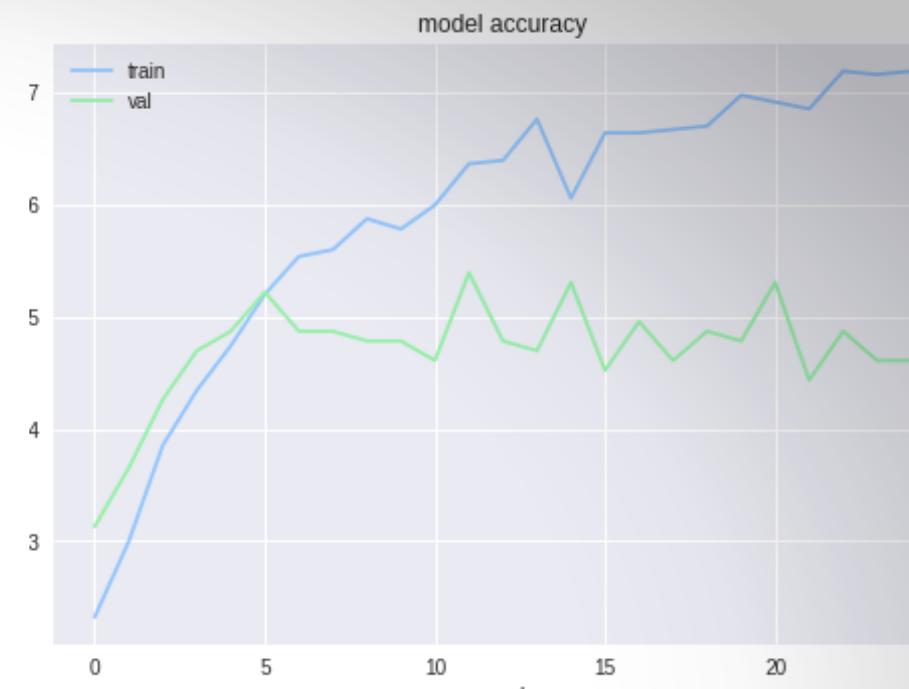
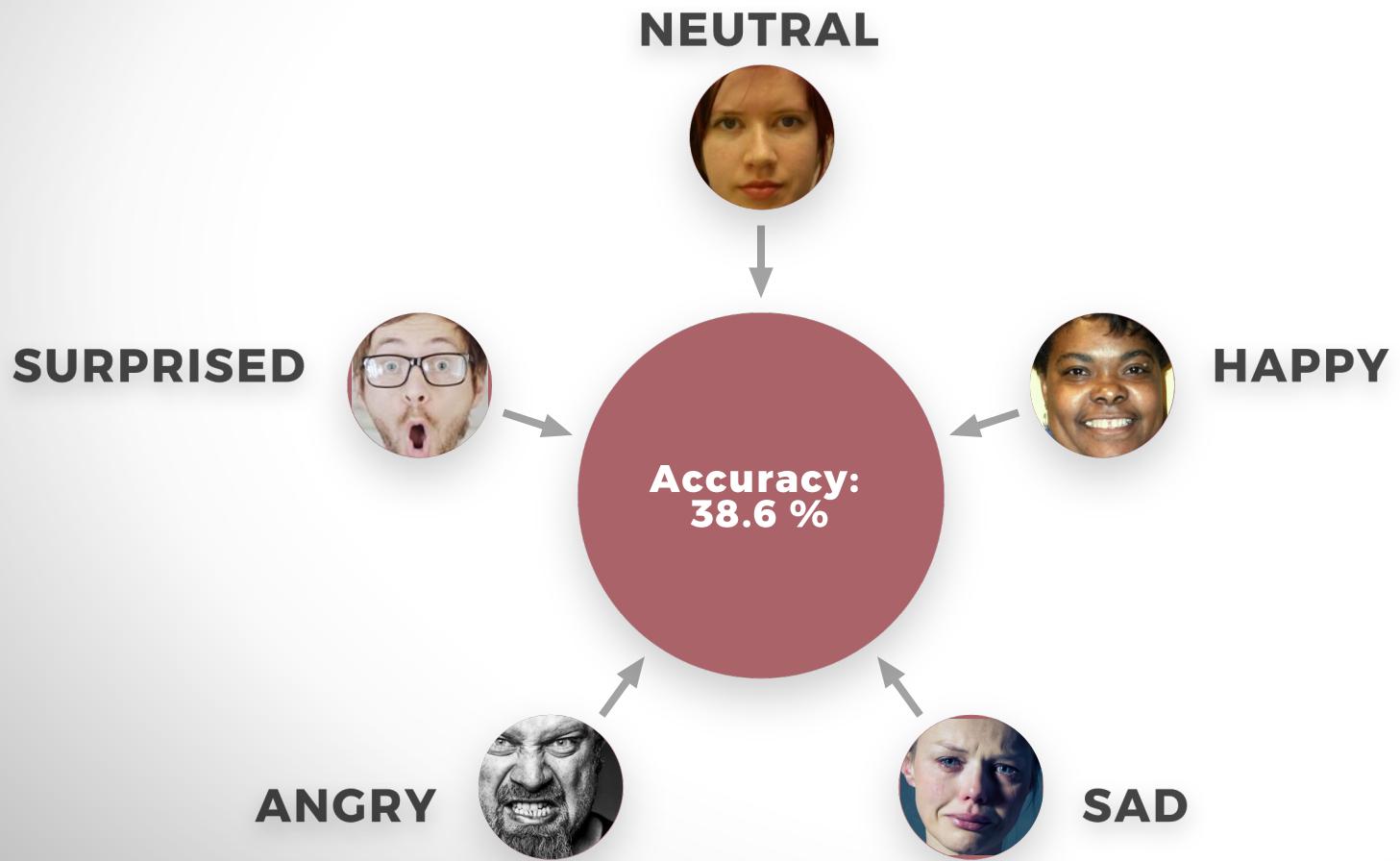
# FACIAL EXPRESSION



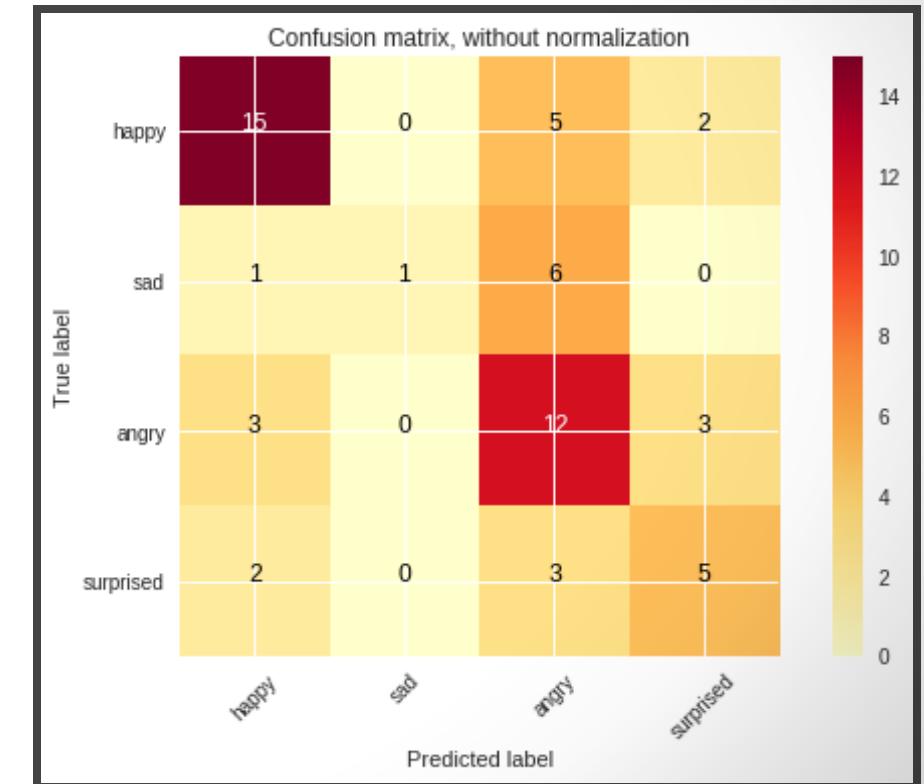
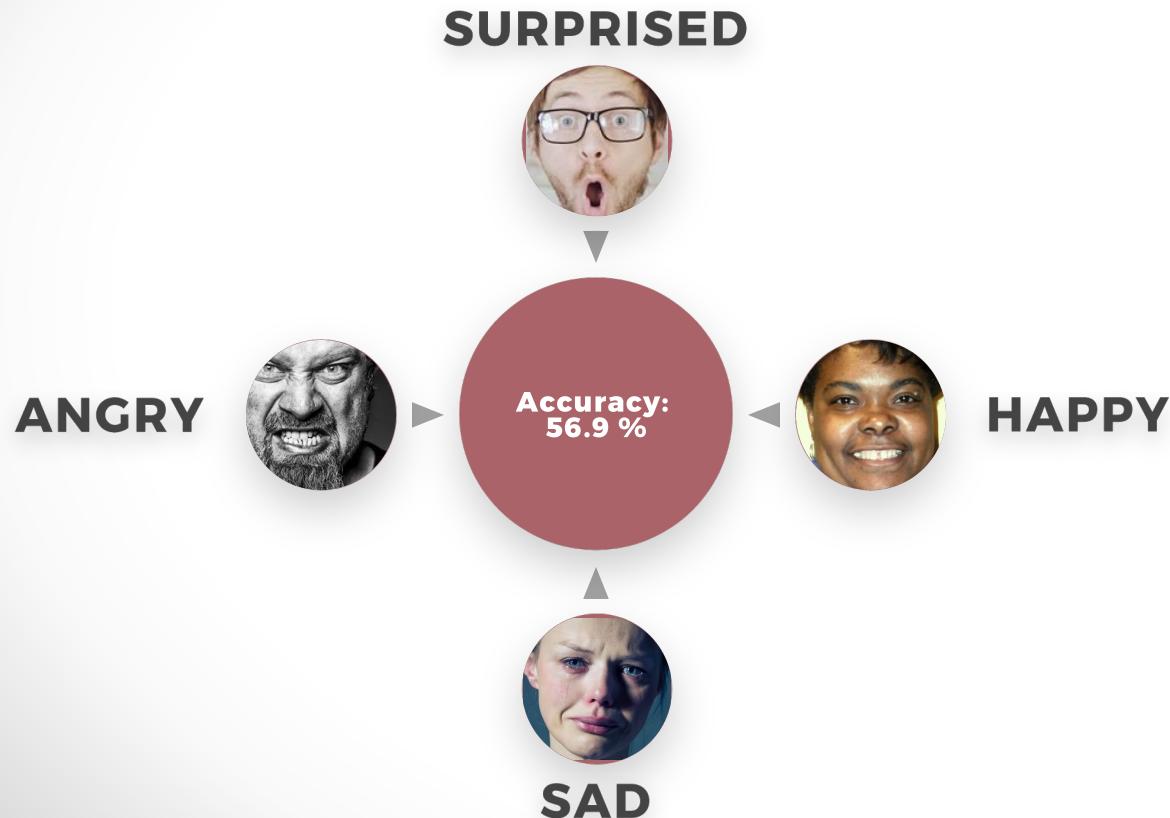
