MSE Milestone Two Fruit recognition

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1. Block diagram:

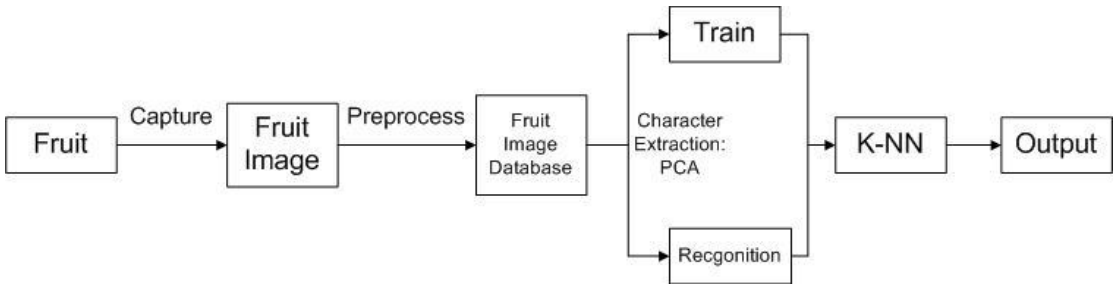

Figure 1 Block diagram of fruit recognition

2. PCA

Principal component analysis (PCA) is a statistical procedure that uses orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components.

1) Read in images: Pick up M images from the database. For each image, connect its pixels one by one and present into a column vector.
2) Calculate covariance matrix:

$$\mu = \frac{1}{M}\sum_{i=1}^{M} X_i , \qquad C = \sum_{i=1}^{M}(X_i - \mu)(X_i - \mu)^T = AA^T$$

$$A = [X_1 - \mu, X_2 - \mu, \ldots X_M - \mu]$$

3) Singular value decomposition theorem:

$$u_i = \frac{1}{\sqrt{\lambda_i}} A v_i$$, λ: eigenvalue ; v: eigenvector of C', $C' = A^T A$

3. K-NN

In pattern recognition, the k-nearest neighbors algorithm (k-NN) is a non-parametric method for classification that predicts objects' class memberships based on the k closest training examples in the feature space.

1) Calculate distance between the vector of recognizing image and database vector.
2) Compare the distance.
3) Assign to a kind of fruits.

References:

[1]. Lades M, Vorbriiggen J C, Buhmann J. Distortion invariant object recognition in the dynamic link architecture. IEEE Transactions on Computers，1933，42(3):300-311.

[2]. GSL Team (2007). "§13.4 Singular Value Decomposition". *GNU Scientific Library. Reference Manual*.