

Catching Nod

Judged by a machine

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Here we have for the last time...

Catching Nod

Judged by a machine

Here we have for the last time...

... a Kevin Björk Production

Outline

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- Facial Recognition in modern society

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- The Data and image preprocessing

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- Facial Recognition in modern society
- The Data and image preprocessing
- How does image classification work?
 - What is an image?
 - Neural Network Classifier
 - The mind of the machine

Outline

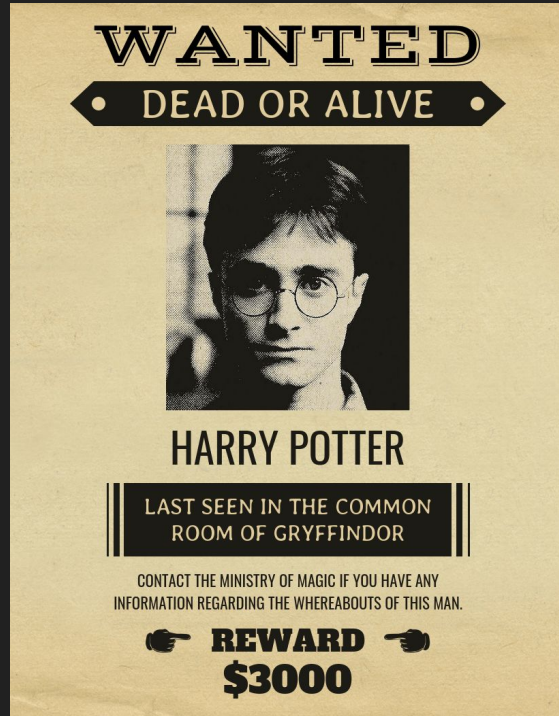
- Facial Recognition in modern society
- The Data and image preprocessing
- How does image classification work?
 - What is an image?
 - Neural Network Classifier
 - The mind of the machine
- Machine Learning:
 - Catching Nod
 - Mapping face to name

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 - Catching Nod
 - Mapping face to name
- Summary

Facial Recognition in modern society

From this:



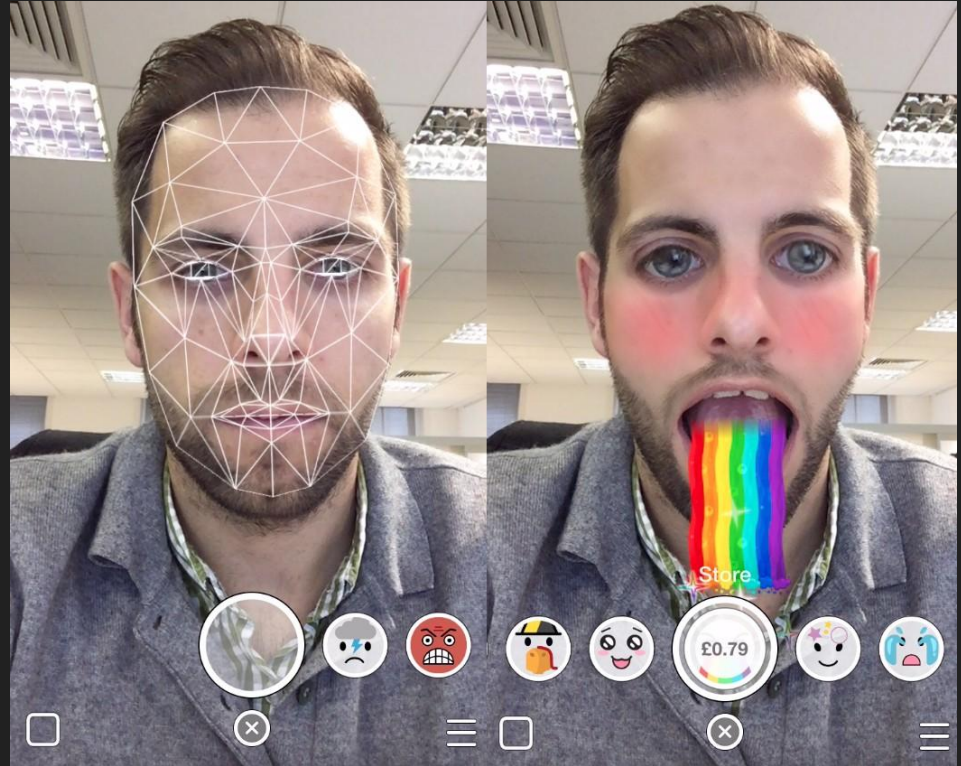
To this:



