Assignment 1 - Shape Analysis
Report (Question 2)

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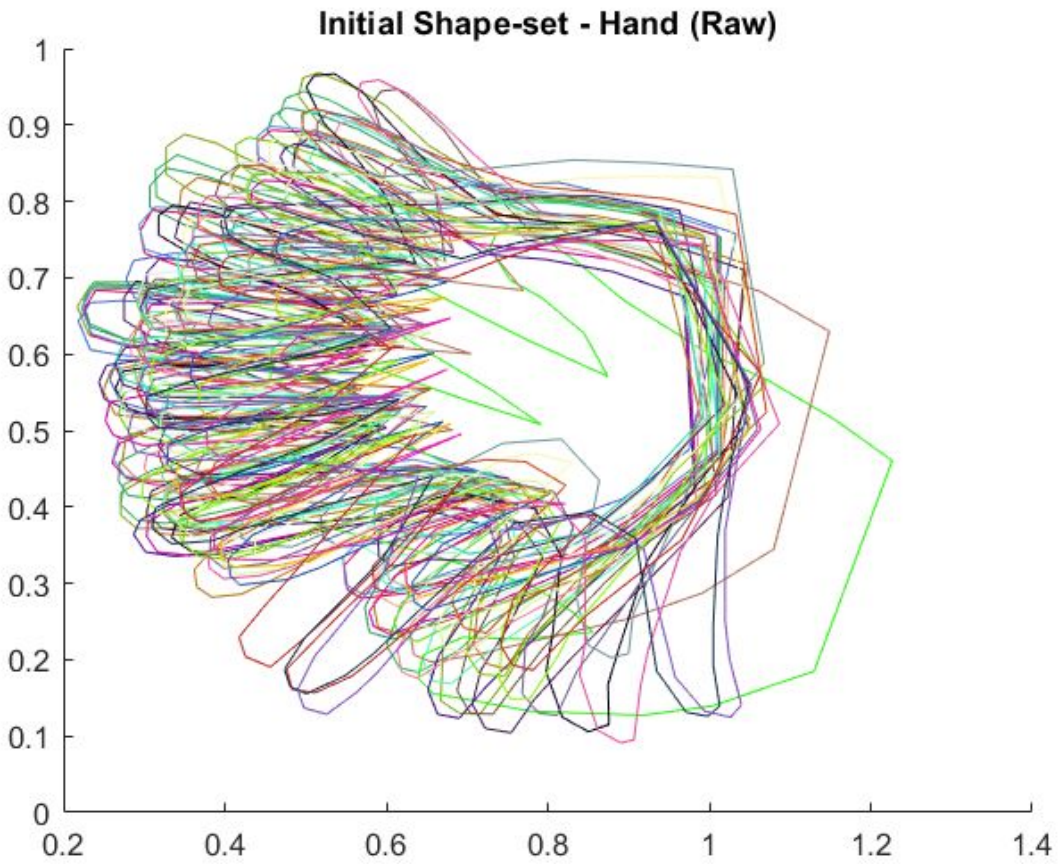
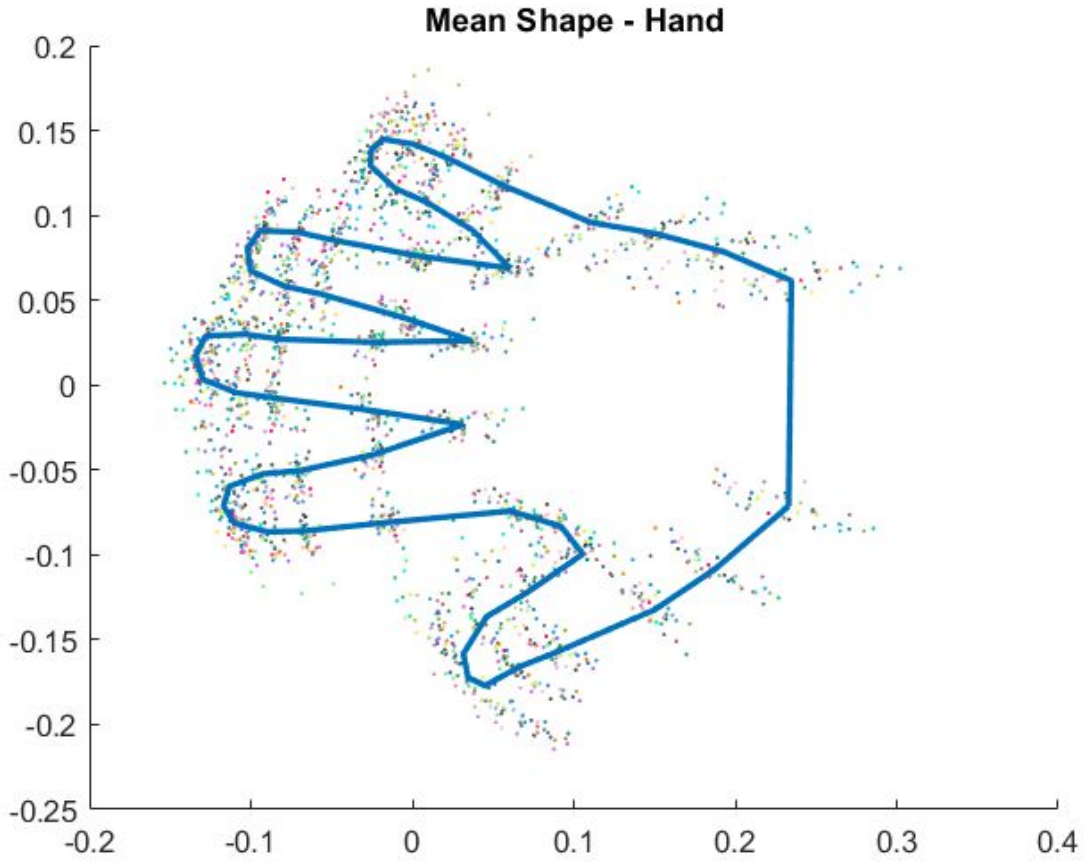
Data Collection (refer getPointset.m file):

