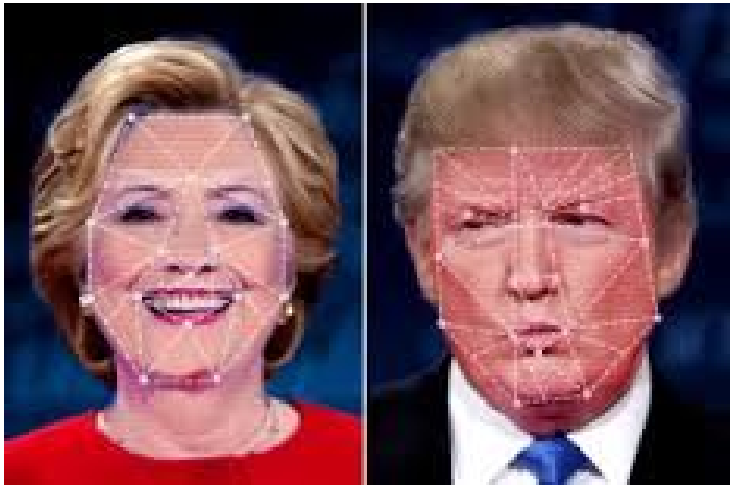

Show Me Your Face! :)

Metis Project 3: McNulty

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Sarick Shah
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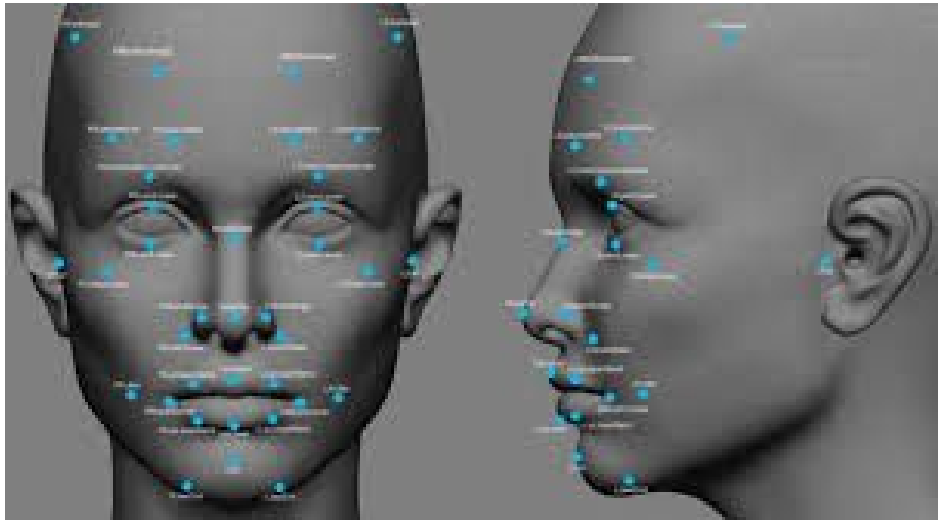
Introduction

- Most humans can recognize others' emotions easily, ***but what about computers and machines?***



- **Miscellaneous uses**:
  - Security, privacy protection, digital personalization, entertainment, and even mental health benefits!

Start at 0:56

Goals

- Build a model that will automatically recognize an emotion associated with a given image.

- Integrate model with a webcam application that displays a timeline of emotions.

Method

1) FER2013 dataset - Facial Emotion Recognition (Kaggle)

- Over 30,000 images, 48 x 48 pixels grayscale

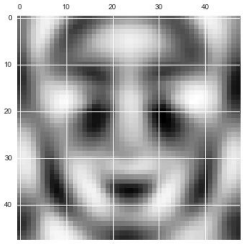
2) Cohn-Kanade dataset (CK)

- ~ 700 images, 350 x 350 pixels grayscale

➢ Across both data sets, emotions include: ***neutral, angry, disgust, fear, happy, sad, surprise***

Pipeline

- **Face Recognition**
  - Template matching to detect features in faces (nose, mouth, eyes, etc.)
- **Dimension Reduction**
  - Eigenfaces and Fisherfaces
  - Find low dimension representation of a face which comes from a higher dimension
  - A way to describe the most dominant features of the training set as a whole.