# FACIAL EXPRESSION - INCL. SCRAPED IMAGES



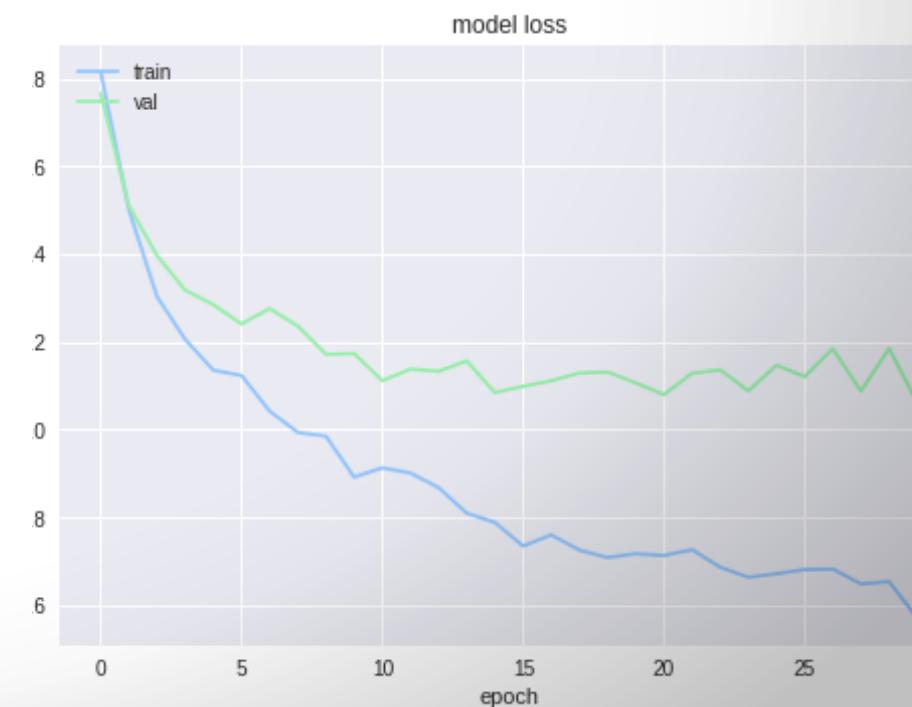
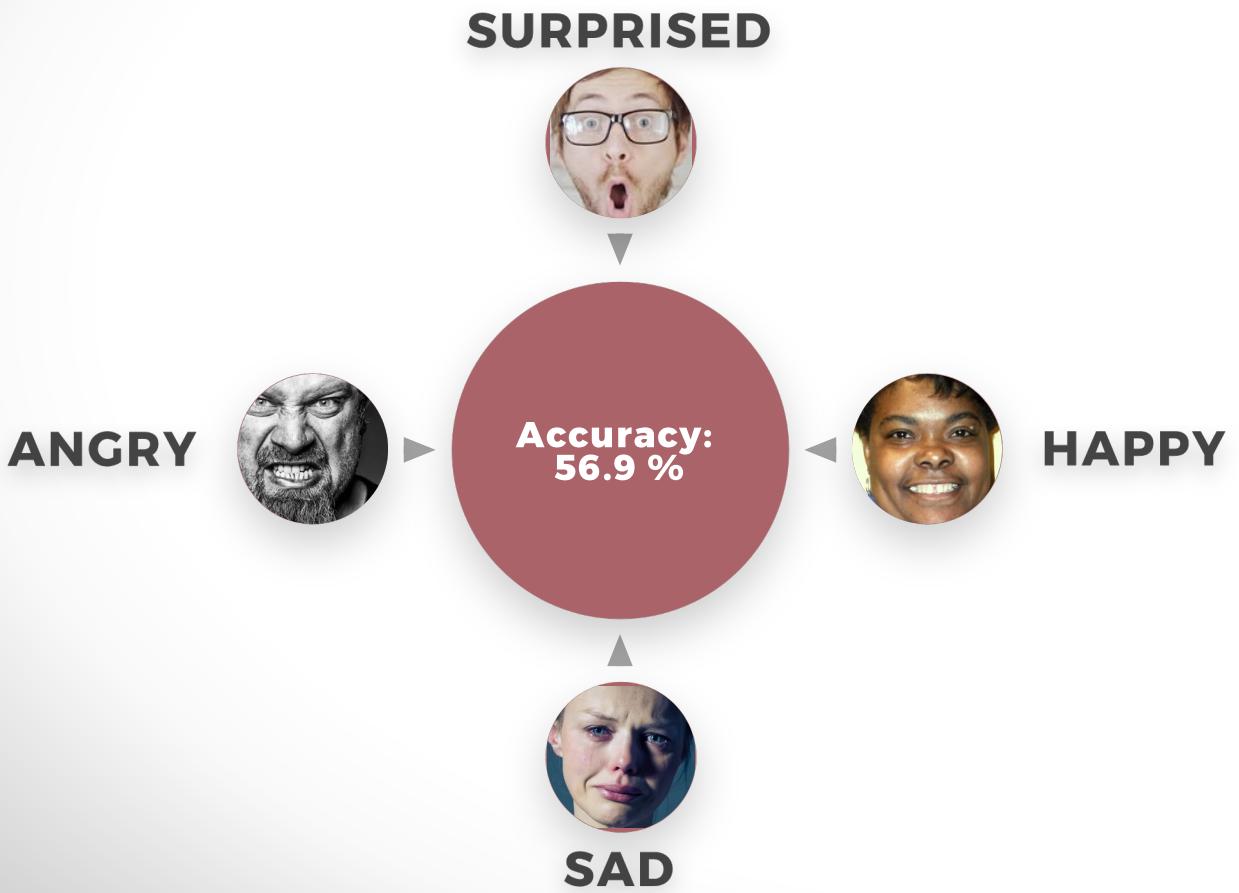
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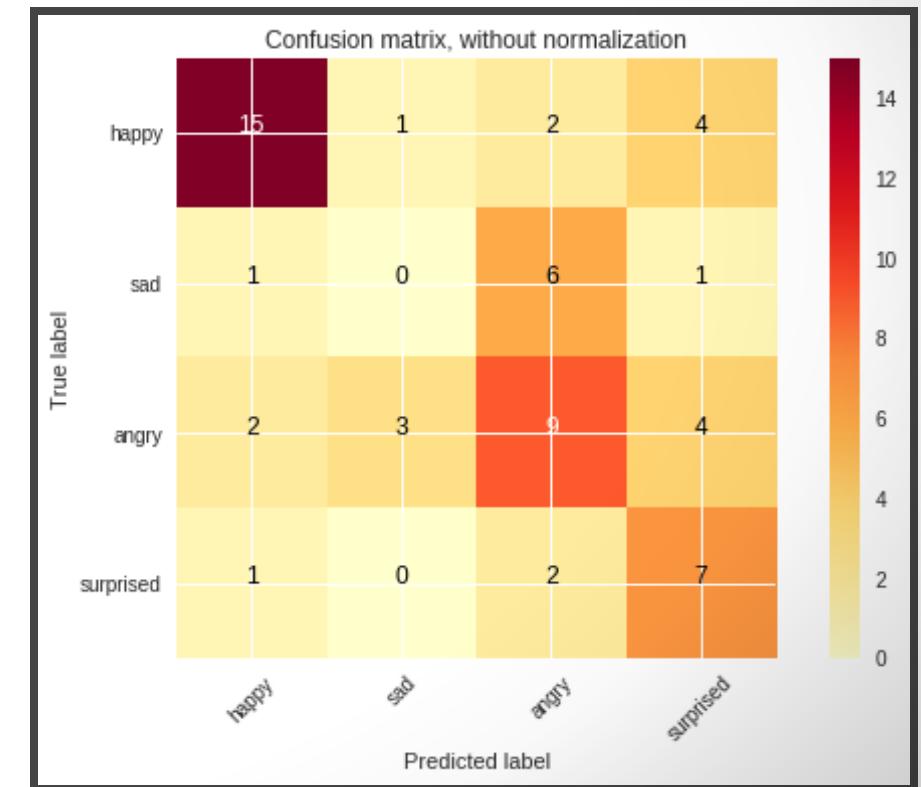