The raw data file was already supplied, whose plot looked like:



Pointset Alignment:

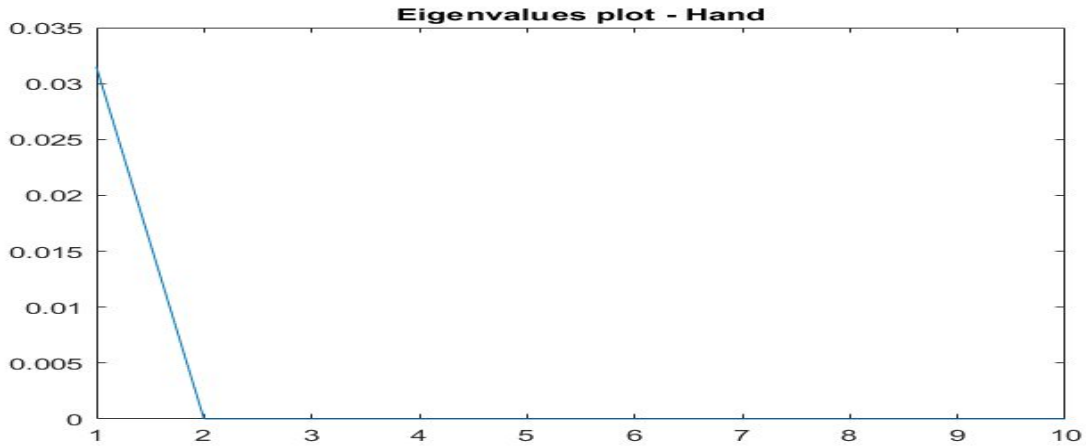
Each pointset was translated to origin and scaled down by its norm. The scatterplot, with the shape mean looked like (note only translation and scaling is done yet) is shown along with the mean that was calculated by plotting together the mean of each individual pointclouds. The resulting plot was:

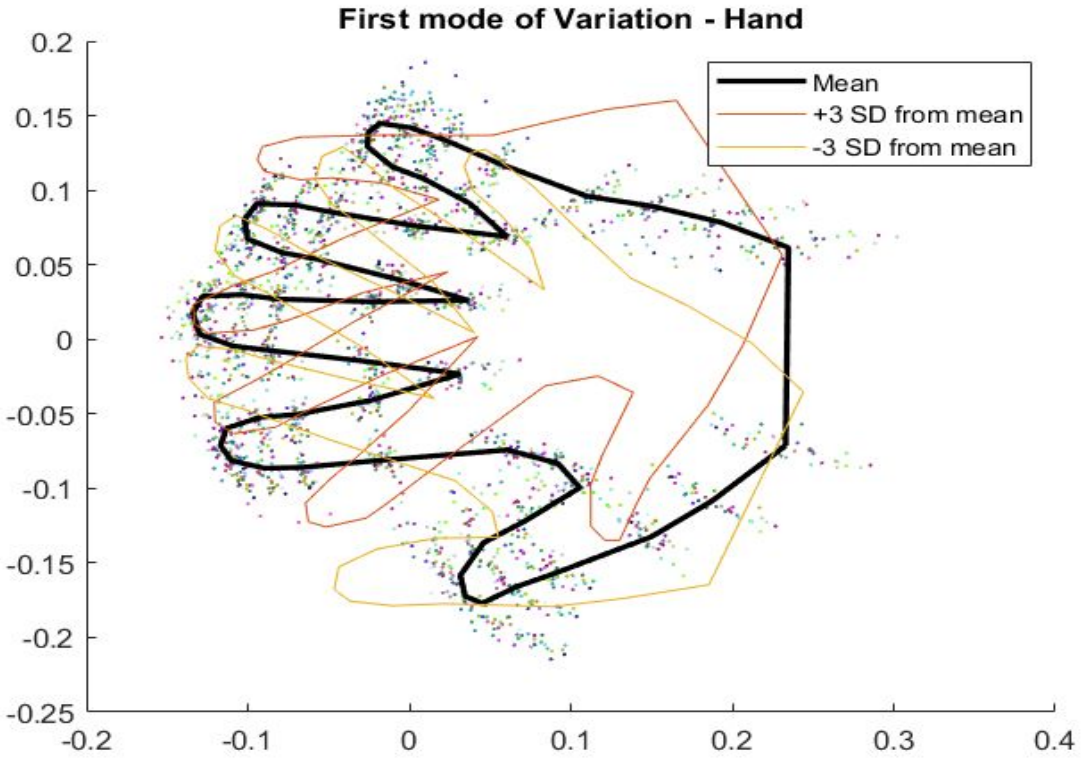


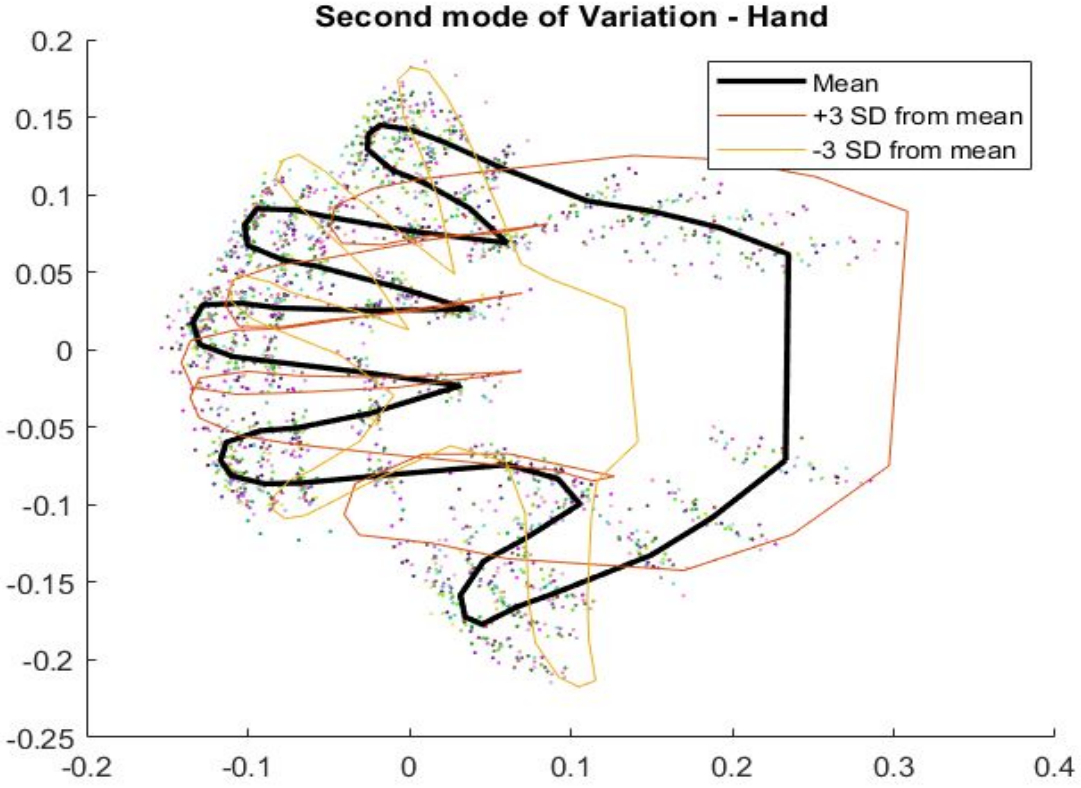
Once the mean is obtained, each pointset is aligned (rotated; since all are already translated and scaled) with respect to the mean shape.

