M693 Geometric Data Analysis
Problem Set Three

Thursday, March 21, 2002

1 Theory

Solve six out of the following seven problems:

1. Text problem 4.2
2. Text problem 4.7
3. Text problem 4.11
4. Text problem 4.16
5. Text problem 4.17
6. Show why it is not necessary to constrain the magnitude of the eigenvectors in the maximum noise fraction derivation.
7. Let $X' = M^T X$ and $Y' = N^T Y$ be nonsingular change of bases. Show that
   - the canonical correlations between the data matrices X' and Y' are the same as between X and Y.
   - the canonical correlation vectors for X' and Y' are given by $a_i' = M^{-1}a_i$ and $b_i' = N^{-1}b_i$ where a_i and b_i are the canonical correlation vectors for X and Y.

2 Computing

Solve two of the following four problems:

1. Text problem 4.21 (missing data problem).
2. Text problem 4.22 (MNF problem).

3. Text problem 4.23. (Vector KL problem). Here you might consider collecting a set of RGB images to apply the vector KL procedure to.

4. Record ten to twenty *movies* of roughly twenty frames each. For example, speaking lips would provide a good example where each movie corresponds to a different word. You might collect one single movie and then splice this into submovies. Now, apply the KL procedure treating each movie as a data point and display the *eigenmovies*. Comment on your results. *Note: You could splice the rotating face movie for this project.*