Emotion Detection

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What is Facial Emotion Detection?

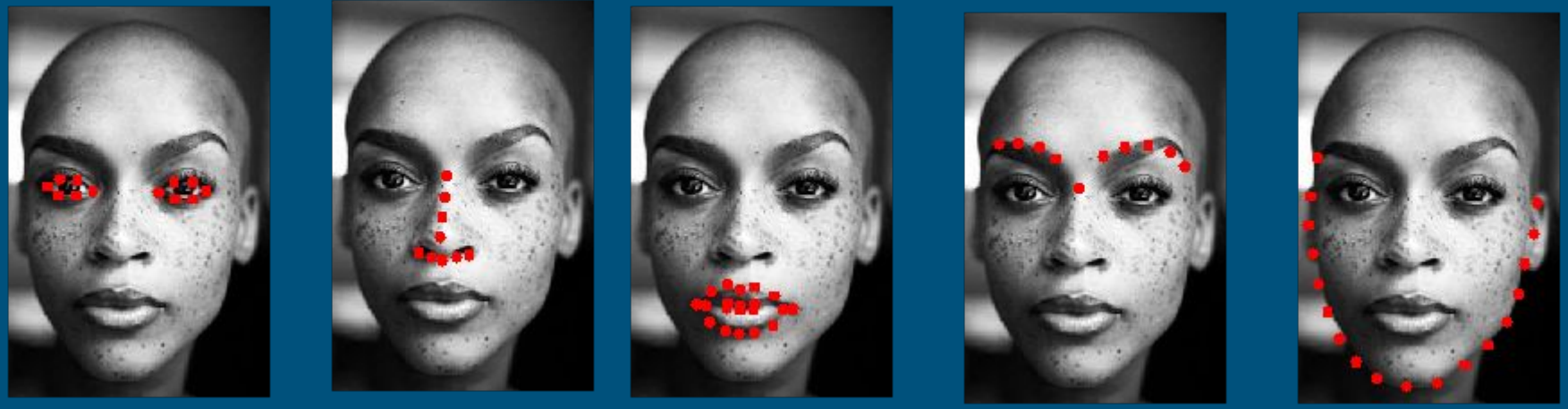
- Facial Emotion detection is a practical means of going beyond the spoken or written feedback and appreciating what the user is experiencing.

- We used a variety of different techniques such as
  - Face data analysis
  - Common ML models
  - Neural Networks

The landmarks our model made.

Data Preprocessing

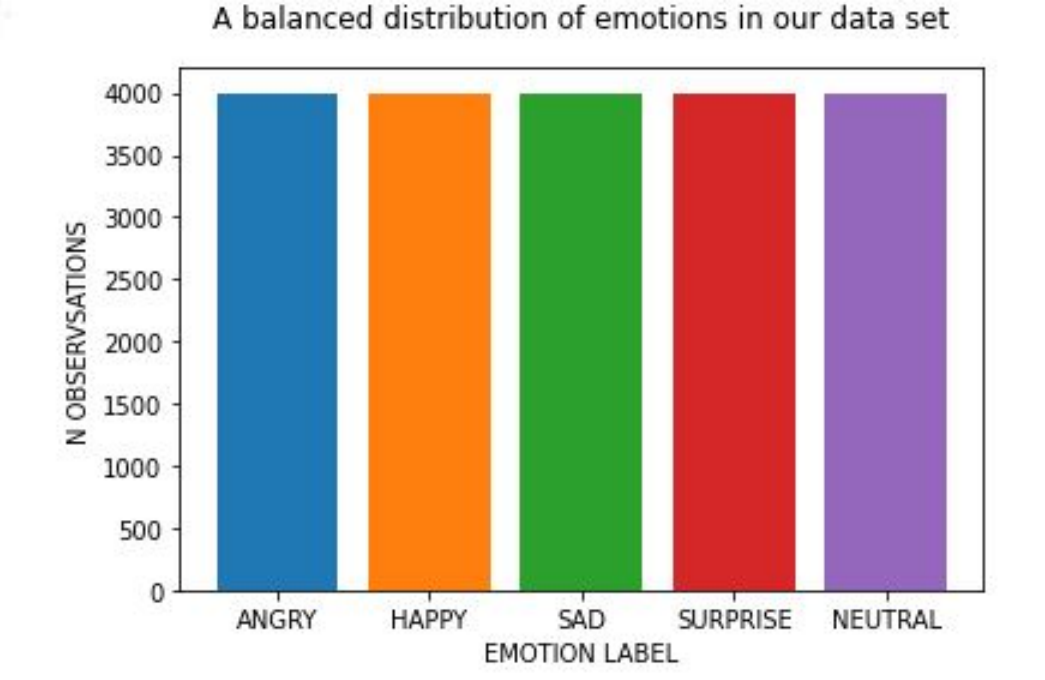
- Face and Landmark Detection



- Standardization of Data
- Principal Component Analysis

Types of emotions that our model could classify

- These are emotions that were each labelled with an index:
  - 0 ---> Angry
  - 1 ---> Happy
  - 2 ---> Sad
  - 3 ---> Surprise
  - 4 ---> Neutral

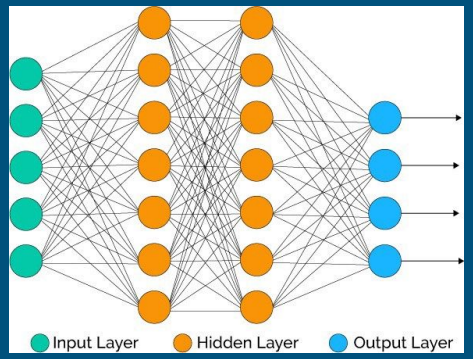


Data and ML Problem Setup

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

- Inputs: Euclidean distances and the pixel values from the pictures.
- Outputs: A integer assignment from 0-4 about what emotion it is.

