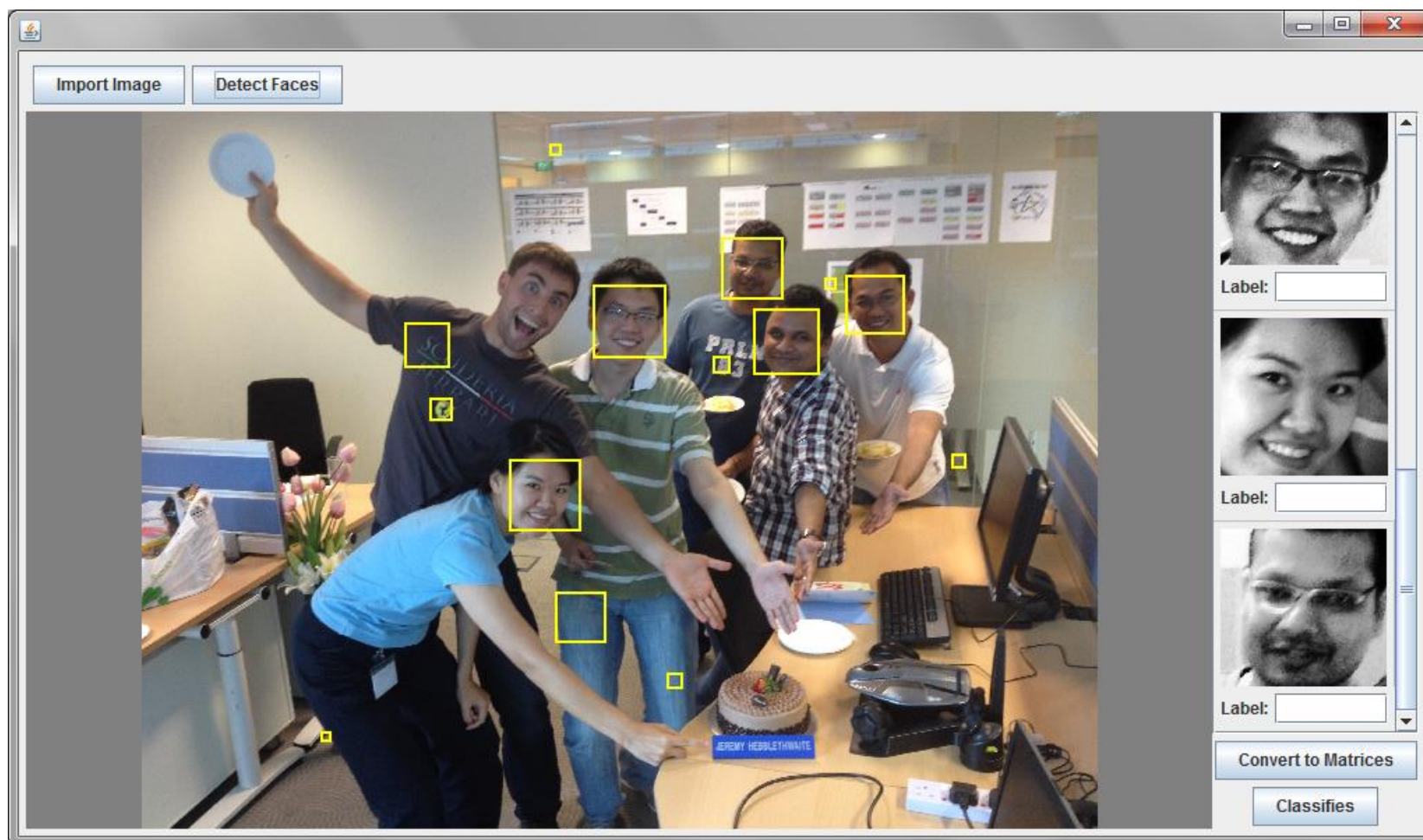# FACE RECOGNITION PROJECT

Outline

1. Face image cropping and preprocessing

2. Appearance-based face recognition methods
   - Principal Component Analysis (PCA)
   - Linear Discriminant Analysis (LDA)
   - Locality Preserving Projections (LPP)
   - K-nearest neighbor as the classification method