Uses of FR

Uses of FR

- Snapchat filters



Uses of FR

- Snapchat filters
- ID verification



Uses of FR

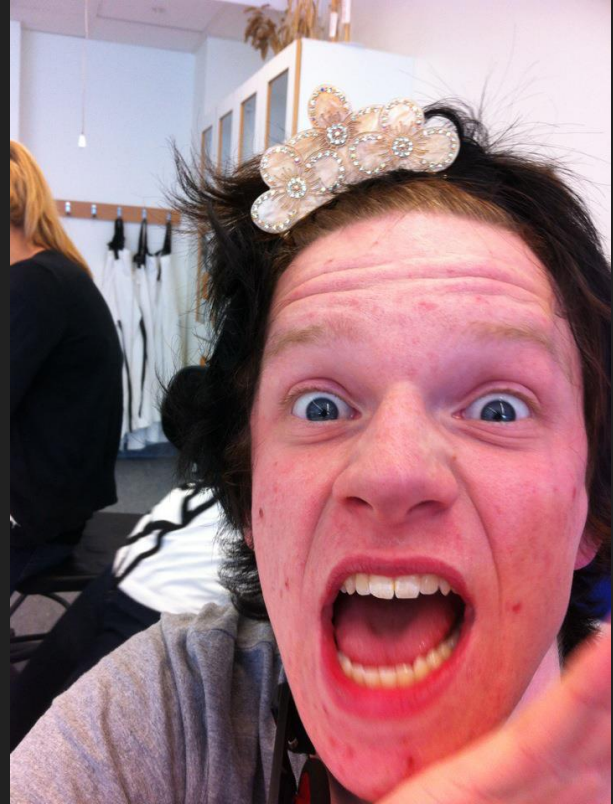
- Snapchat filters
- ID verification
- Police investigations

Surveillance [\[edit \]](#)

The [American Civil Liberties Union](#) criticized a test of a system used at the event to monitor the people in attendance. A group of four companies installed a [face recognition](#) system to scan the faces of fans entering the stadium and compare them with a database of criminals. Attendees were not told that they were subject to this [surveillance](#).^[20] Tampa police reported that the system identified nineteen criminals, but due to complaints and trouble with [false positive](#) results, it was not re-used the next year.^[21] [Super Bowl XXXVI](#) and all subsequent Super Bowls have been designated as a [National Special Security Event](#), qualifying for extra security detail from the [Secret Service](#).

Uses of FR

- Snapchat filters
- ID verification
- Police investigations
- Facebook tagging



Uses of FR

- Snapchat filters
- ID verification
- Police investigations
- Facebook tagging
- Confirming purchases