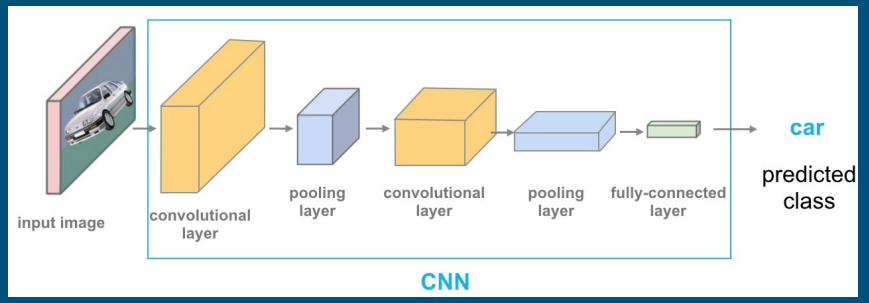
- We trained
  - Neural Networks
  - KNN models
  - Logistic and Linear Regression
  - Decision Tree Classifier
  - CNN Models
  - Multilayer perceptron models



These used 90% training and 10% testing when the data was split.

Hyperparameter tuning

- Comparison: Multilayer perceptron
  - Only pixels, no convolution
  - Dense(1024), Dense(512), Dense(5)
    - Dropout 0.3
  - **0.45 accuracy**
- Comparison: KNN
  - 1 nearest neighbor
  - **0.4615 accuracy**
- Comparison: Decision tree
  - Single layer depth
  - **0.307 accuracy**
- Convolution (C) -> batch norm (B) -> pooling (P) -> dropout (D)
  - **Repeated for greater complexity**
  - Followed by 3 dense layers and output softmax
- Dropout: 0.5
  - Regularization effect (prevent overfitting)



Baseline Results

- Human Accuracy on fer2013: 65% (+- 5%)

Models	Pixel Values	Distances
Logistic Regression	40%	50%
K Nearest Neighbours	43%	46%
Decision Tree	26%	30%
mlp	46%	54%

Results - Con. NN

- CNN:

	Pixel Values
Convolutional Neural Network	71%
vgg	68%

- Significantly higher success rate
- CNNs generally better at Computer Vision tasks.
- Best model reached 71%

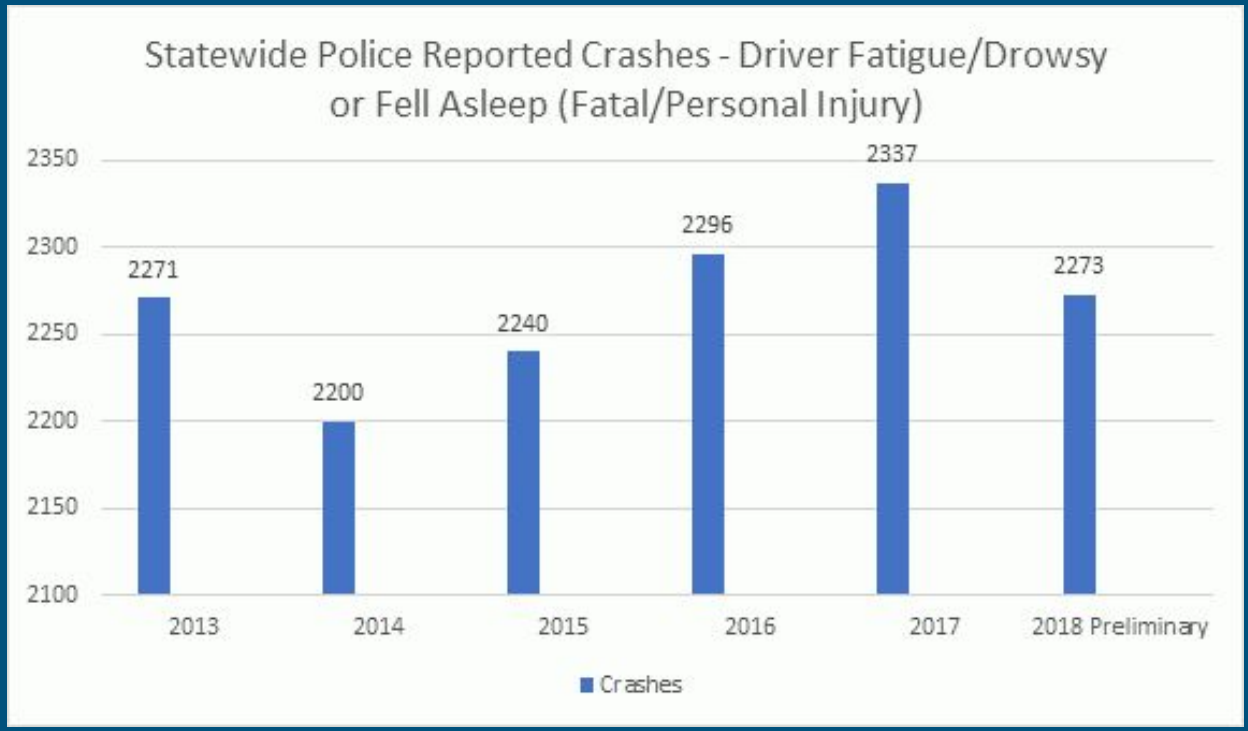
Real-World Application

- Emotion detection can be used to help improve safety, research, healthcare, and security.

Emotion recognition software paired with Google Glass helps autistic children recognize visual cues and build confidence and social skills.

Real-World Implementation

- Car safety
- Research and video game testing
- Healthcare
- Interviews



Yearly reported crashes due to drowsy driving in New York between 2013 and 2018

Acknowledgements

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