3. Experimental Results

4. Demonstration

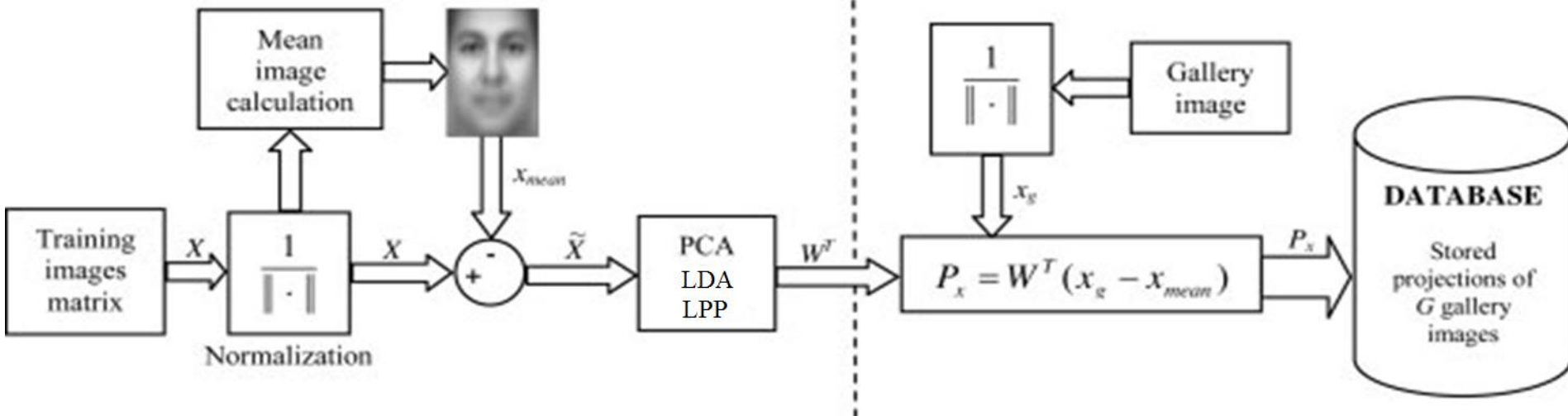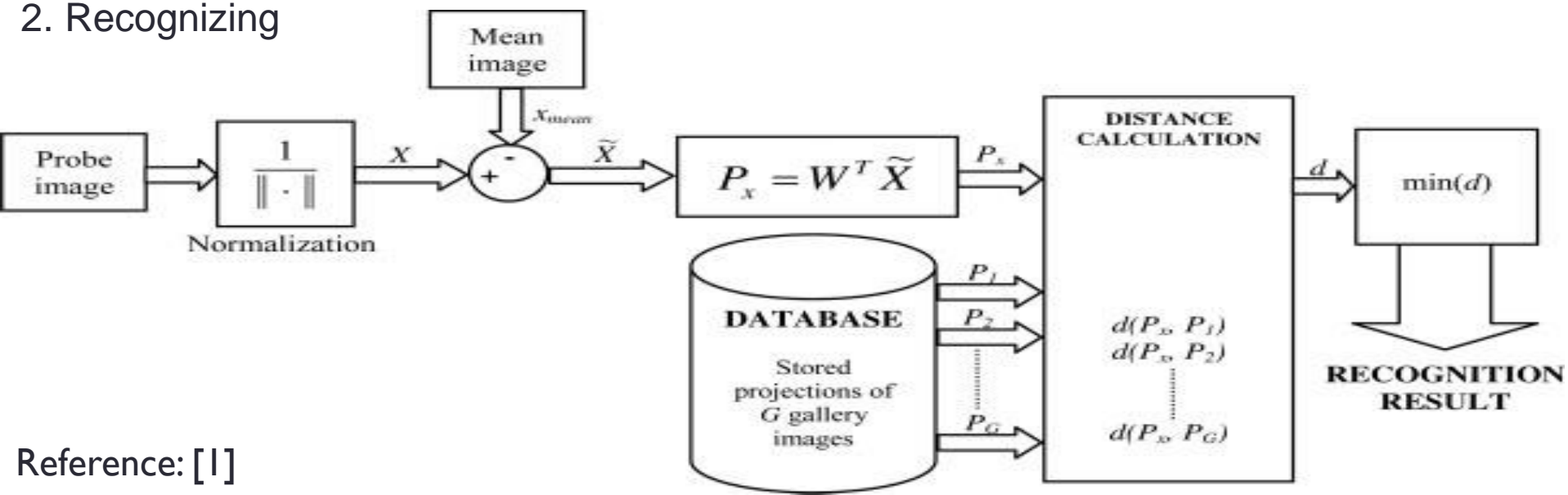# Face image cropping and preprocessing

