Recognize My Face

CSE546: Machine Learning

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In this work we explore a well-known approach for facial recognition using Principal Component Analysis (PCA). PCA is generally used for dimensionality reduction. It projects images onto eigenspace. Face-space has the information of the variation among the training images. The eigenvectors of this face-space are referred to as eigenfaces[1].

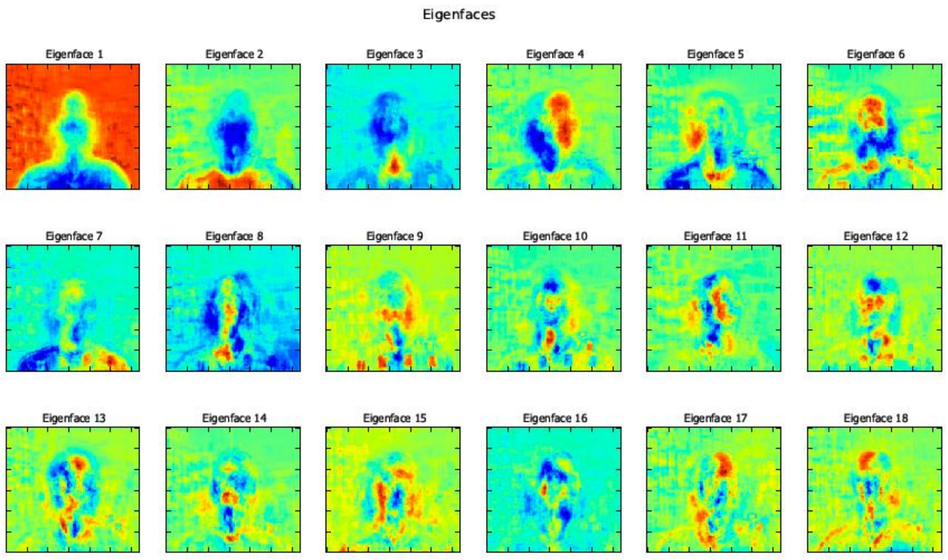

Fig 1: The most significant 18 eigenfaces for the hi-res dataset.

The dataset that we used for this study can be downloaded online*. The data consists of about 2000 images containing four different characteristic features: person, orientation, mood and eyewear. Also, the dataset comes with three different resolutions.

We try to identify different sets of image features by calculating the projections of eigenfaces onto the images. Then, we use different classifiers to differentiate among features: person, orientation, mood and eyewear. We have studied 5 different classifiers, namely, nearest neighbor, 3NN, GMM, LDA and SVM[2, 3].

