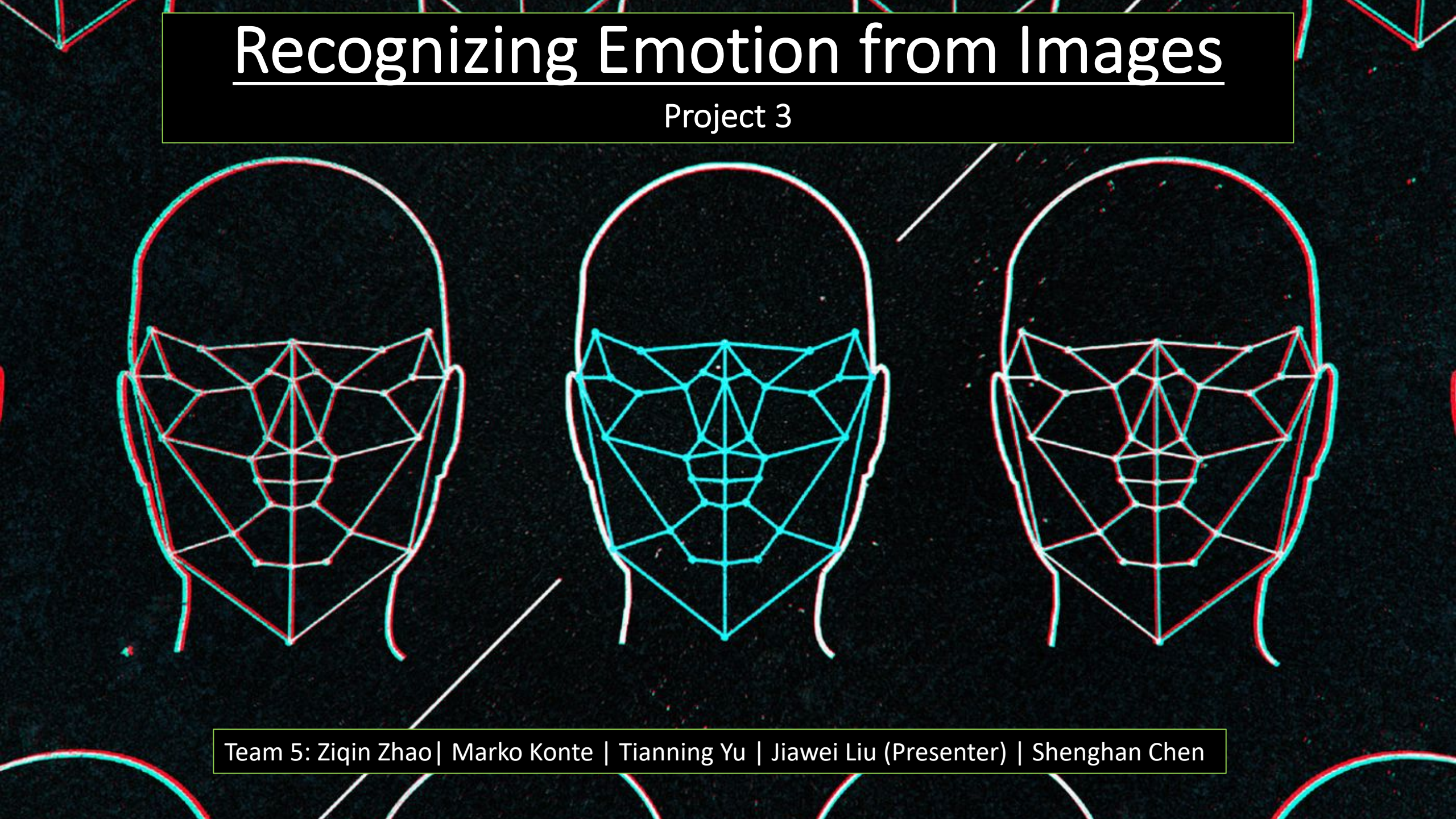
Recognizing Emotion from Images

Project 3



Team 5: Ziqin Zhao| Marko Konte | Tianning Yu | Jiawei Liu (Presenter) | Shenghan Chen