Results- Model Accuracy:

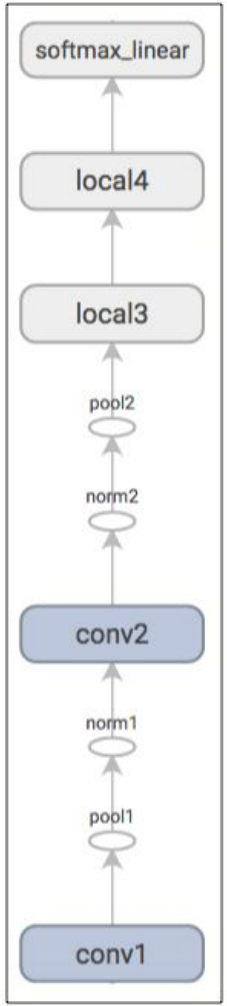
	Cohn-Kanade (CK)	Kaggle FER2013
SVM	84%	44%
Fisher Face Recognizer	82%	32%
Multilayer Perceptron	77%	37%
RandomForest Classifier	54%	42%

MLP Image Misclassification

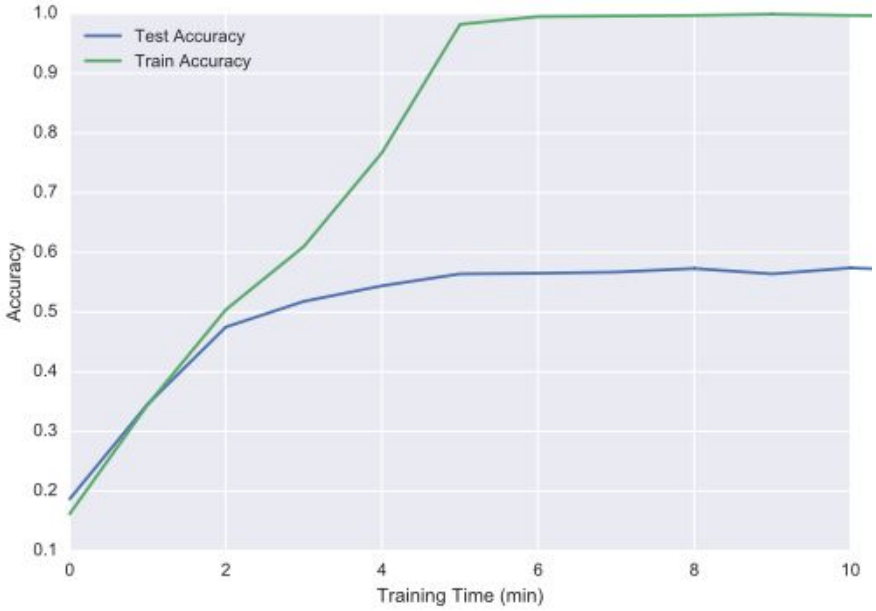
Classified as Anger--Actual label Neutral

Convolutional Neural Network

- State of the art method for image classification
  - Automatically learns features
- Requires huge amount of data
  - Only trained on Kaggle FER2013 dataset
- Network from Tensorflow tutorial
  - Uses ReLU for activation functions



Convolutional Neural Network - Results



Peaked after 6 minutes of GPU training
20x slower on CPU

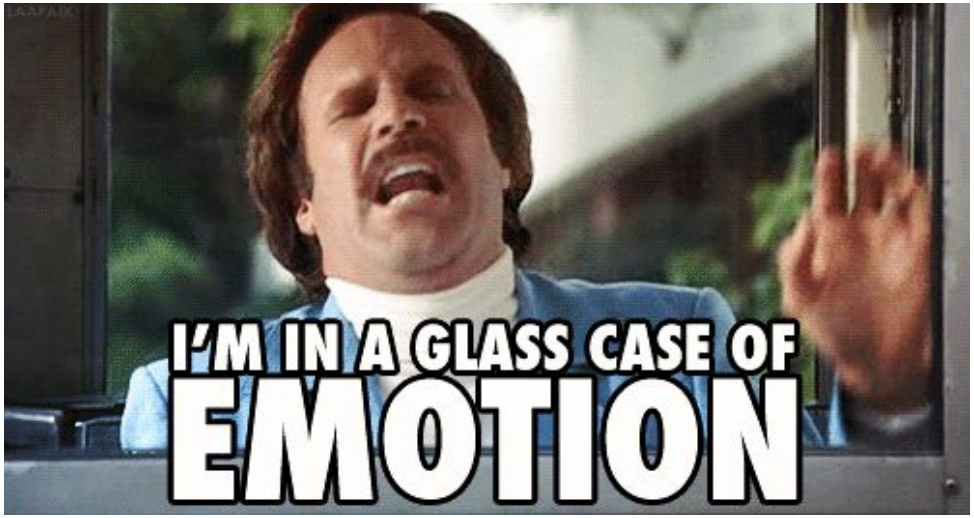
- **Training accuracy:** ~ 0.999
- **Test accuracy:** - ~ 0.57
  - **Winning model**: 0.711
- Extreme overfitting
- “Dropout” - regularization by randomly dropping nodes from the neural net