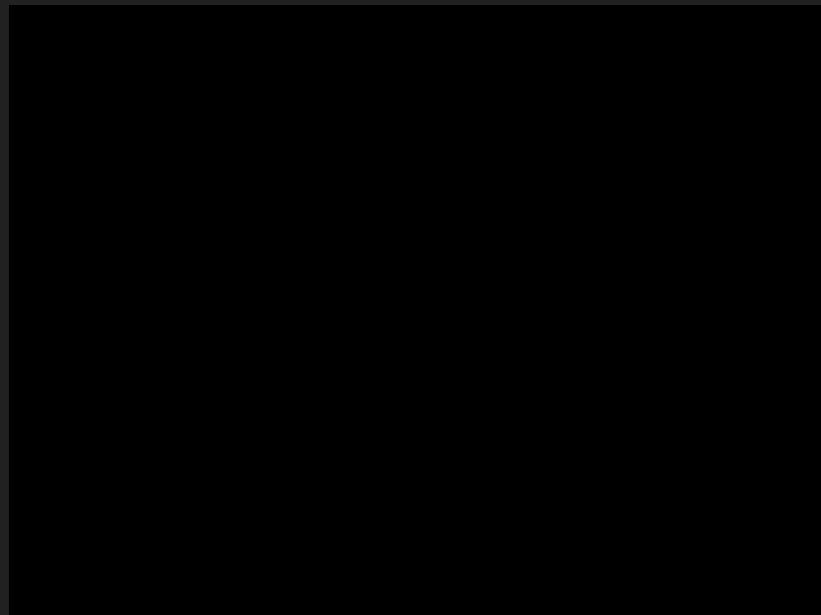
Uses of FR

- Snapchat filters
- ID verification
- Police investigations
- Facebook tagging
- Confirming purchases
- Many, many more...

The Data

The Data

LFW People



Nod



LFW People



LFW People

- A database with pictures of primarily celebrities faces
 - Over 13000 pictures in total



LFW People

- A database with pictures of primarily celebrities faces
 - Over 13000 pictures in total
- Run by The University of Massachusetts Amherst

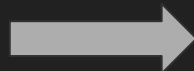
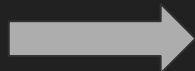


LFW People

- A database with pictures of primarily celebrities faces
 - Over 13000 pictures in total
- Run by The University of Massachusetts Amherst
- Can easily be accessed through SKlearn



Data Cleaning



We are ready to do FR...

We are ready to do FR...

... but how does it work?

What is an image?

What is an image?

- Images are made up of pixels, small coloured boxes

What is an image?

- Images are made up of pixels, small coloured boxes
- The bigger the picture, the more pixels are required to construct it (could be in the millions)

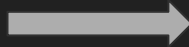
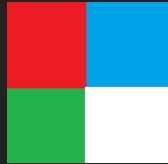
What is an image?

- Images are made up of pixels, small coloured boxes
- The bigger the picture, the more pixels are required to construct it (could be in the millions)
- Each pixel have 3 values associated with it that decide it's color
 - These are the R(ed) G(reen) B(lue) values

What is an image?

- Images are made up of pixels, small coloured boxes
- The bigger the picture, the more pixels are required to construct it (could be in the millions)
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 - These are the R(ed) G(reen) B(lue) values

• Example:



R: 255 G: 0 B: 0	R: 0 G: 0 B: 255
R: 0 G: 255 B: 0	R: 255 G: 255 B: 255

How a computer classifies an image

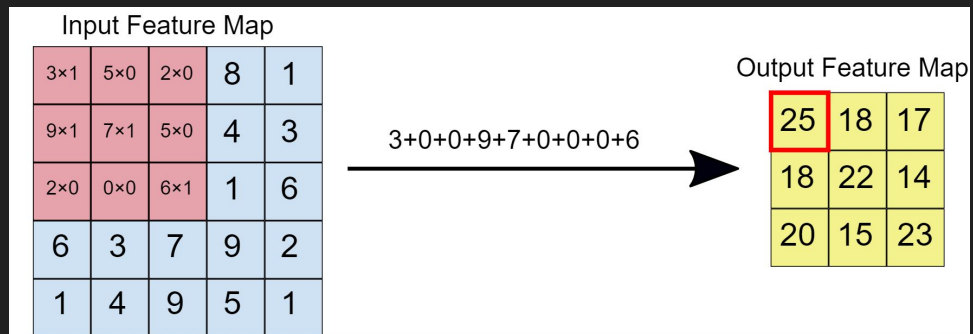
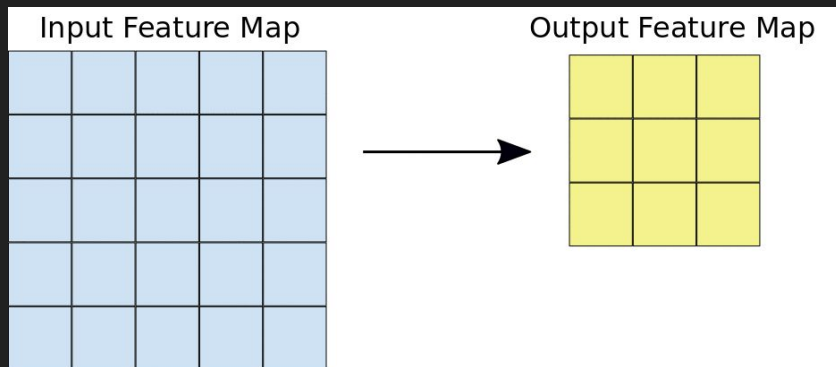
How a computer classifies an image