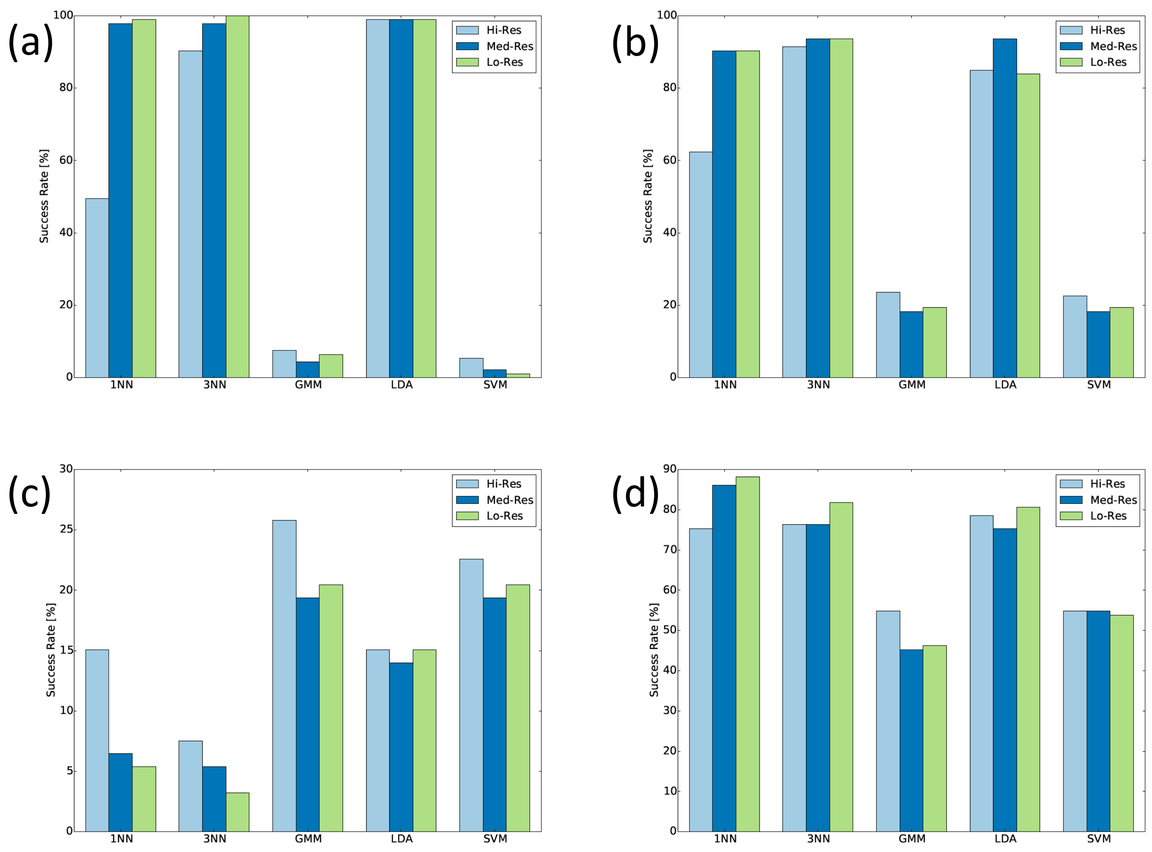

Fig 2: Success rate of different classifiers for classifying different features: (a) person, (b) orientation, (c) mood and (d) eyewear.

We train our algorithm on the training set, which corresponds to 60% of our dataset, and we choose classifiers for different features by running our algorithm on the validation set, 15% of our dataset. After choosing the best performing classifiers on the validation set, we run it on the test set.

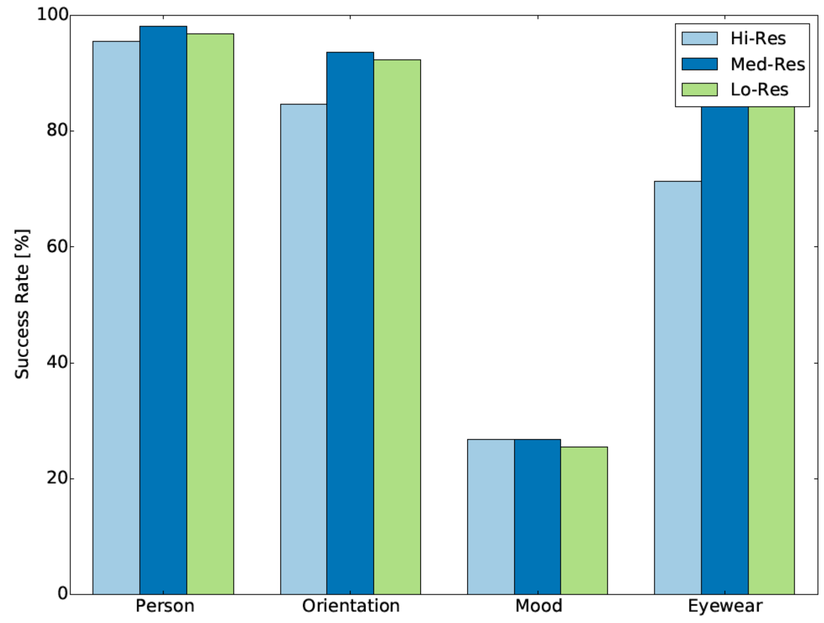

Fig 3: The best performing classifiers on the test set.