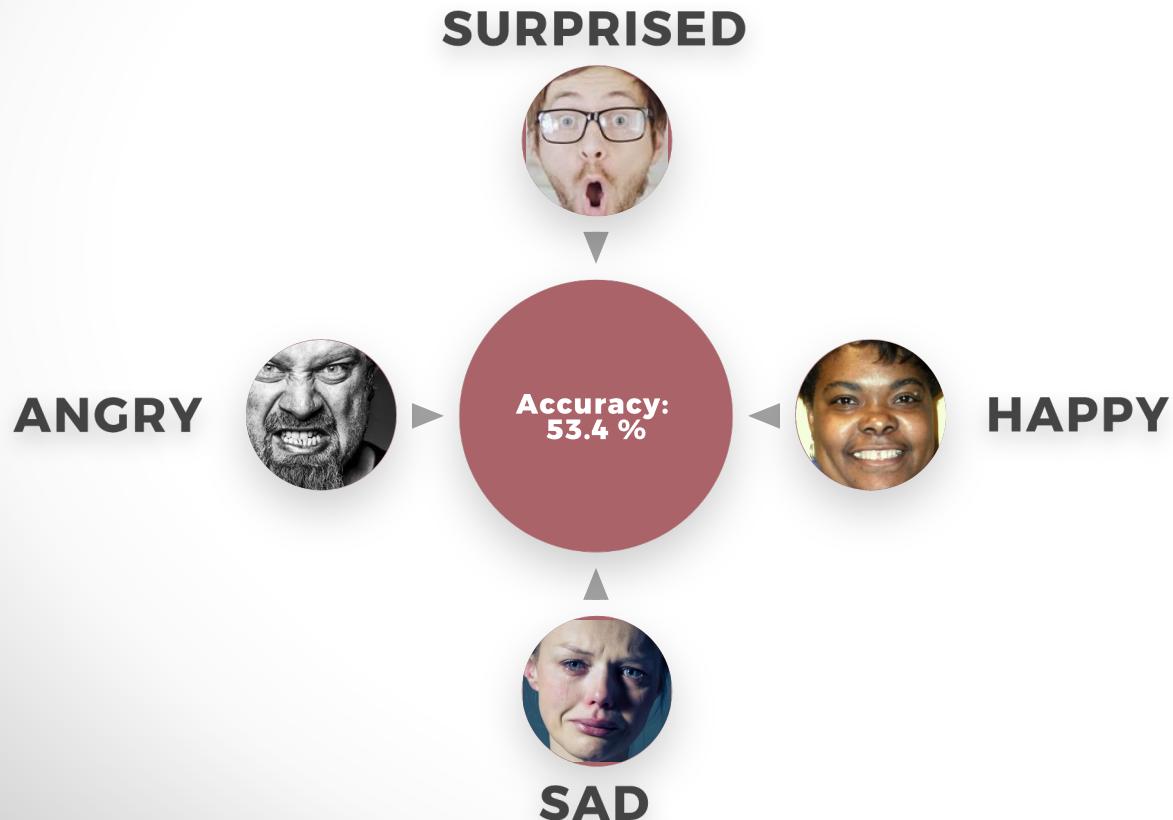
# FACIAL EXPRESSION - NO NEUTRAL CLASS



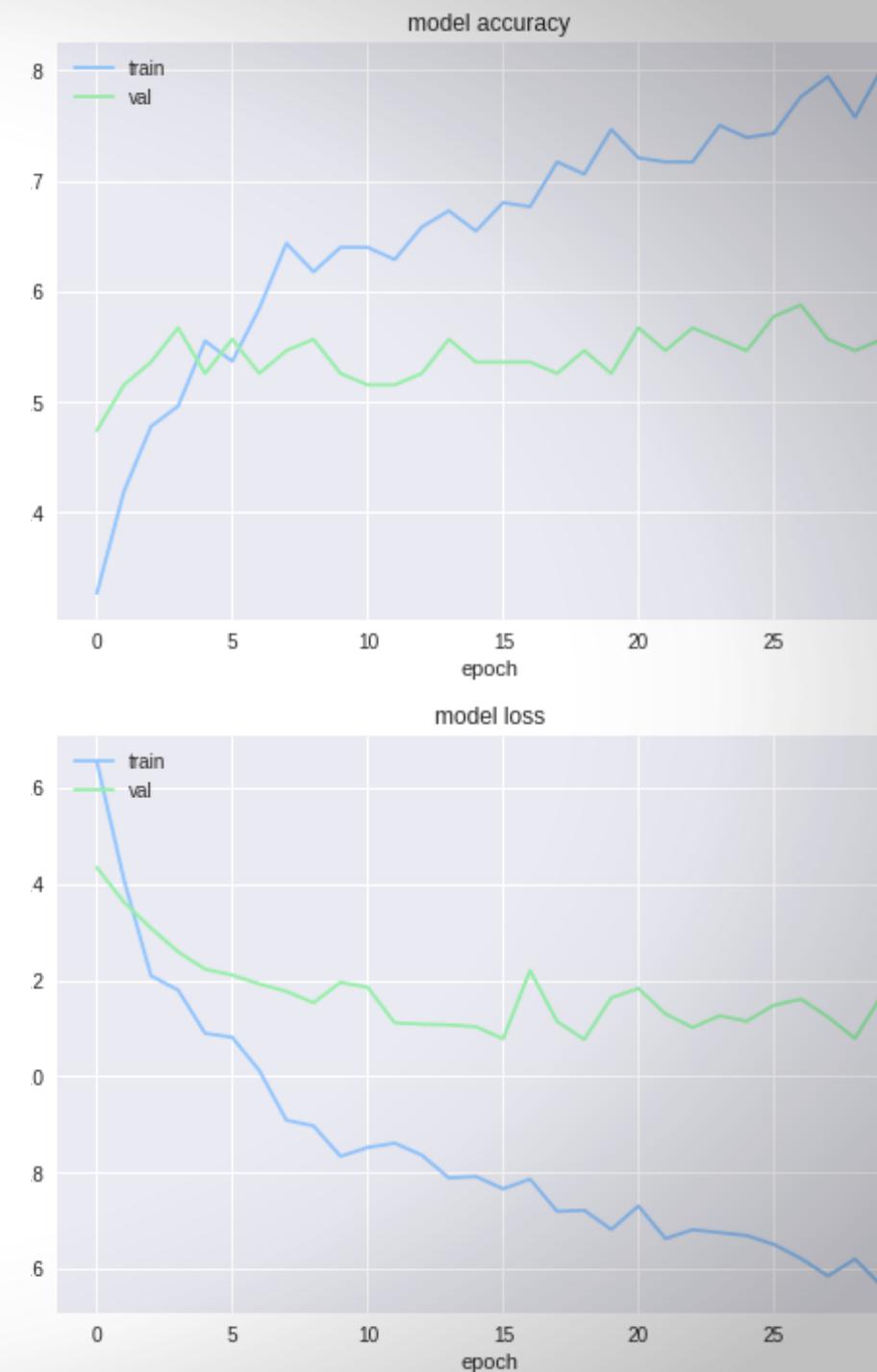
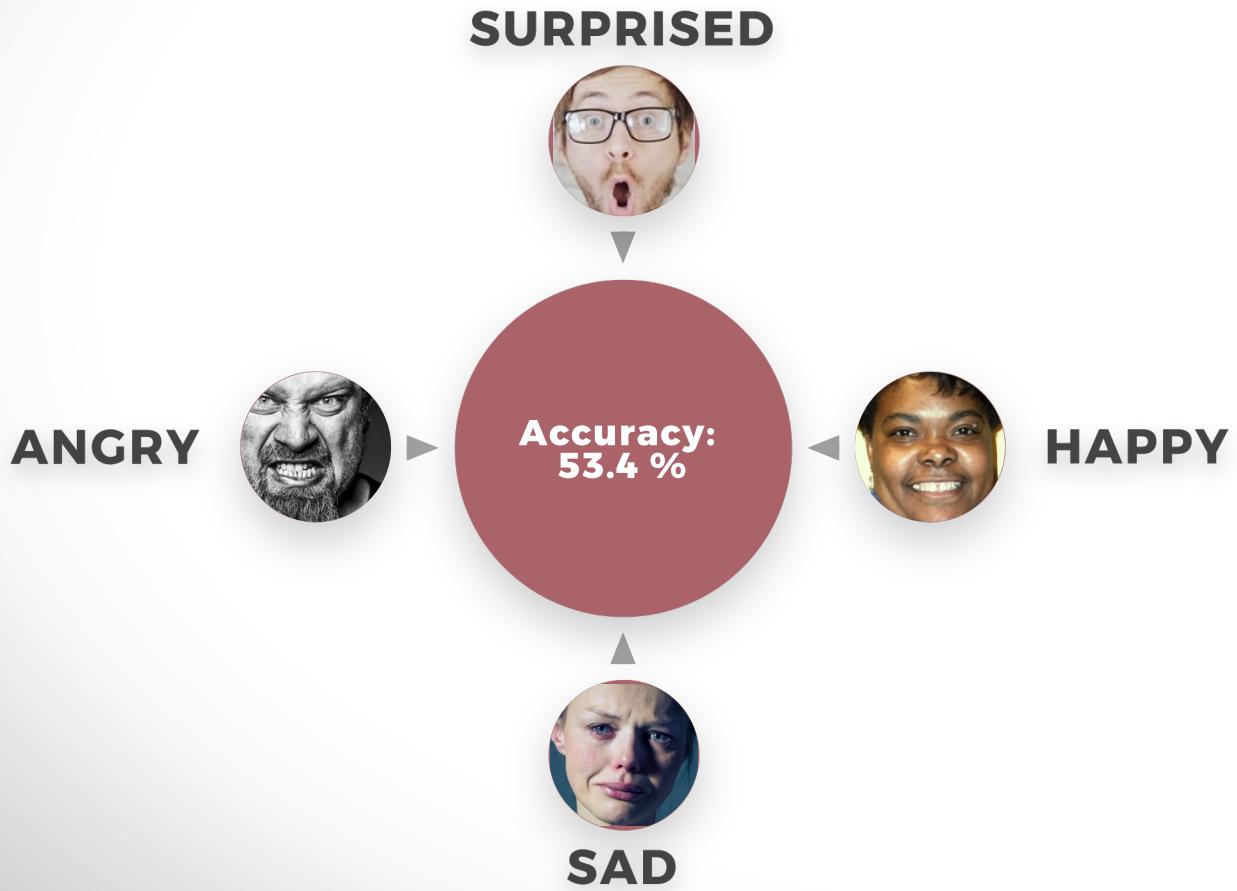
