**CM0669 Machine Learning and Computer Vision**

**Lab 11** Face recognition using machine learning techniques

Download the Matlab codes and the training and test face images in a new folder ‘Week11’. Because the images are of good quality and the faces are well localised, the implemented face recognition systems do not include the pre-processing stage. The feature extraction stage consists of transforming the image into three wavelet decomposition levels. The mean and standard deviation of each sub-band (except the approximation sub-band) constitute the feature vector. The dataset consists of two sets for training and testing. Both the training and testing sets have ten classes (persons) where each class contains five face images.

**1. Face recognition using Artificial Neural Network**

The matlab codes ‘ANN\_training.m’ and ‘ANN\_testing.m’ implement a face recognition system using an ANN with two hidden layers (25 neurons in the first layer and 20 neurons in the second one). The output layer has 10 linear neurons corresponding to 10 classes. Run the Matlab code ‘ANN\_training.m’ to train the network and then ‘ANN\_testing.m’ to see the output of the network for five test images corresponding to class 1 (person 1). A correct answer should be ‘1000000000’ (first digit is 1 and the rest is zero). Similarly, a correct answer for class 2 should be ‘0100000000’ and so on. Note that ‘ANN\_testing.m’ uses C1 as default class.

a. Ensure you understand the Matlab codes. Ask your module tutor if you have any questions.

b. Complete the following table.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Class | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 |
| FPR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3/45 | 3/45 |
| FNR | 0 | 1/5 | 5/5 | 3/5 | 0 | 0 | 1/5 | 0 | 0 | 0 |

**2. Face recognition using Bayes’ classifier**

The matlab codes ‘Bayes\_training.m’ and ‘Bayes\_testing.m’ implement a face recognition system using Bayes’ classifier.

Run the Matlab code ‘Bayes\_training.m’ to train the network and then ‘Bayes\_testing.m’ to see the output of the network for five test images corresponding to class 1 (person 1). A correct answer should be ‘C1’. Similarly, a correct answer for class 2 should be ‘C2’ and so on. Note that ‘Bayes\_testing.m’ uses C1 as default class.

a. Ensure you understand the Matlab codes. Ask your module tutor if you have any questions.

b. Complete the following table.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Class | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 |
| FPR | 2/45 | 0/45 | 0 | 8/45 | 0 | 0 | 3/45 | 1/45 | 3/45 | 0 |
| FNR | 0 | 4/5 | 5/5 | 3/5 | 3/5 | 0 | 0 | 0 | 1/5 | 1/5 |

**2. Face recognition using Decision Tree**

Create new Matlab codes that implement a face recognition system using a decision tree as classifier. Complete the following table

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Class | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 |
| FPR | 0/45 | 3/45 | 3/45 | 5/45 | 1/45 | 4/45 | 4/45 | 1/45 | 3/45 | 0/45 |
| FNR | 0/5 | 4/5 | 5/5 | 3/5 | 3/5 | 1/5 | 3/5 | 2/5 | 1/5 | 2/5 |