MP2: Vision Based Person Identification (Face Recognition)

ECE417 – Multimedia Signal Processing

Spring2015

Goal

- Person identification system
- Feature extraction
  - Raw pixel
  - PCA
  - Random projection
- Classification
  - Use K-nearest neighbor for classification

Data

- 80 different face images
  - 4 different people, 20 images for each person
- Format: [Person][Instance].jpg
- Example:




Read Images in MATLAB

- Read image files in MATLAB: imread
- Work with grayscale images: rgb2gray
- Work with double type
- Example:
  Img=double(rgb2gray(imread('A1.jpg')));

Experiments

- Feature Extraction
  - Raw pixel
  - PCA
  - Random projection
- Classification
  - Nearest neighbor
  - 5-Nearest neighbor

Feature – Raw Pixel

- Each 90x70 image
- 1. Use “reshape” function to convert it into a 6300x1 vector
  - Ex: `Fea=reshape( Img, [6300, 1] );`
- 2. Resize image to 45x35, 22x17
  - Ex: `Img=imresize( Img, [45, 35] );`
- 3. Pick a pair of N1 and N2 so that N1xN2 is roughly equal to the choice of N in PCA. (the ratio between N1 and N2 is unchanged)

Feature - PCA

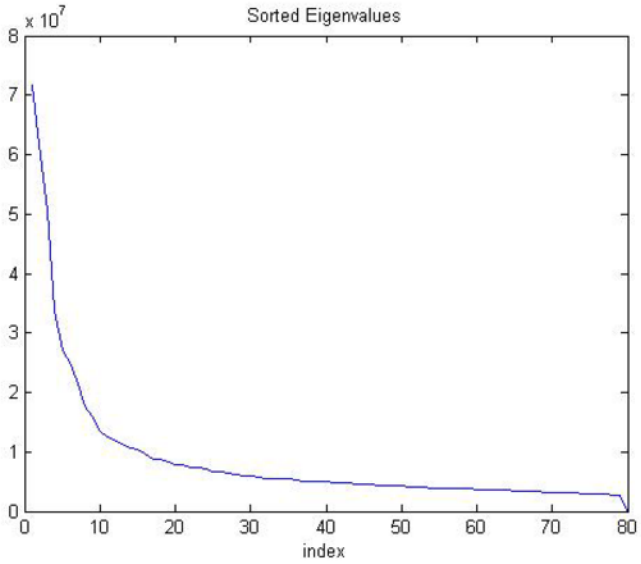
- Implement PCA (not using built-in PCA function)
- Choose N principal components such that 95% of the total energy is kept
- Project 6300x1 image vector onto the PCA subspace, resulting in a Nx1 vector as a feature

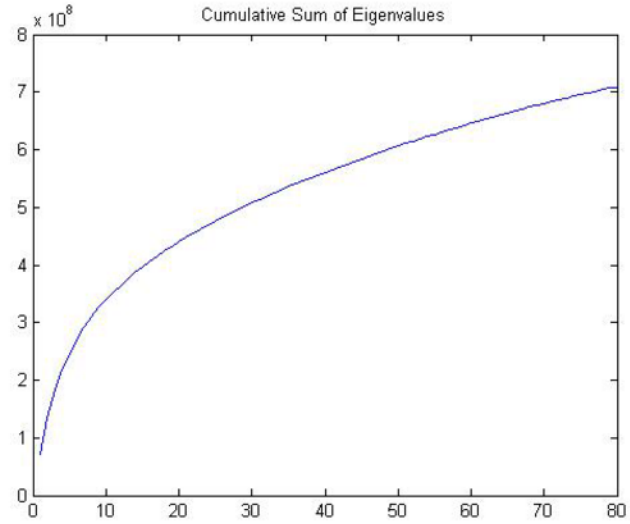
Implement PCA (I)

- 1. Subtract mean w.r.t. each pixel
  - MATLAB function: mean, repmat/bsxfun
- 2. Compute the scatter matrix
  - S=X'*X, where X the zero-mean 6300x80 matrix, S is 80x80
- 3. Compute eigenvalue of the scatter matrix
  - MATLAB function: eig
  - [V, D]=eig(A), V is the matrix of eigenvectors, diag(D) are eigenvalues

Implement PCA (II)

- 4. Sort eigenvalues from high to low
  - [sorted_values, ori_index]=sort(diag(D), ‘descend’);
- 5. Find N principal components to keep K% of the total energy
- 6. Projection data on selected eigenvectors





Feature – Random Projection

- Use randn to generate a projection matrix of size 6300xN
- Project each 6300x1 image onto the random subspace, resulting in a Nx1 vector as a feature
- Select N to be the same as in PCA case

Experiment

- Use nearest neighbor, 5-nearest neighbor for classification
- Validation number:
  - Raw features 6300x1 + nearest neighbor: 88.75% accuracy
  - PCA (95% energy) + nearest neighbor: 96.25% accuracy