Pattern Recognition Assignments' Presentation

The Blue Guys

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KWS - Implementation Details

Implemented in Python

Used external libraries

KWS

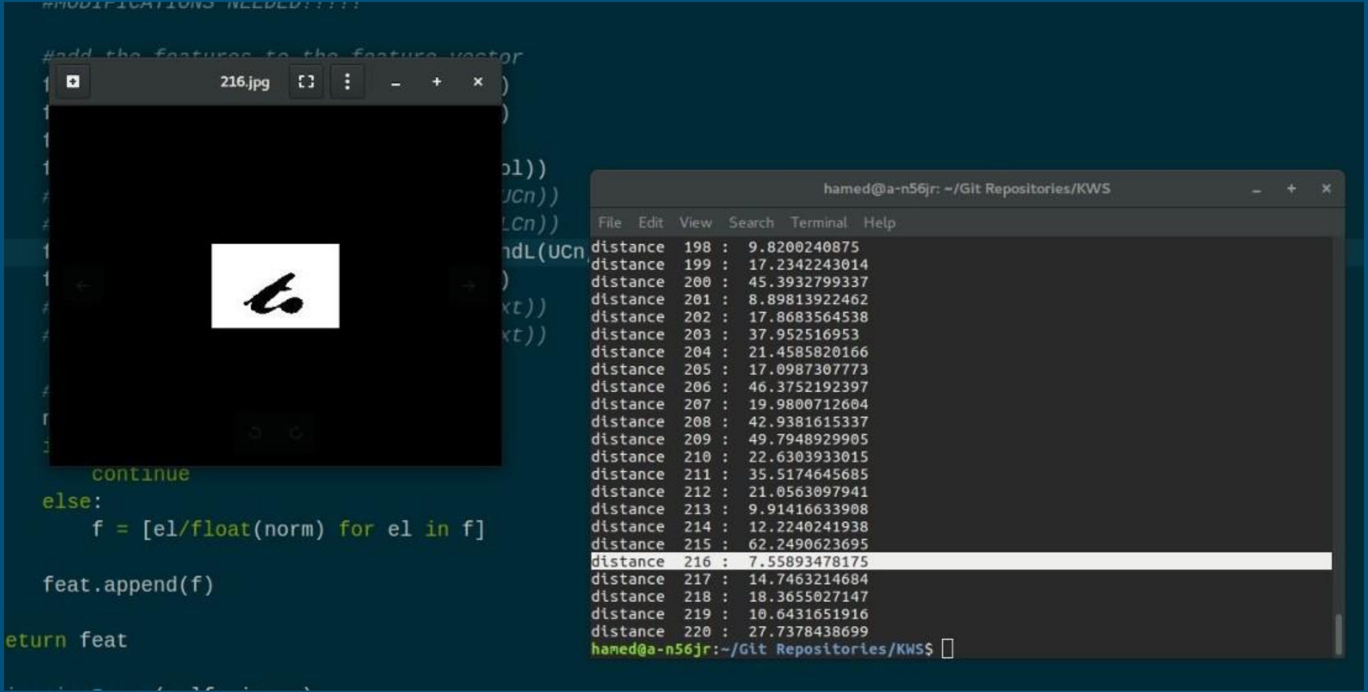
Things we did:

- Find a way to cut the segmentations (used PIL)
- Find appropriate features for describing images
- Using a library for doing DTW
- Getting it all together

KWS - Feature Vector

- Used Features:
- Fraction of black pixels
- Upper contour
- Lower contour
- Number of transitions
- Fraction of black pixels between lower half and upper half

KWS - Features



```
#MODIFICATIONS NEEDED!!!!!

#add the features to the feature vector
    continue
else:
    f = [el/float(norm) for el in f]

feat.append(f)

eturn feat
```

hamed@a-n56jr: ~/Git Repositories/KWS
File Edit View Search Terminal Help

```
distance  198 :  9.8200240875
distance  199 :  17.2342243014
distance  200 :  45.3932799337
distance  201 :  8.89813922462
distance  202 :  17.8683564538
distance  203 :  37.952516953
distance  204 :  21.4585820166
distance  205 :  17.0987307773
distance  206 :  46.3752192397
distance  207 :  19.9800712604
distance  208 :  42.9381615337
distance  209 :  49.7948929905
distance  210 :  22.6303933015
distance  211 :  35.5174645685
distance  212 :  21.0563097941
distance  213 :  9.91416633908
distance  214 :  12.2240241938
distance  215 :  62.2490623695
distance  216 :  7.55893478175
distance  217 :  14.7463214684
distance  218 :  18.3655027147
distance  219 :  10.6431651916
distance  220 :  27.7378438699
hamed@a-n56jr:~/Git Repositories/KWS$
```

KWS - DTW Library

- Learnt the theories behind DTW first
- Used fastdtw 0.3.0 for the DTW part

Signature Verification

Collect biometric data as the users are signing at certain time intervals

Data: coordinates, pressure, pen-up/down, angles

Signature Verification

Problem: Even the same person can take variable amounts of time to make a signature.

Difficult to compare uneven sets of data.

Dynamic Time Warping

Solution: Dynamic Time Warping is a technique to measure the distance between two uneven temporal sequences.

Data Preparation

- Read data from file save them in an nx7 matrix.
- N is variable depending how much time the signatory need to sign
- 7 is the number of the original features.
- Data
  - Time
  - X, Y coordinates
  - Pressure
  - Pen-up
  - Azimuth
  - Inclination

Feature extraction

- Calculate speeds for each coordinate on every time-stamp
- Features used:
    - X, Y
    - Speed X and Y
    - Pressure
- Final matrix n x 5

Preprocessing

Rescaling:

$$RescaledX = \frac{x - min(x)}{max(x) - min(x)}$$

Distances

- For each signature to be verified we calculate its distance from each of the original signatures of the particular signatory.
- Calculate the mean.