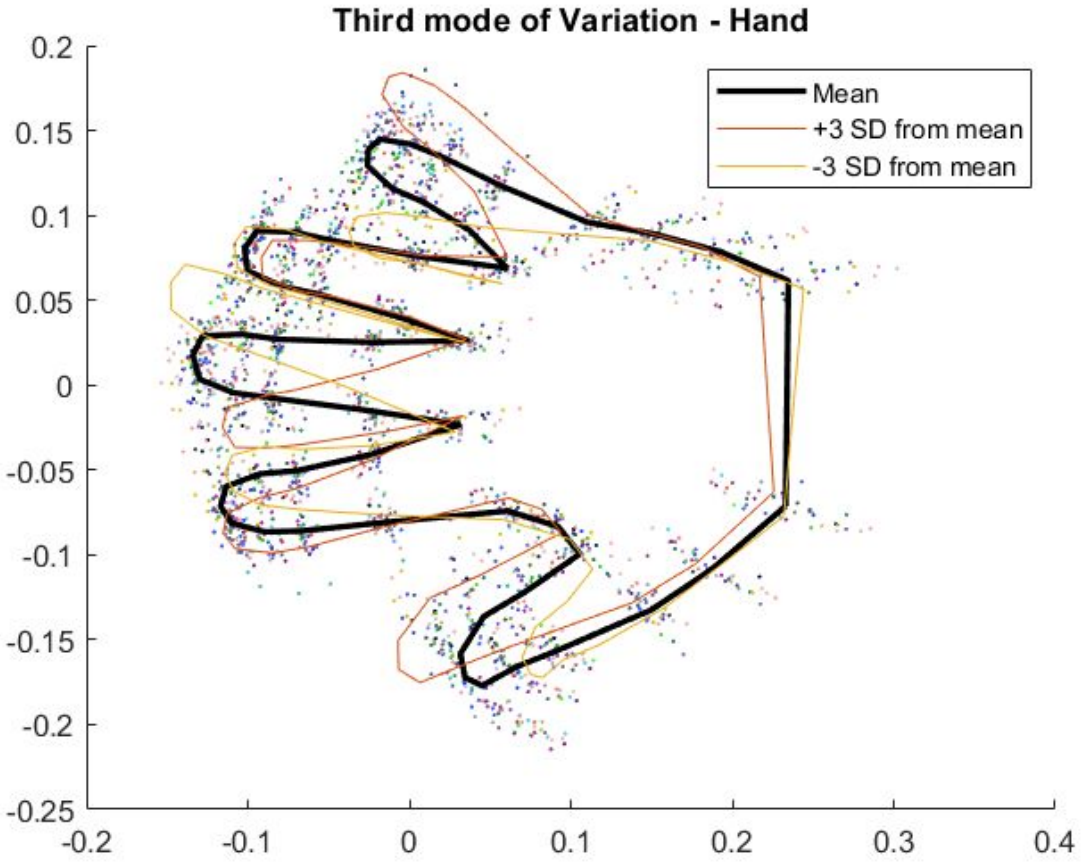
Statistical Analysis:

Instead of investigating isolated point variance, the set of shapes was stretched into a single vector of the form [x_1, y_1, x_2, y_2,.....] and PCA shape decomposition was carried out. This results in an ordered basis where each component is ranked after variance. The PCA shape decomposition is able to represent much of the variance, just using the three parameters. Following are the plots of the sorted(top 10) eigenvalues and first three modes of variation:

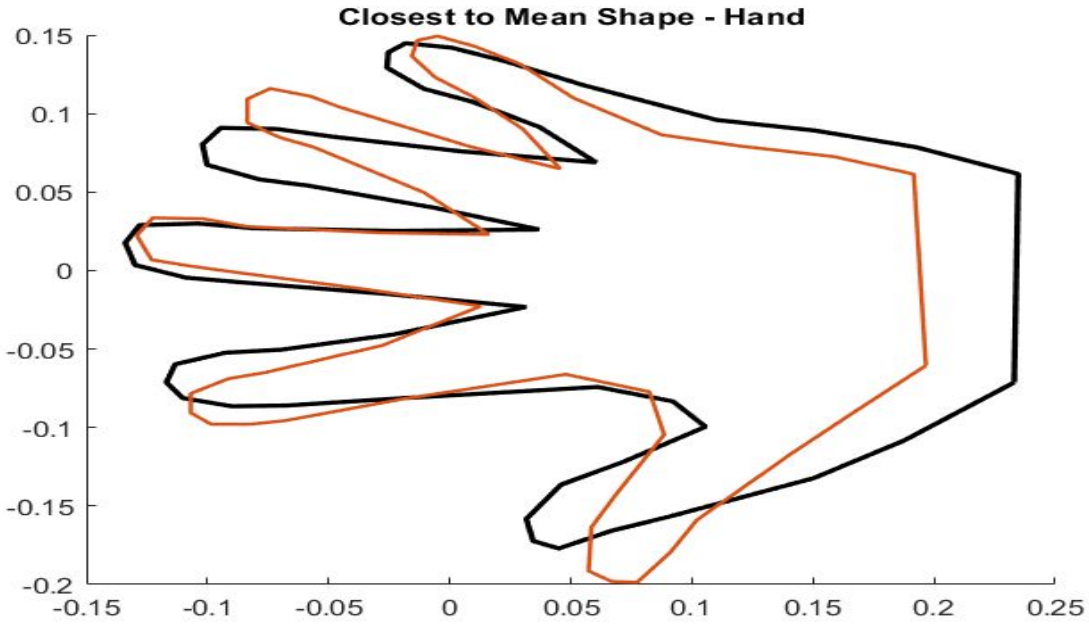


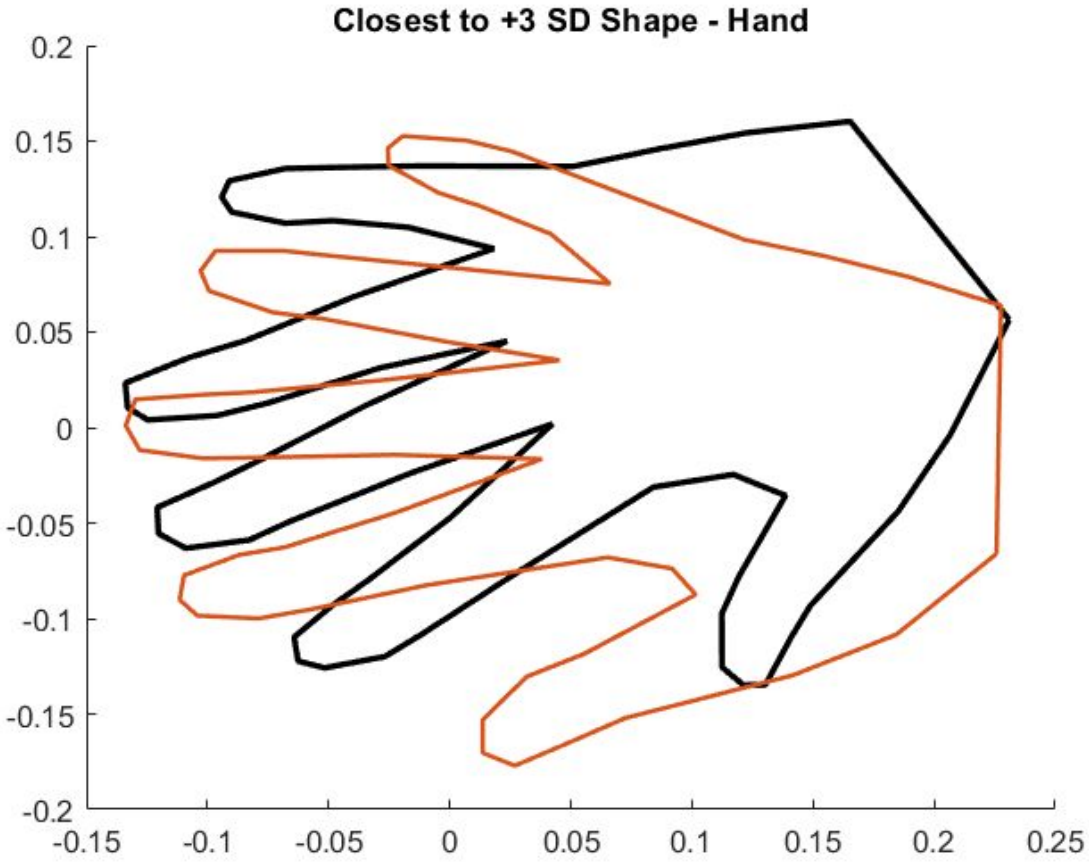

First mode of Variation - Hand
Mean
+3 SD from mean
-3 SD from mean
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.2
-0.1
0
0.1
0.2
0.3
0.4

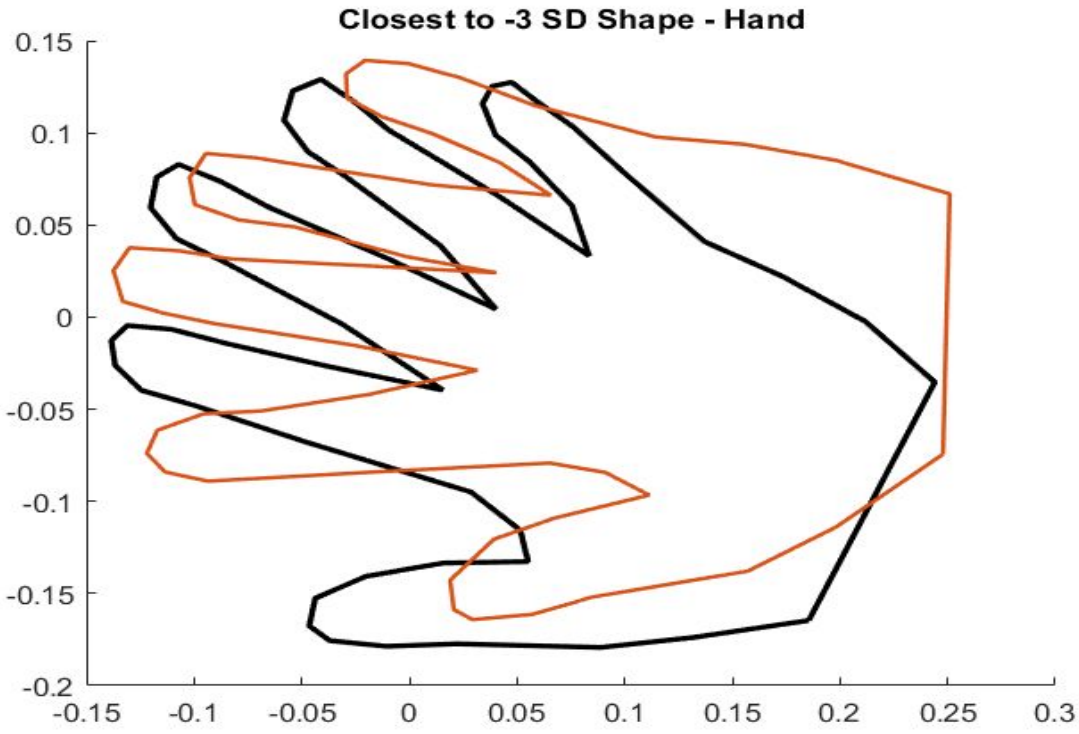

Second mode of Variation - Hand
Mean
+3 SD from mean
-3 SD from mean
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.2
-0.1
0
0.1
0.2
0.3
0.4



The following plots are the pointsets which were most similar(ranked against L2 norm) with the mean, +3 SD away from the top mode of variation and -3 SD away from the top mode of variation respectively (black curve is the reference curve):




Closest to +3 SD Shape - Hand
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25


Closest to -3 SD Shape - Hand
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.15
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3