

# Assignment 1 - Shape Analysis

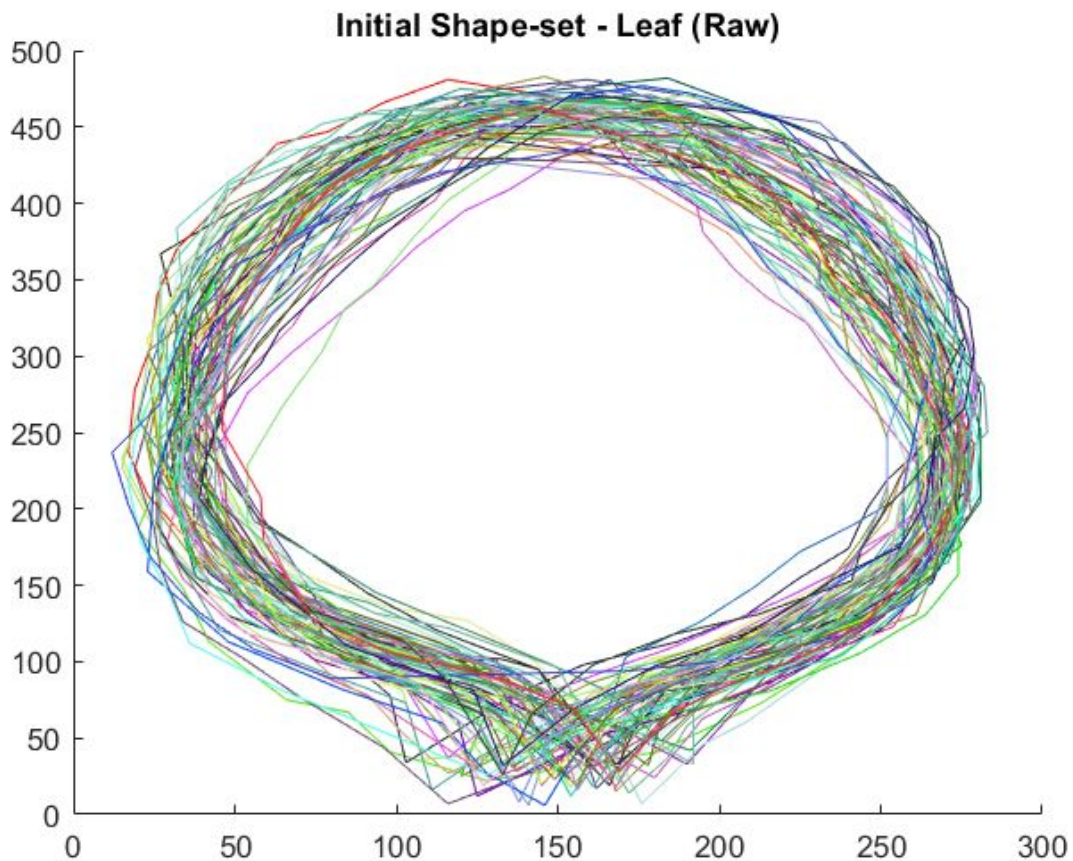
## Report (Question 3)