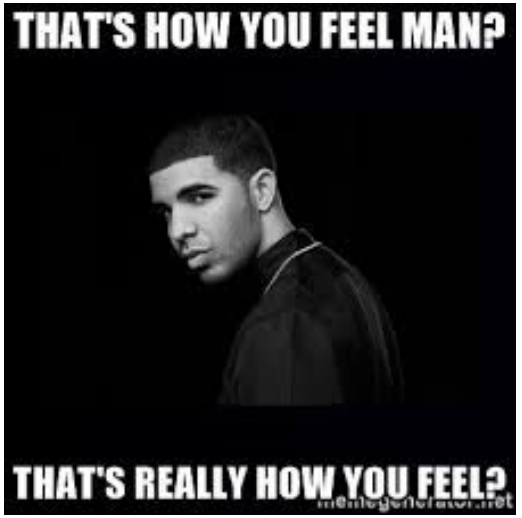

preview
Press Esc to QUIT
Sarick Shah
@SarickShah
Joined February 2013
TWEETS 1
FOLLOWING 11
FOLLOWERS 2
MOMENTS 0
Edit profile
Tweets
Tweets & replies
Who to follow · Refresh · View all
Moody @EricNMoody
Followed by Fantasy Nugget
Follow
Curtis P. @ccpatrick13
Followed by Fantasy Nugget
Follow
Find friends
Trends · Change
#NationalPumpkinDay
47.1K Tweets
#WorldSeries
@cnnbrk is Tweeting about this
#WednesdayWisdom
75.9K Tweets
#HBDHRC
DeMarcus Ware
4,534 Tweets
#edfunders16
You followed Fantasy Nuggets NFL, Jack Perkins, Floyd Mayweather and 8 others
Following
Fantasy Nuggets NFL
@FFNuggets
Maximizing your greatest #FantasyFootball weapon, @Twitter. Filtering the latest updates, advice, stats & resources from various analysts.
Following
Jack Perkins
@purehoop
Instagram @purehoop • Basketball Painter & T-Shirt Maker • Freelance Illustrator • Draws stuff for Family Guy • Dad • Unlikely to break your ankles

Conclusion and Implications

- **Ultimately, machines and computers are still *not as good* at detecting emotions compared with humans**
    - Facial expressions are much more complex than the label of a single emotion.
    - Advances in machine facial recognition will yield tremendous societal benefits.

- **Potential uses for facial recognition data:**
  - Security, privacy, personalization of digital devices...etc.
  - We are often unaware of how we *really* feel given how subtle our emotions may be. Facial recognition can help us better understand ourselves and attend to our needs.





- **Machine facial recognition for improving mental health**
  - Mood monitoring (e.g., for depression)
  - Efficacy of psychiatric drugs
  - Advances in facial recognition may help improve compliance and the accuracy of these records

Emotions are universal and cross-cultural. Advances in machine facial recognition will help us better understand ourselves, each other, and our complex world.


THANK YOU!

Resources

- http://eyalarubas.com/face-detection-and-recognition.html
- http://docs.opencv.org/2.4/modules/contrib/doc/facerec/facerec_tutorial.html
- http://www.paulvangent.com/2016/04/01/emotion-recognition-with-python-opencv-and-a-face-dataset/
- https://realpython.com/blog/python/face-recognition-with-python/
- http://docs.opencv.org/trunk/d7/d8b/tutorial_py_face_detection.html

Fisherface/ Eigenface SUPPL.

Fisherfaces:

- Imagine a situation where the variance is generated from external sources, let it be light The axes with maximum variance do not necessarily contain any discriminative information at all, hence a classification becomes impossible. So a class-specific projection with a Linear Discriminant Analysis was applied to face recognition
- Minimize the variance within a class, while maximizing the variance between the classes at the same time.

Eigenfaces:

- Lower-dimensional subspace is found with Principal Component Analysis, which identifies the axes with maximum variance.
- Performance degrades with different lighting conditions