The scatter plots show clustering of the training dataset over most prominent two eigenfaces. It's clear that it's nearly impossible to determine mood, since there is more noise than correlation between the labels.

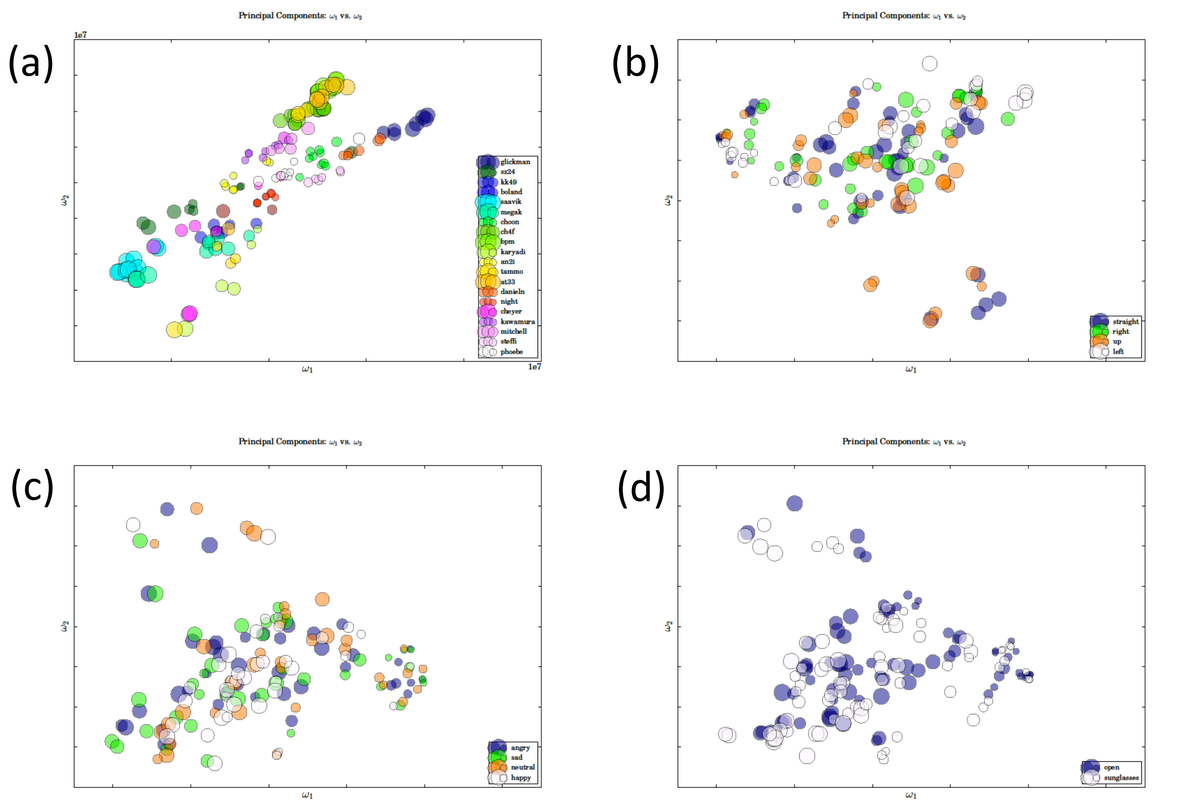

Fig 4: Scatter plots for the most two significant eigenfaces: (a) person, (b) orientation, (c) mood and (d) eyewear.

References:

1) Turk, Matthew and Pentland, Alex. Eigenfaces for recognition. Journal of Cognitive Neuroscience, 3(1):71–86, Jan 1991.

2) Murphy, Kevin P. Machine learning a probabilistic perspective. Cambridge, Mass: MIT Press, 2012.

3) Pedregosa et al. Scikit-learn: Machine Learning in Python. JMLR 12, pp. 2825-2830, 2011.

*http://www.cs.cmu.edu/afs/cs.cmu.edu/project/theo-8/faceimages/faces/