**Members: Bavish (170040106) and Manan**

### **Data Collection :**

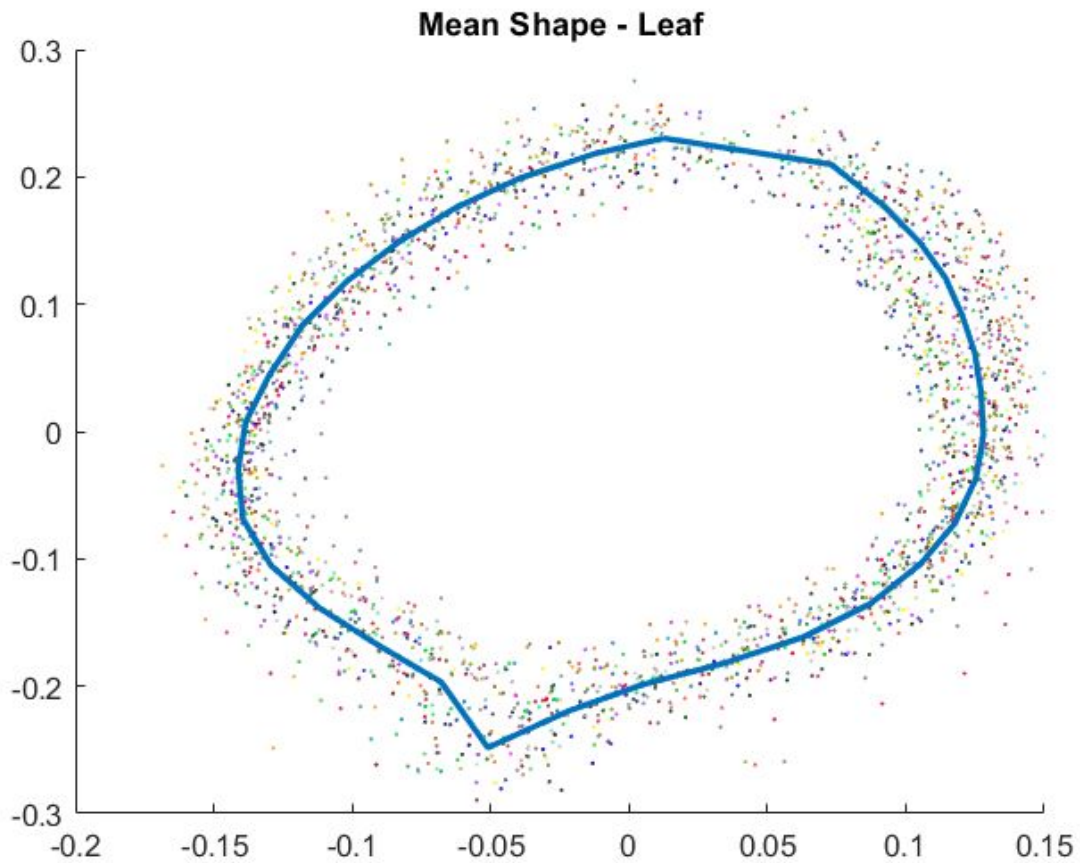
The leaf pointsets were captured manually with the corresponding file supplied in code. The pointsets looked like:

Plot of all pointsets after translating and scaling:



### **Pointset Alignment:**

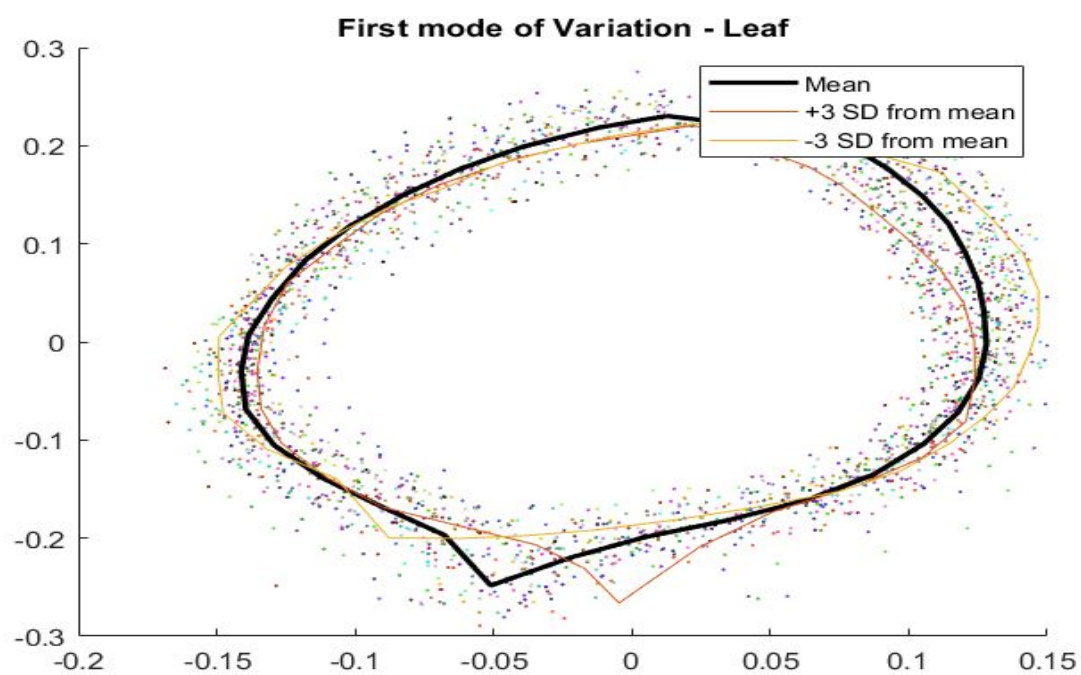
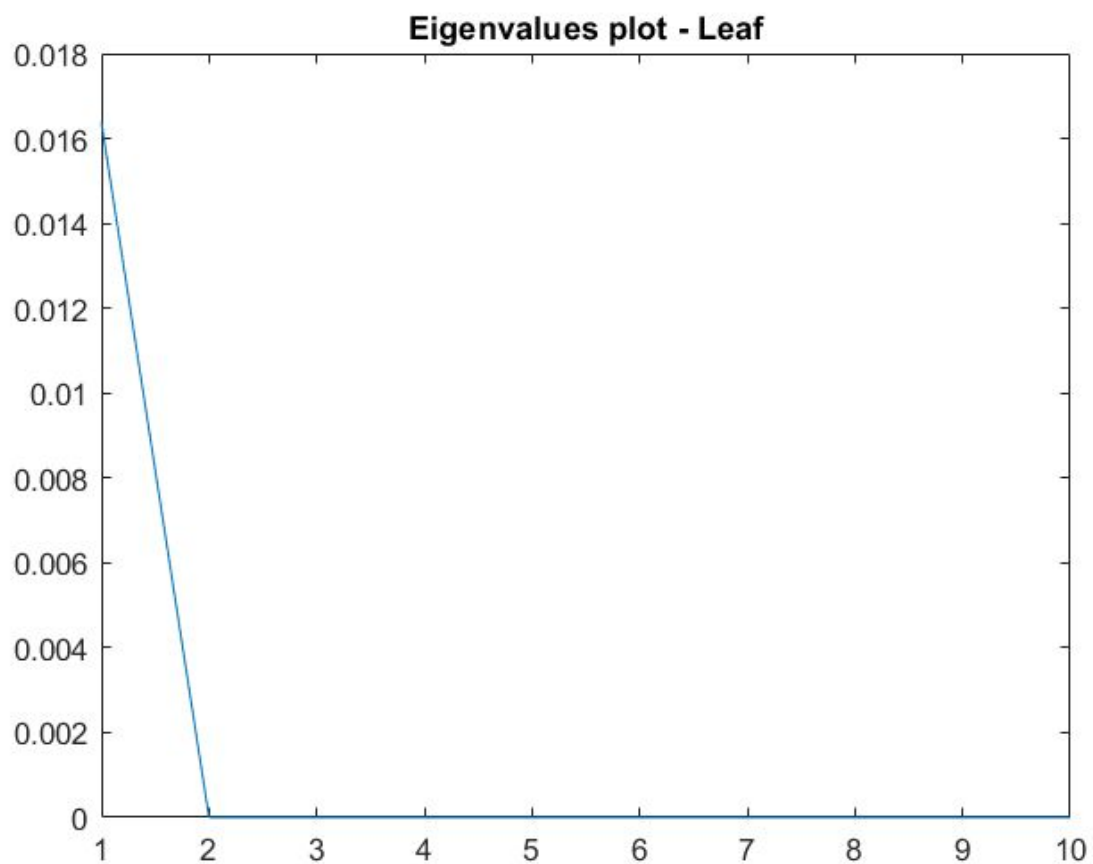
Once all the pointsets were captured, each pointset was translated to origin and scaled down by its norm. The scatterplot looked like (note only translation and scaling is done yet) with the mean that was calculated by plotting together the mean of each individual pointclouds. The resulting plot was:



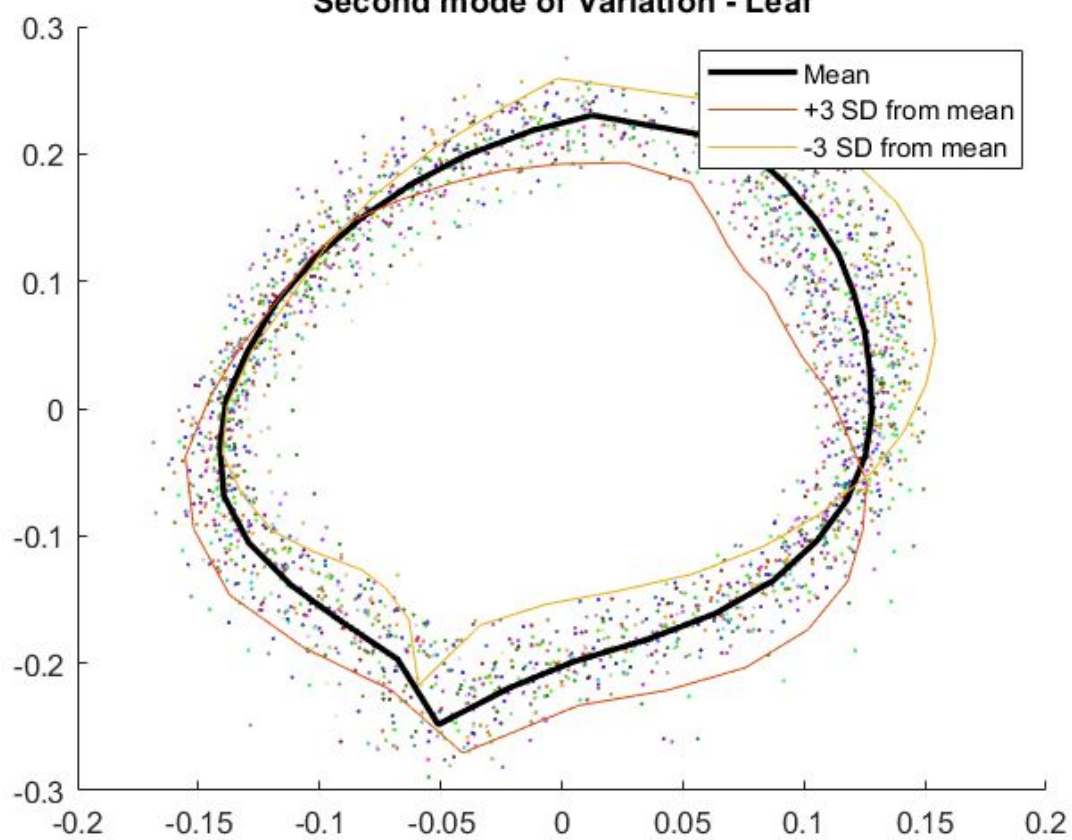
Once the mean is obtained, each pointset is aligned (rotated; since all are already translated and scaled) with respect to the mean shape.