- Use a neural network classifier, specifically a 'convolutional Neural Network classifier' (CNN)
 - SKlearn: MLPClassifier

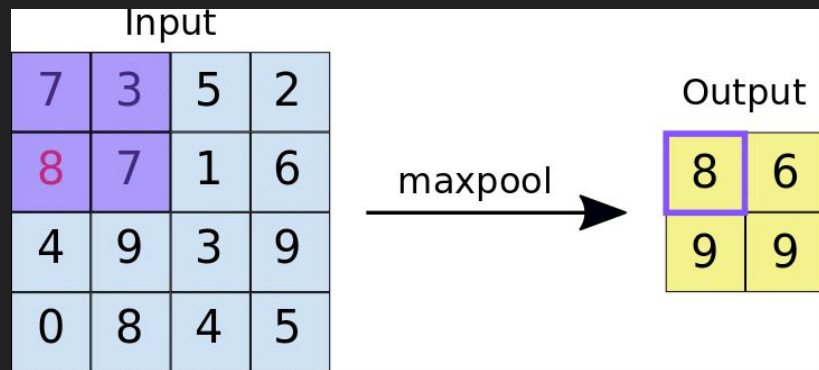
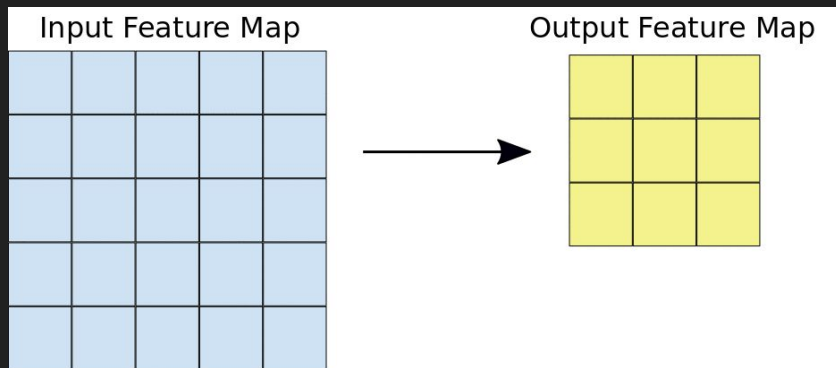
How a computer classifies an image

- Use a neural network classifier, specifically a 'convolutional Neural Network classifier' (CNN)
 - SKlearn: MLPClassifier
- Other classifiers would work too (often not as well...)