Methods Used

- Baseline: Gradient Boosting Model (**Claimed test accuracy: 38%)**

- Best Advanced Model: Neural Network (**Claimed test accuracy: 54%)**

- Other Methods used:

Ensemble (2nd best)
XGBoost
SVM
LDA
Logistic Regression
Random Forest

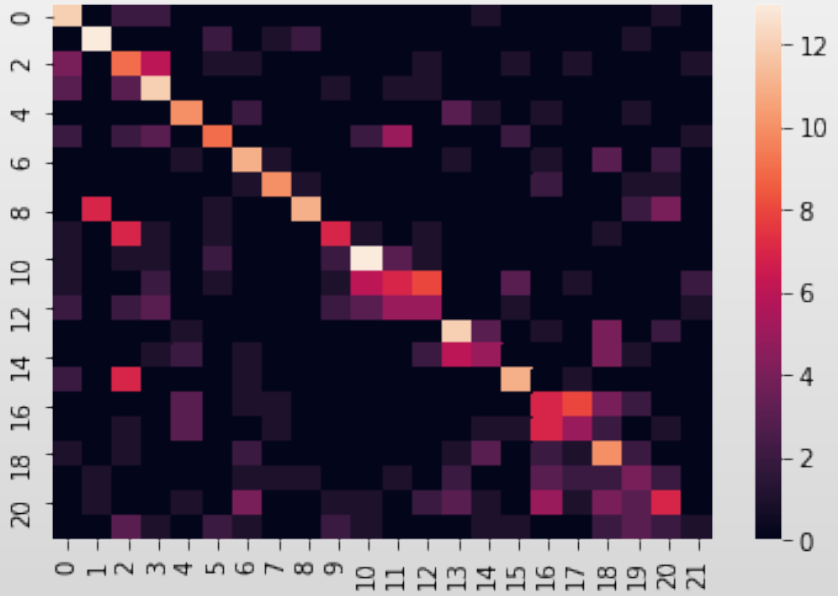
Baseline: Gradient Boosting

- Gradient Boosting Models is a powerful approach which learns on repeated iterations using the most significant predictive features from data.

- GBM parameters:
  - n_estimators = 100
  - Max_depth= 1
  - learning_rate=0.1

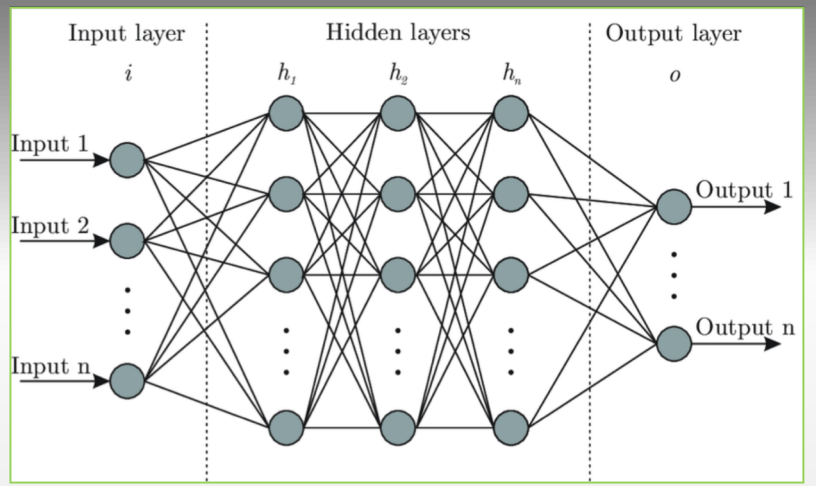
- **Performance results:**
  - **Accuracy: 38.20%**
  - **Time for fitting: 8.6 Minutes**
  - **Time for prediction: 0.036s**

Confusion Matrix:



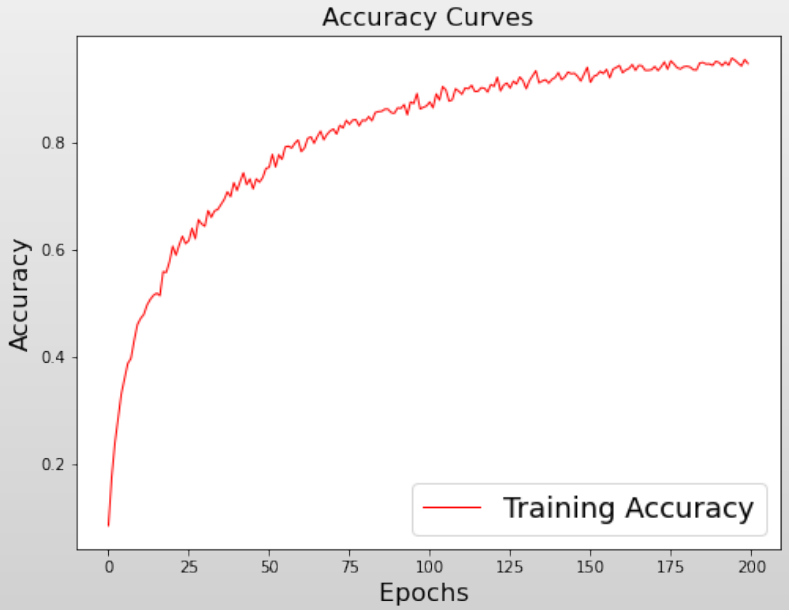
Best Advanced Model: Neural Network

- Neural Network models take a collection of inputs and improves accuracy by building on significant features validated through thresholds calculated within the hidden layer. This ultimately creates a predictor for the classifier within the output layer- image representation:



NN Parameters used:

- Activation input: Rectified linear Unit (element wise non linear)
- Activation output: Softmax (normalized, winner take all)
- Epochs = 200



Performance Results:

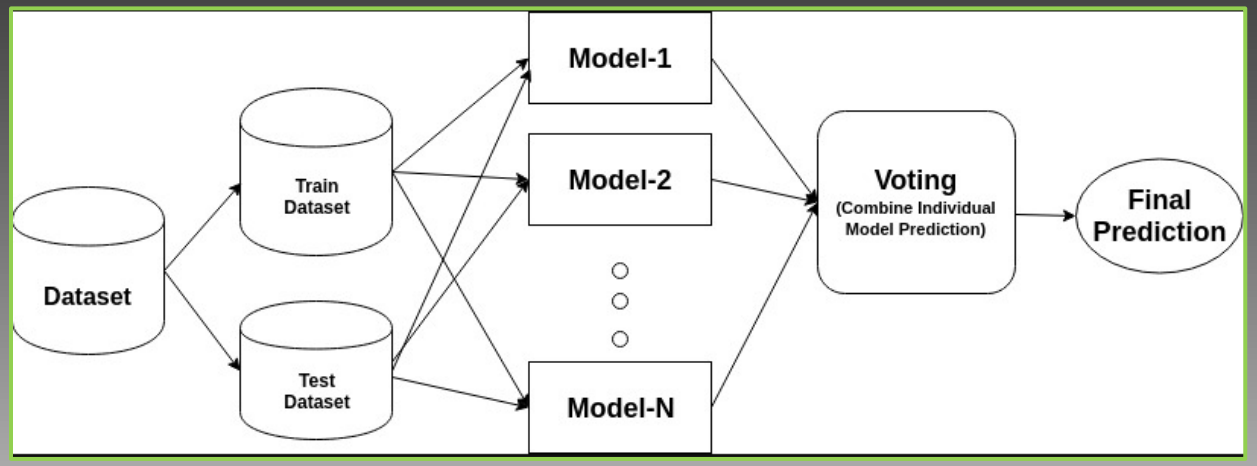
Test Accuracy: 53.86%

Time for fitting: 11.24 minutes

Time for prediction: 0.9s

Second Best Advanced Model: Ensemble

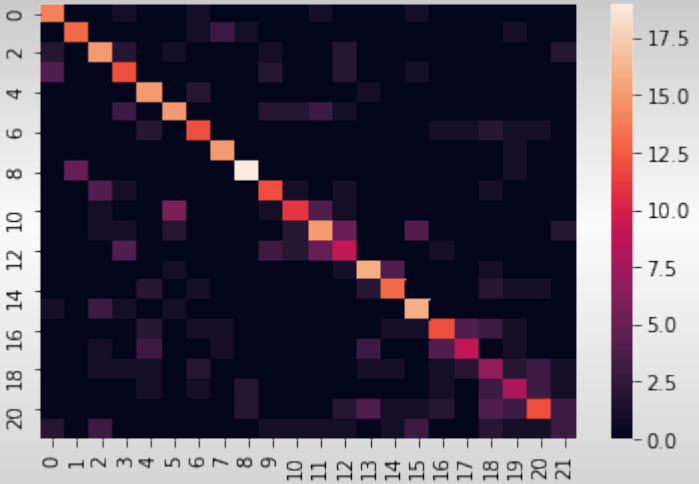
- This type of model allows for combining multiple model results to improve the end classification. In our model we used the Voting method for the ensemble model to make the final combination using Logistic Regression, LDA, and SVM Methods.



- Models used:
  - Linear Discriminant Analysis (LDA)
  - Logistic Regression
  - Support Vector Machine (SVM)

- **Performance Results:**
  - **Test accuracy: 53.48%**
  - **Time for fitting: 3.07 minutes**
  - **Time for prediction: 6.7s**

Confusion Matrix Ensemble:



Additionally tested Advanced Models

- SVM
  - Test Accuracy: 48.4%
  - Model Fitting time: 18.2s
  - Model Prediction: 5.26s
- LDA
  - Test accuracy: 53.8%
  - Model time: 1.15 minutes
- XGBoost
  - Test accuracy: 49.2%
  - Model Fitting time: 33 minutes
  - Model Prediction: 1.18s
- Logistic Regression
  - Test accuracy: 51.4%
  - Model Fitting time: 15 s
  - Model Prediction: 0.0084s
- Random forest
  - Test accuracy: 43.0%
  - Model Fitting Time: 7.9 seconds
  - Model Prediction: 0.04s

Comparison Matrix

	Candidate Model	Training Accuracy(%)	Testing Accuracy(%)	Fitting Time	Prediction Time
1	Baseline(GBM)	83.8	38.2	521s	0.036s
2	XGBoost	100	49.2	1987s	1.18s
3	Logistic Regression	77.25	51.4	15s	0.0084s
4	LDA	85.8	53.8	68.77s	0.0077s
5	SVM	81.45	48.4	18.18s	5.26s
6	Random Forest	100	43	7.9s	0.04s

Comparing Best Performing Advanced Models

Why Neural Network and Ensemble:

Predicting a classification with so many features as a facial expression has requires a model that will reduce those dimensions while iterating on itself to pick the most significant variables. These two model types provide this in differing ways. NN's through iterating significant features in a network, and Ensemble by running multiple model types and combining for the best result.

Ultimately, Neural Network was chosen as it had slightly better accuracy with lower deviation in its result on a consistent basis, although there were iterations where Ensemble performed better. While Ensemble generally took less time, both models performed at acceptable time frames.

	Model	Training Accuracy	Test Accuracy	Fit CPU	Predict CPU	Fit memory	Predict memory	Saved Model Size
1	NN	99.92% (sd 0.06%)	53.86% (sd 1.29%)	90%	"0"%	+1GB	"0"	16mb
2	Ensemble	83.57% (sd 0.73%)	53.48% (sd 1.85%)	71% 50% 14%	13.7%	+2GB +1GB +1GB	+1GB	653mb