Introduction
Purpose: low resolution facial recognition
- Extract image/video from source
- Identify the person in real time given a trained-database

taken from https://github.com/alexjc/neural-enhance
Face Recognition
Libraries

- histogram of oriented gradients (HOG)
- dlib
- Support Vector Machines (SVM)
Process

- Neural Enhance library
  - increase the resolution of low pixel density
  - Theano (neural network)
    → Lasagne (train)
    → upsampled image

- dlib
  - Histogram of oriented gradients (HOG)
  - SVM
  - feature descriptor for detecting faces
Database

- IMDb
  - Internet Movie Database is an online database of information related to films, television programs and video games
  - low and high resolution versions of the same image
  - high-resolution 'base' image to train the Support Vector Machine (SVM)
Support Vector Machine for Face Recognition
SVM

Identify the
Rock

Images similar to
Dwayne
Johnson

Image of
Dwayne
Johnson
SVM

+ The Rock
- not The Rock

Images similar to Dwayne Johnson

Image of Dwayne Johnson
SVM

Separate data

Images similar to Dwayne Johnson

Image of Dwayne Johnson
SVM

Which line?

Images similar to Dwayne Johnson

Image of Dwayne Johnson
SVM

Thickest line

Images similar to Dwayne Johnson

Image of Dwayne Johnson
SVM

Separate data?

Images similar to Dwayne Johnson

Image of Dwayne Johnson
SVM
Non-linear separation
Images similar to Dwayne Johnson

Image of Dwayne Johnson
Generative Adversarial Network for Upsampling Images
GAN

Back with The Rock

Images similar to Dwayne Johnson

Image of Dwayne Johnson
Images similar to Dwayne Johnson

Generate this image? +

GAN

Image of Dwayne Johnson
Generative Network
produce an image

Discriminative Network
real or fake

VS
How to train your Generative Adversarial Network
GAN

Train discriminative network

Discriminative Network

real

fake
GAN

Train both networks

random noise

Generative Network → Discriminative Network

negative gradient → positive gradient

backpropagation

Fake
GAN

Eventually?

random noise

Generative Network

Discriminative Network

backpropagation

Real
Code can be found at: https://github.com/PresidentDwayneCamacho/super-res-face
super resolution
video samples
face recognition in enhanced-resolution video
super resolution image enhancement

boring Bruce Springsteen
100 x 100

enhanced Bruce Springsteen
200 x 200

actual Bruce Springsteen
high res
super resolution face recognition

unrecognized Bruce Springsteen
100 x 100

that’s Bruce Springsteen!
200 x 200
<table>
<thead>
<tr>
<th>true face</th>
<th>false face</th>
</tr>
</thead>
<tbody>
<tr>
<td>high res</td>
<td>high res</td>
</tr>
<tr>
<td>low res</td>
<td>low res</td>
</tr>
<tr>
<td>enhanced res</td>
<td>enhanced res</td>
</tr>
</tbody>
</table>
matches across groups, filtered by unrecognized

proportion of matches

high res  high ctrl  low res  low ctrl  enhanced res  upres ctrl
threshold across groups, filtered by unrecognized

vector distance

- high res
- high ctrl
- low res
- low ctrl
- enhanced res
- upres ctrl
future directions

- find robust metric with which to filter data
- test efficacy of various algorithms
- generate larger dataset
References