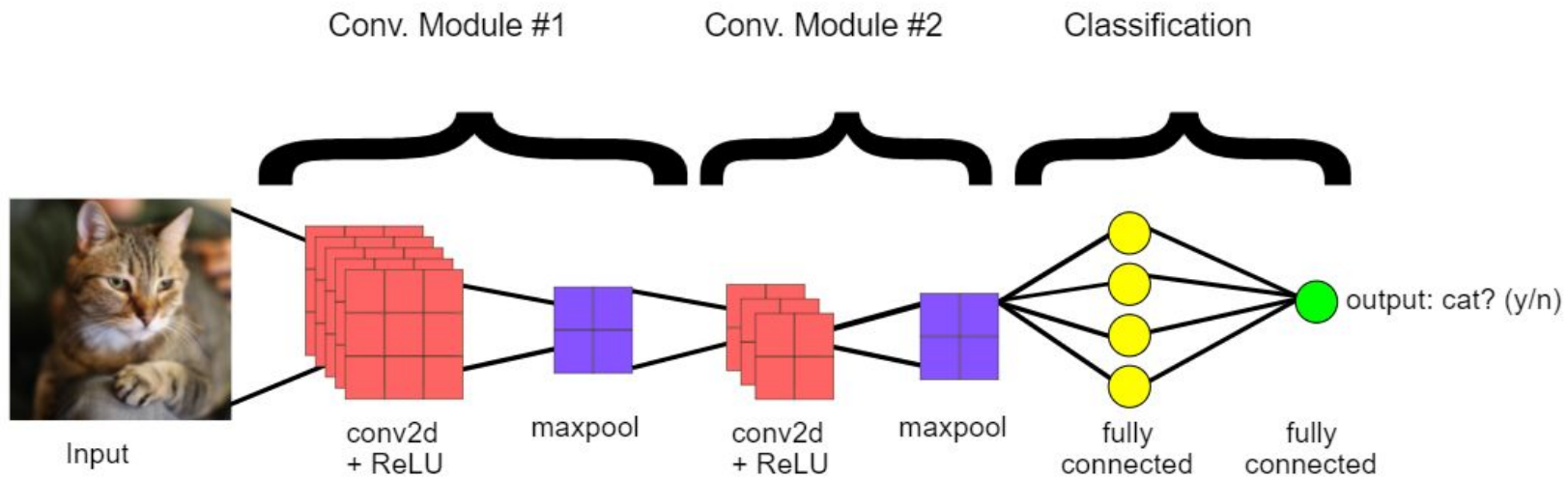
CNN



CNN



CNN

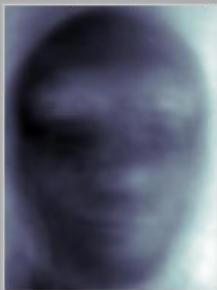


How does the machine weigh pixels?

1. component (ca 22 %)



2. component (ca 10 %)



3. component (ca 10 %)



4. component (ca 7 %)



5. component (ca 4 %)



6. component (ca 3 %)



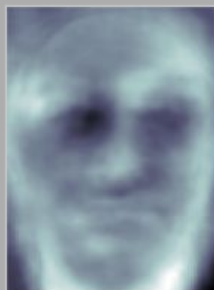
7. component (ca 2 %)



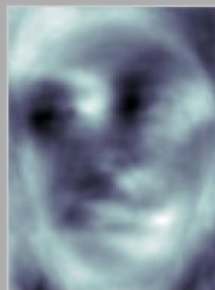
8. component (ca 2 %)



9. component (ca 2 %)



10. component (ca 2 %)



11. component (ca 1 %)



12. component (ca 1 %)



13. component (ca 1 %)



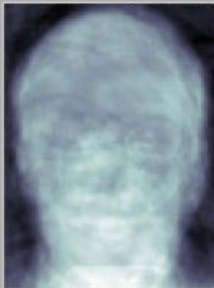
14. component (ca 1 %)



15. component (ca 1 %)



1. component (ca 26 %)



2. component (ca 13 %)



3. component (ca 10 %)



4. component (ca 7 %)



5. component (ca 5 %)



6. component (ca 4 %)



7. component (ca 3 %)



8. component (ca 3 %)



9. component (ca 2 %)



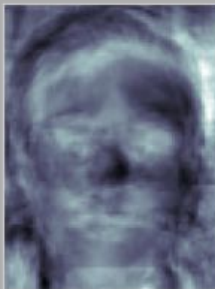
10. component (ca 2 %)



11. component (ca 2 %)



12. component (ca 1 %)



13. component (ca 1 %)