Our Dataset

Appearance-based methods

- PCA
  - dimensionality reduction method
  - produces a compact representation

- LDA
  - supervised learning algorithm
  - find a subspace which separate different classes of objects

- LPP
  - considers the manifold structure for face analysis

1. Training

2. Recognizing

Reference: [1]

Eigenfaces, Fisherfaces & Laplacianfaces

PCA

Eigenfaces

LDA

Fisherfaces

LPP

Laplacianfaces

PCA Reconstruction

| Original Face | d = 2 | d = 6 | d = 10 | d = 20 | d = 40 | d =60 |

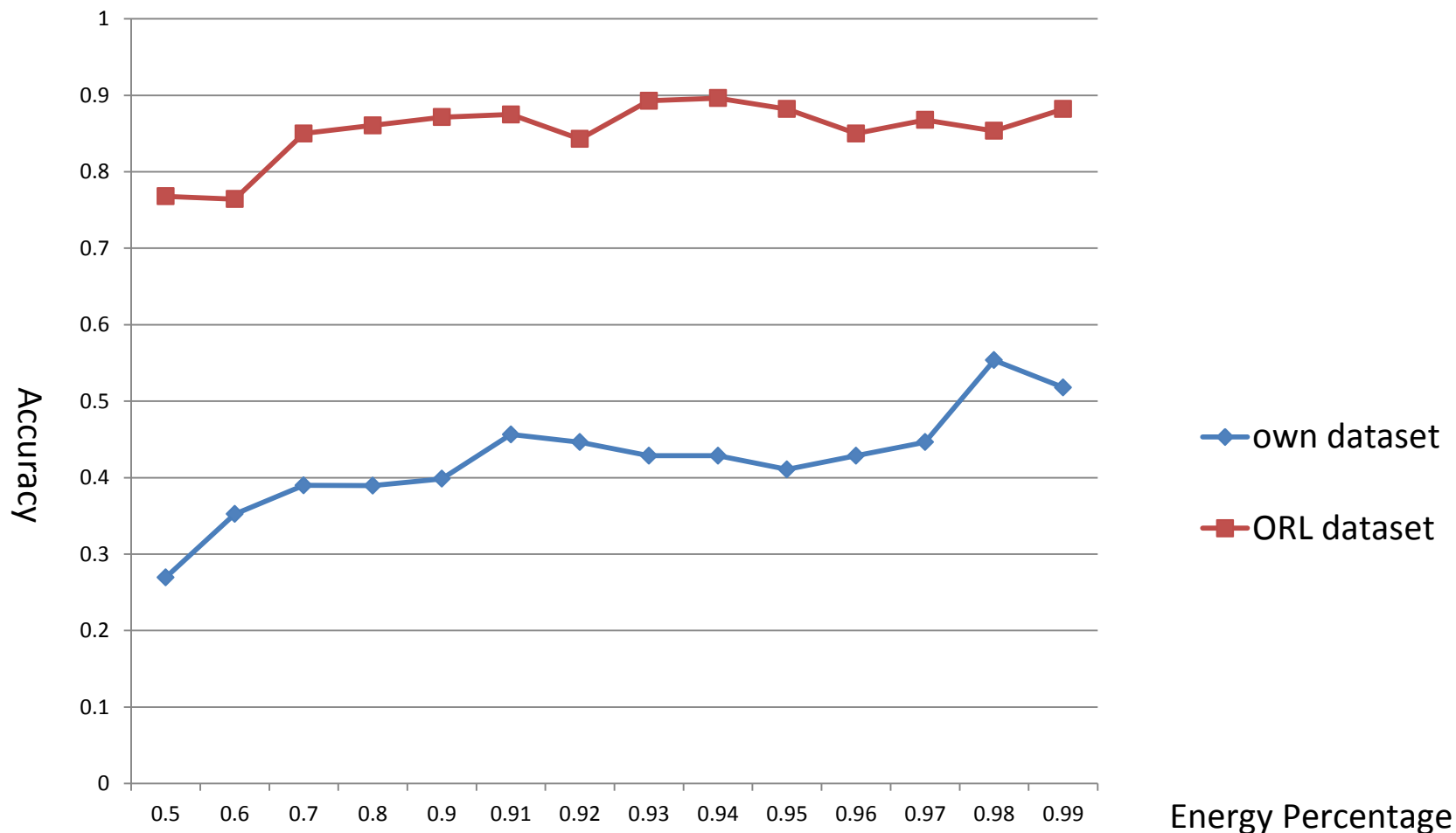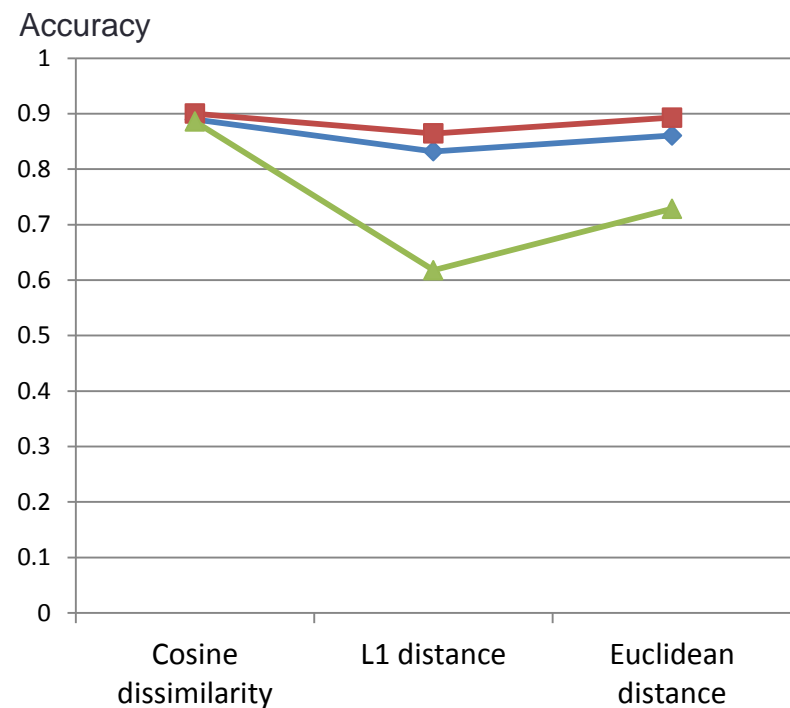| Original Face | d = 2 | d = 6 | d = 10 | d = 20 | d = 40 | d =60 |