# FACIAL EXPRESSION - NO NEUTRAL CLASS



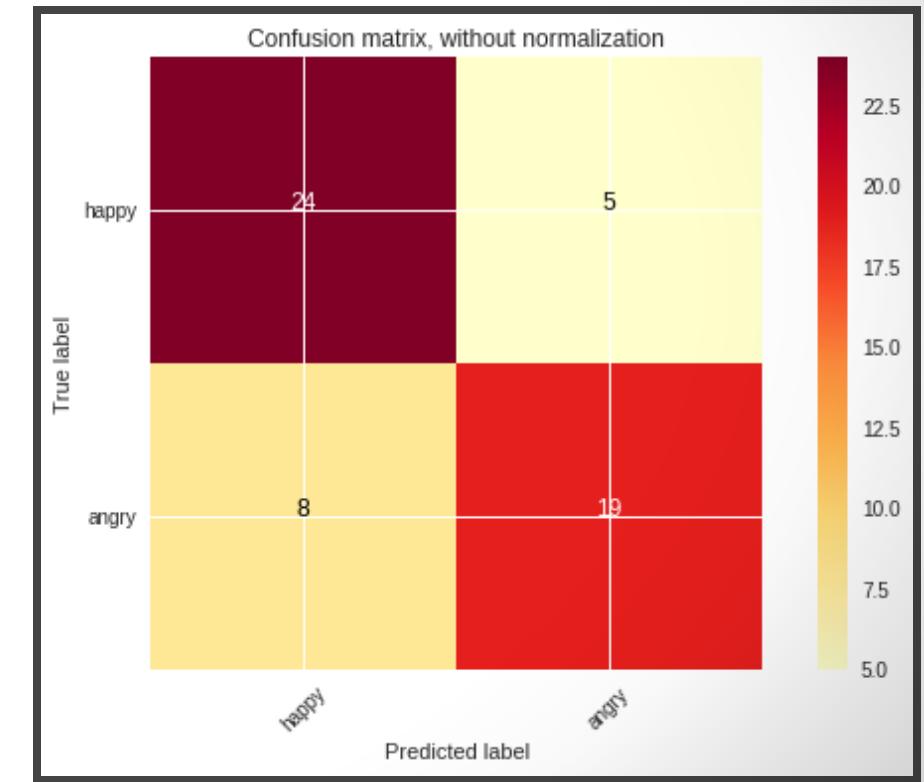
# FACIAL EXP. (VGG19) - NO NEUTRAL CLASS



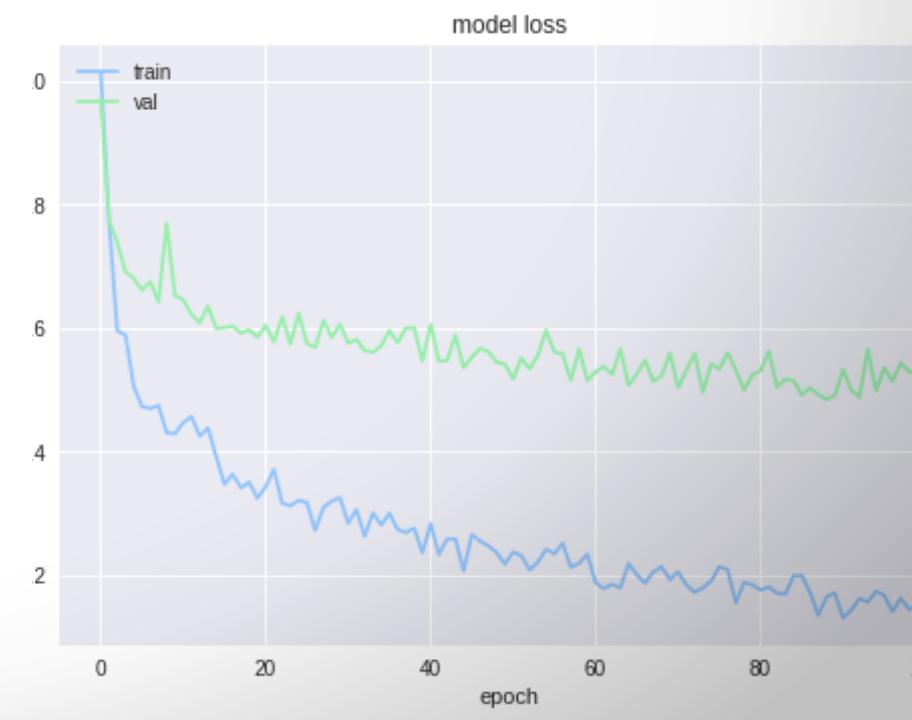
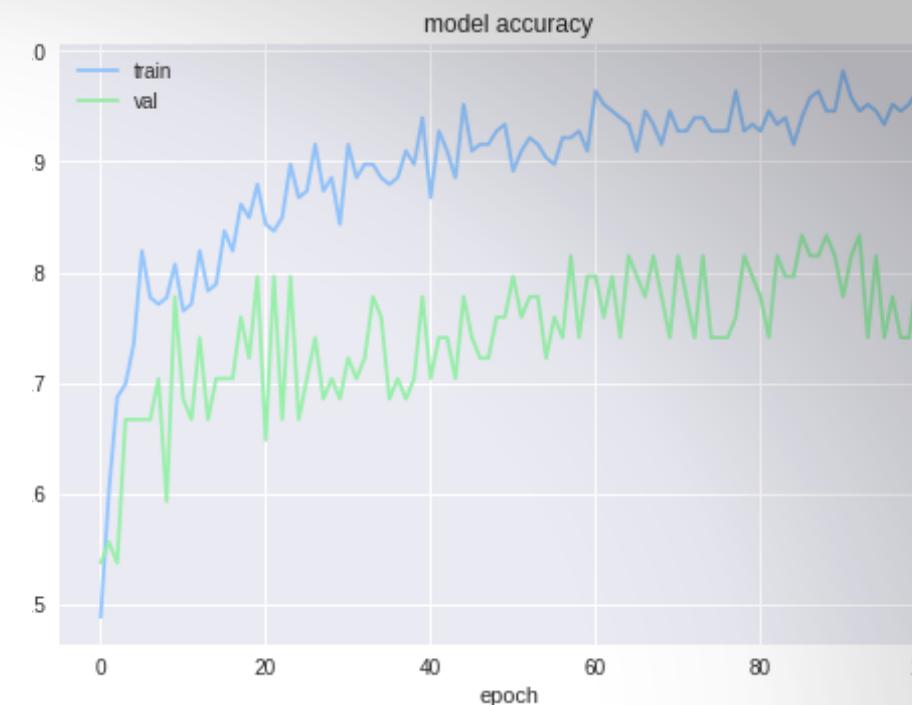