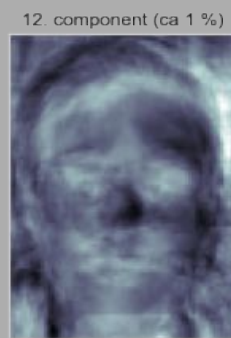
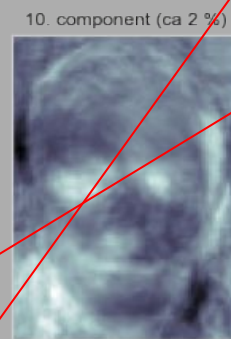
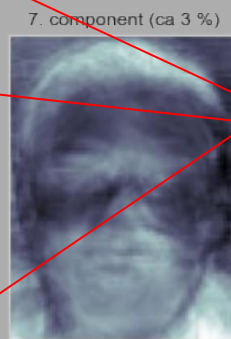
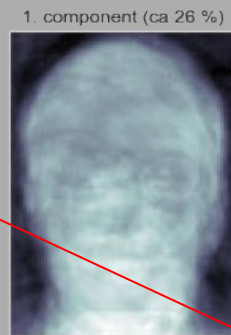


14. component (ca 1 %)



15. component (ca 1 %)





original image



10 components



50 components



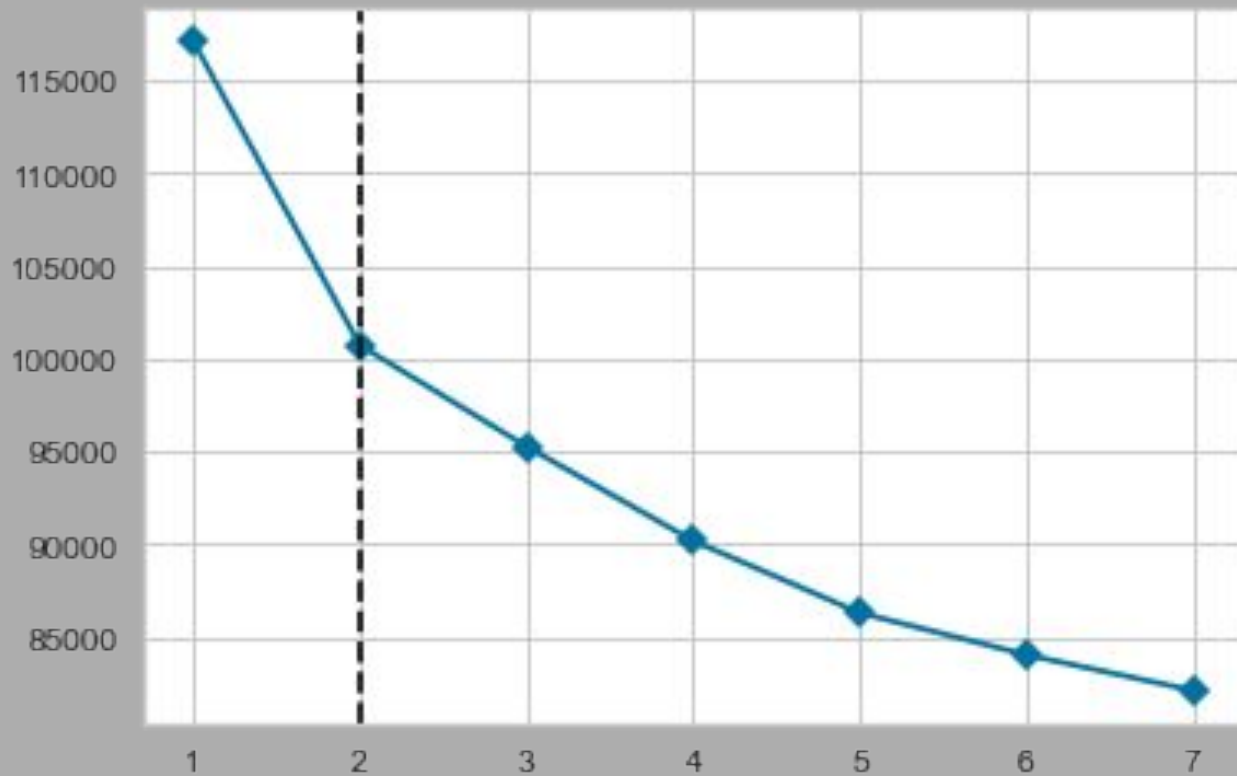
100 components



500 components



Clustering



Clustering

Cluster 0:



Cluster 1:



Clustering (Nod only)

Cluster 0:



Cluster 1:



ML: Catching Nod

- Estimator: MLPClassifier()
- Scoring: Accuracy
- CV: 10

Train: 100 %

Confusion matrix for train data



Test: 99 %

Confusion matrix for test data



ML: Catching Nod

- Estimator: MLPClassifier()
- Scoring: Accuracy
- CV: 10



Train: 100 %

Considered correctly (on train data)



Test: 99 %

Considered correctly (on test data)



ML: Mapping face to name

- Estimator: MLPClassifier()
- Scoring: Accuracy
- CV: 10

Train: 55 %

Test: 9 %

ML: Mapping face to name

- Estimator: MLPClassifier()
- Scoring: Accuracy
- CV: 10

Train: 55 %

Test: 9 %

With PCA:

Train: 100 %

Test: 24 %

Alvaro Uribe



Gustav Svensson



ML: Mapping face to name (Nod Only)

- Estimator: MLPClassifier()
- Scoring: Accuracy
- CV: 5

Train: 100 %

Test: 41 %

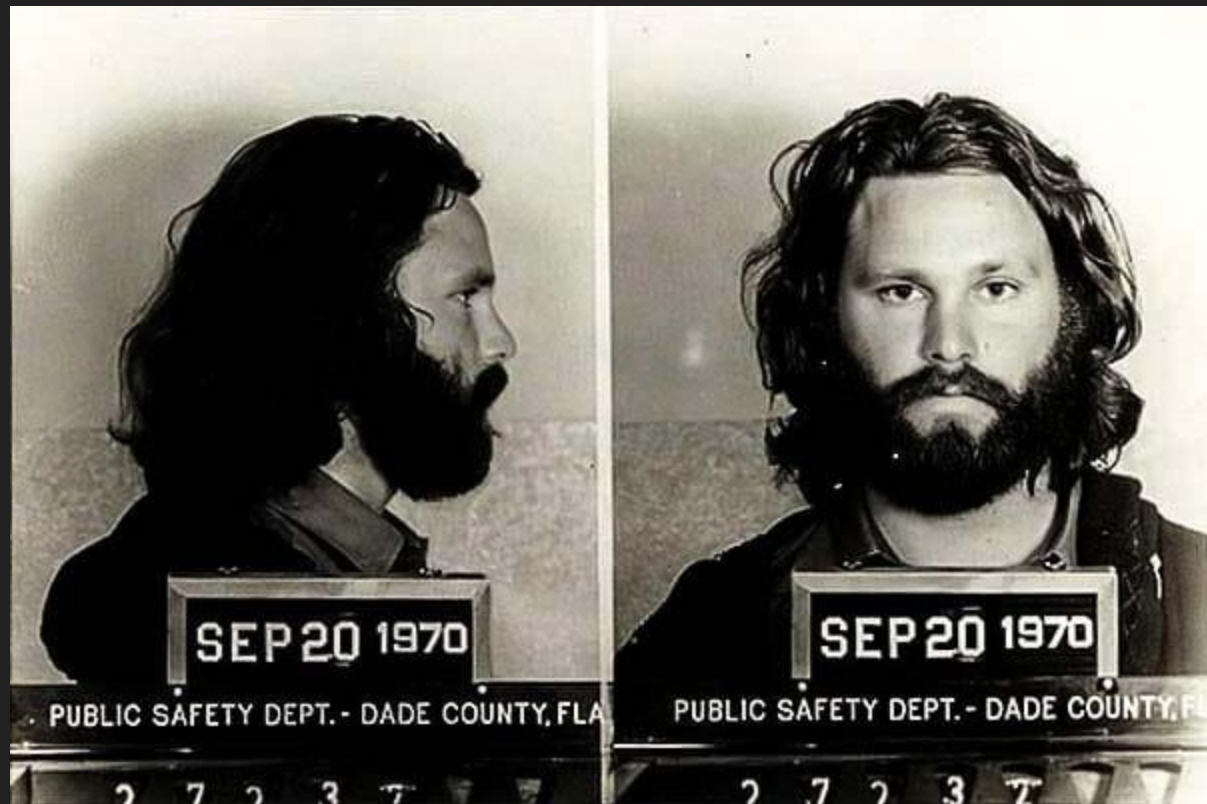
With PCA:

Train: 100 %

Test: 59 %

Summary

- A face database needs to be consistent when taking photos



Summary

- A face database needs to be consistent when taking photos
- Not using grey-scale could be an advantage



Red



Green



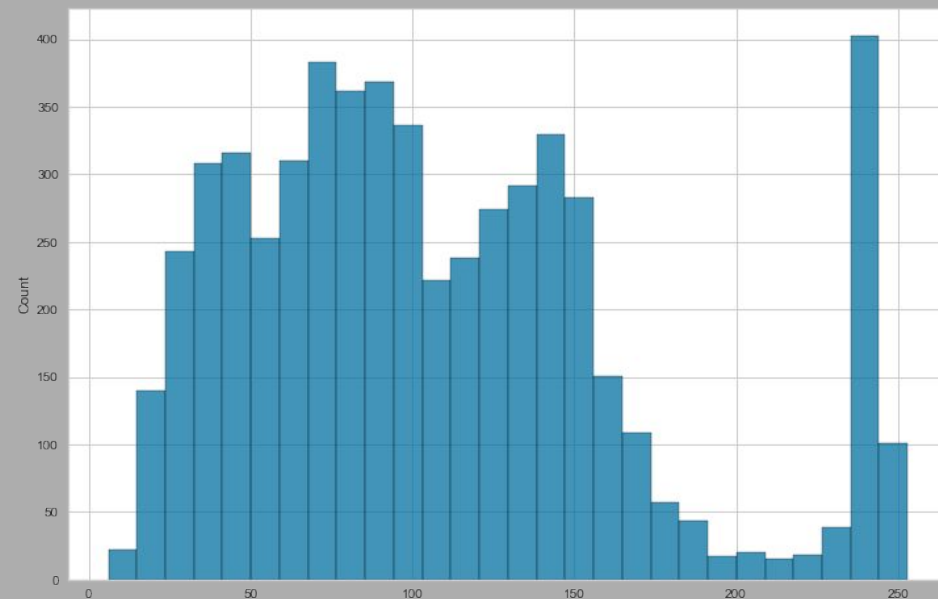
Blue

Summary

- A face database needs to be consistent when taking photos
- Not using grey-scale could be an advantage
- Hard to do EDA

	status	height	width	pix0	pix1	pix2	pix3	pix4	pix5	pix6	...
0	0	100	111	9	33	57	66	79	86	94	...
1	0	100	138	106	105	129	134	93	66	68	...
2	0	100	106	100	93	86	83	82	81	77	...
3	0	100	134	242	210	83	9	0	1	0	...
4	0	100	131	0	0	0	0	0	0	0	...
...
1336	0	100	148	58	51	46	46	45	41	39	...
1337	0	100	109	100	105	104	117	133	100	55	...
1338	0	100	129	17	31	37	51	48	70	91	...
1339	0	107	100	131	120	106	97	100	112	123	...
1340	0	100	120	36	37	37	35	34	33	29	...

1341 rows × 18103 columns



Summary

- A face database needs to be consistent when taking photos
- Not using grey-scale could be an advantage
- Hard to do EDA
- Tricky to reshape data

Summary

- A face database needs to be consistent when taking photos
- Not using grey-scale could be an advantage
- Hard to do EDA
- Tricky to reshape data
- Bootcamp is over :'(

The End