Experimental Results

1. PCA with different energy percentage

2. Different metric types

3. Different partitions for validation

4. Different K for K-nearest neighbor

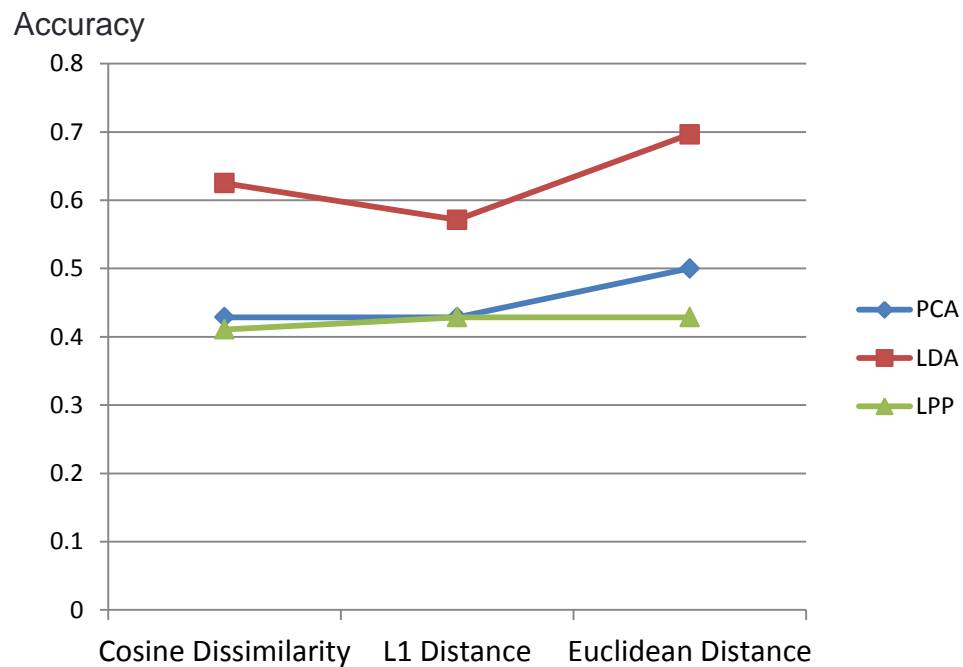5. LPP with different PCA processing

PCA with different energy percentage
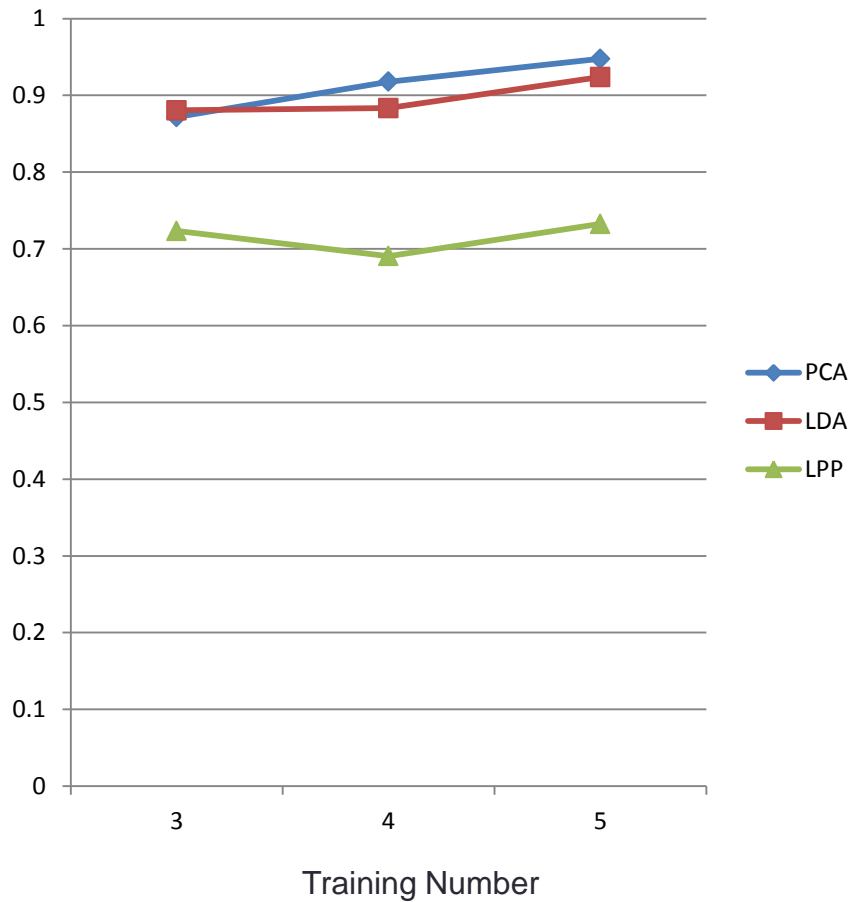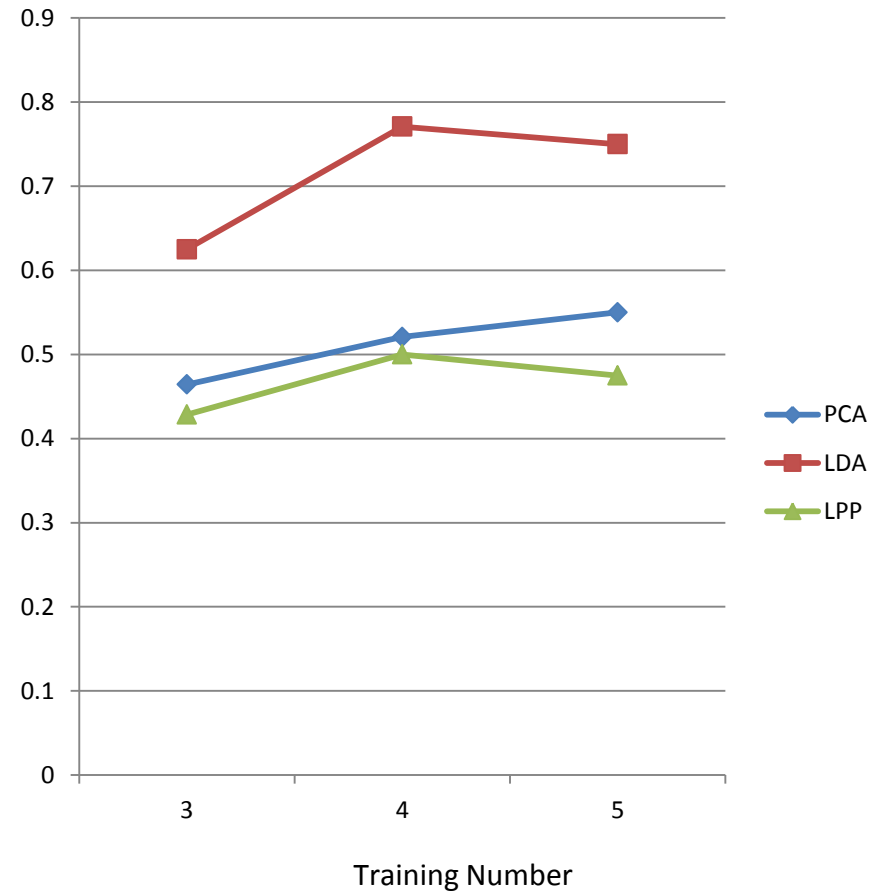
Different metric types