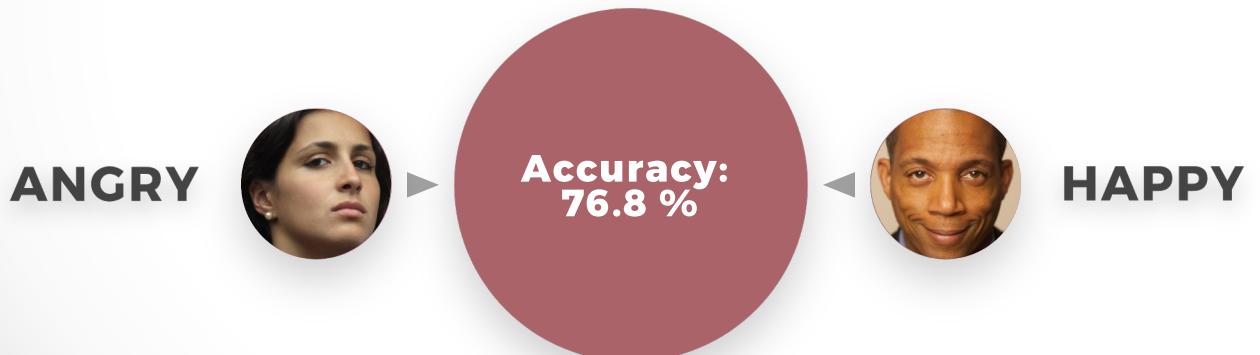
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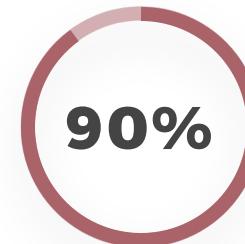
# FACE-OFF: HAPPY VS. ANGRY



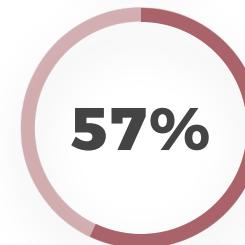
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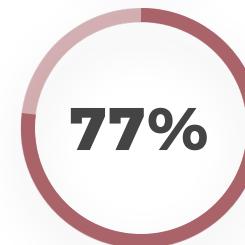
# RESULTS SUMMARY



**SEX CLASSIFICATION  
ACCURACY**



**FACIAL EXPRESSION  
ACCURACY - 4 CLASSES**



**FACIAL EXPRESSION  
ACCURACY - 2 CLASSES**

# NEXT STEPS

- EXPLORE THE USE OF OTHER PRE-TRAINED MODELS TO IMPROVE ACCURACY AND PERHAPS REDUCE OVERFITTING
- RE-TRAIN MODEL ON MORE EXTREME EXEMPLARS, I.E. USE ONLY WIDEST SMILES OR ANGRIEST FACES
- FURTHER EXPLORE PARAM TUNING

# Thank You

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<https://github.com/maf5509>