ORL Dataset

Our Dataset
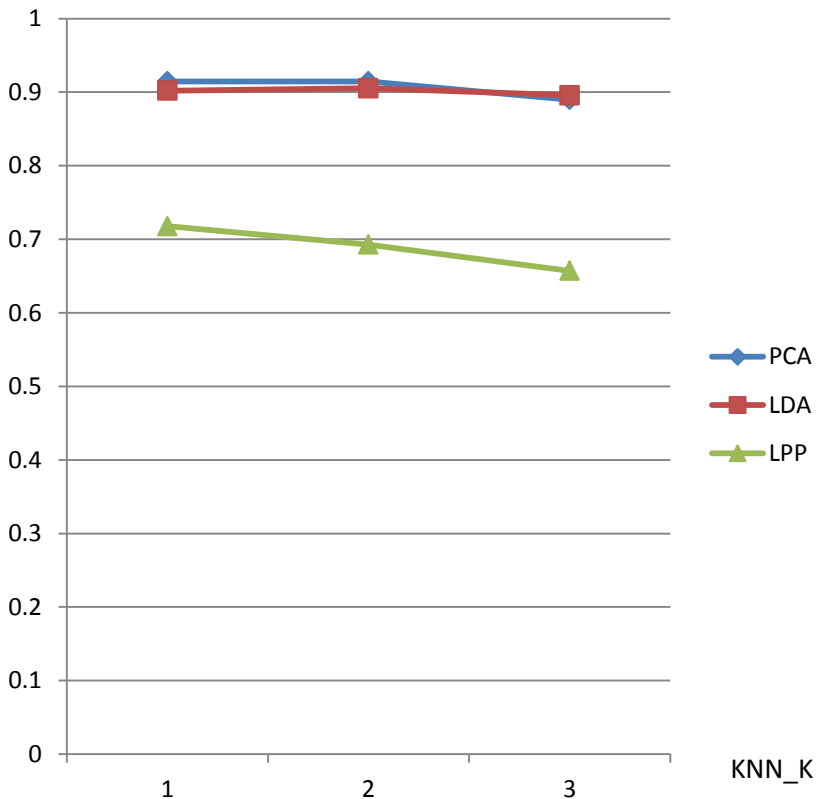
Different partitions for validation

ORL Dataset

Our Dataset

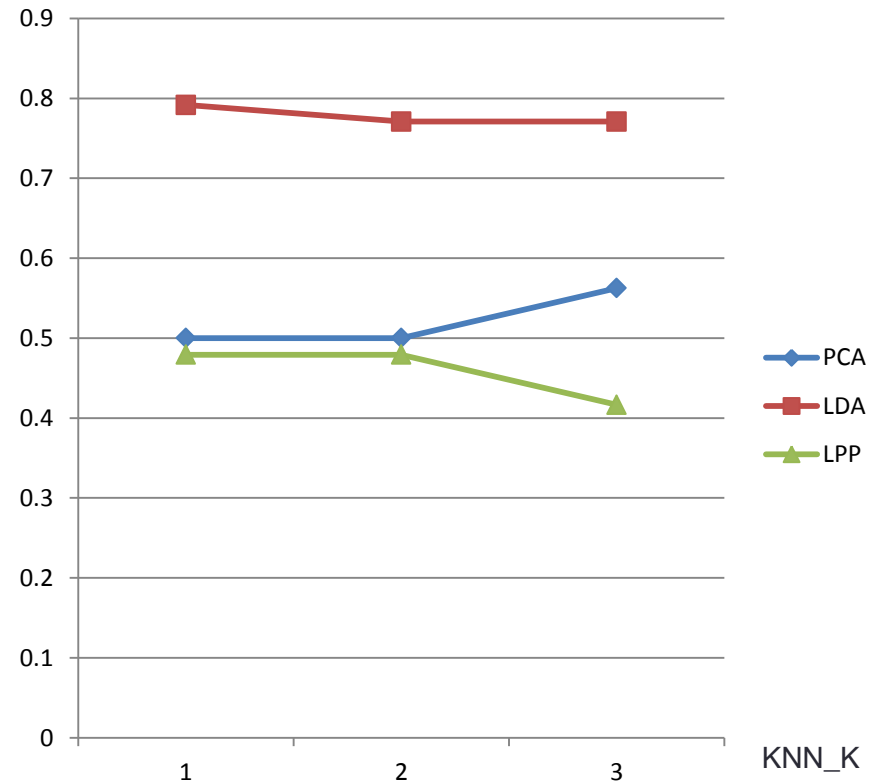# Different K for K-nearest neighbor

ORL Dataset
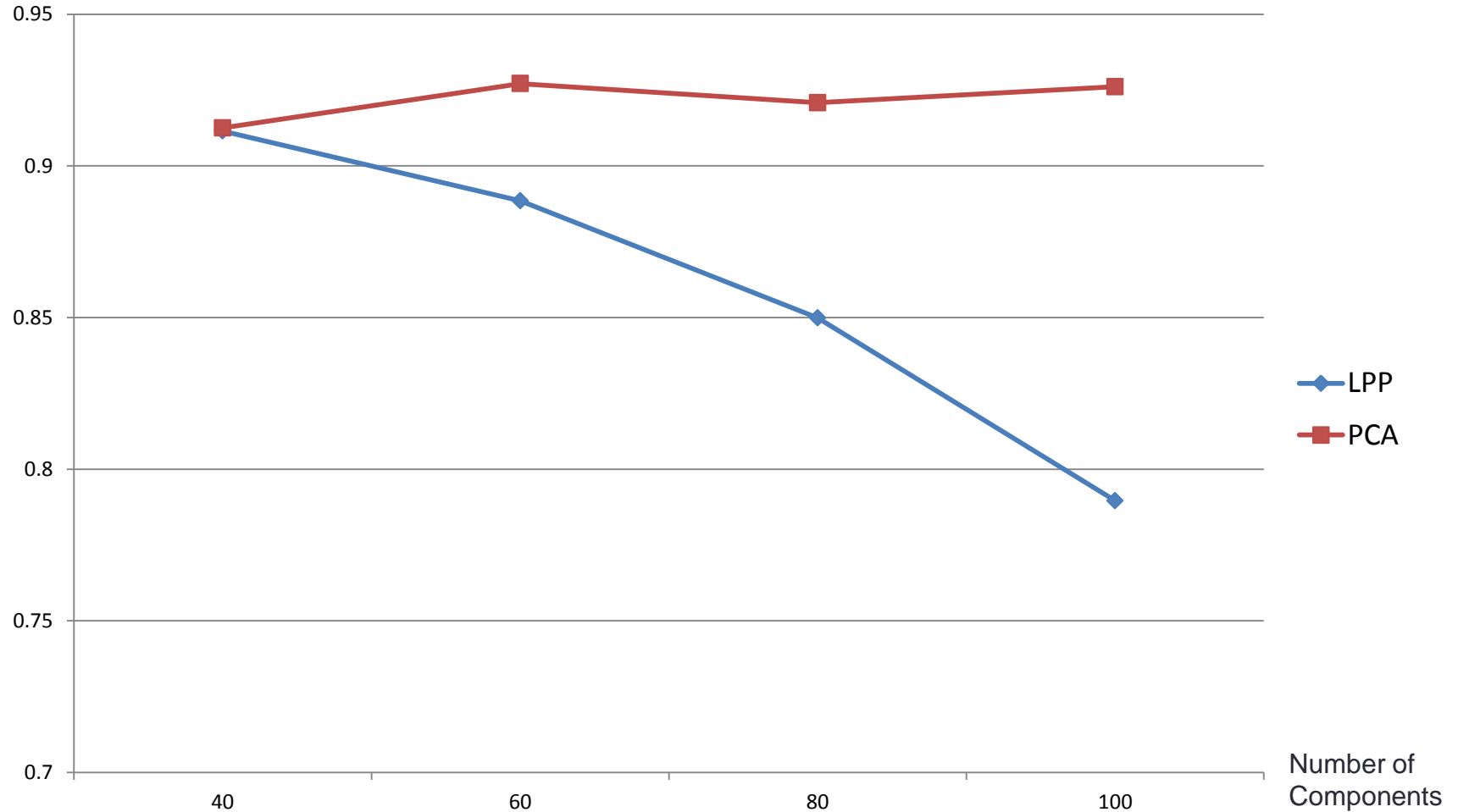
Our Dataset

LPP with different PCA processing

Conclusion

- PCA performs the best on ORL dataset

- LDA performs the best on our dataset
  - Out dataset includes lots of variations

- LPP does not perform as expected
  - This method still could achieve good results with proper setting
  - A more complex method calculating weight matrix may help

References

[1] Delac, K., Grgic, M., & Grgic, S. (2005). Independent comparative study of PCA, ICA, and LDA on the FERET data set. *International Journal of Imaging Systems and Technology*, *15*(5), 252-260.

[2] Turk, M., & Pentland, A. (1991). Eigenfaces for recognition. *Journal of cognitive neuroscience*, *3*(1), 71-86.

[3] Belhumeur, P. N., Hespanha, J. P., & Kriegman, D. J. (1997). Eigenfaces vs. fisherfaces: Recognition using class specific linear projection. *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, *19*(7), 711-720.

[4] He, X., Yan, S., Hu, Y., Niyogi, P., & Zhang, H. J. (2005). Face recognition using laplacianfaces. *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, *27*(3), 328-340.

[5] Viola, P., & Jones, M. J. (2004). Robust real-time face detection. *International journal of computer vision*, *57*(2), 137-154.