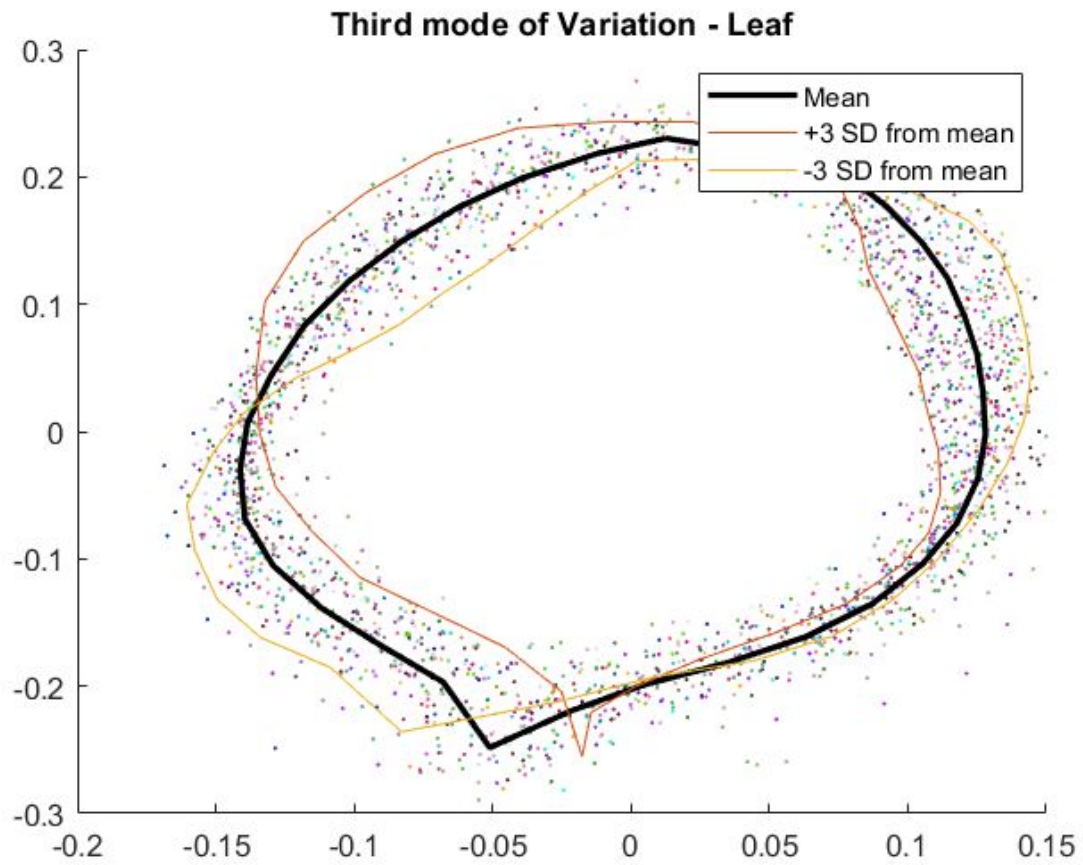
### **Statistical Analysis:**

Instead of investigating isolated point variance, the set of shapes was stretched into a single vector of the form  $[x_1, y_1, x_2, y_2, \dots]$  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 eigenvalues and first three modes of variation:



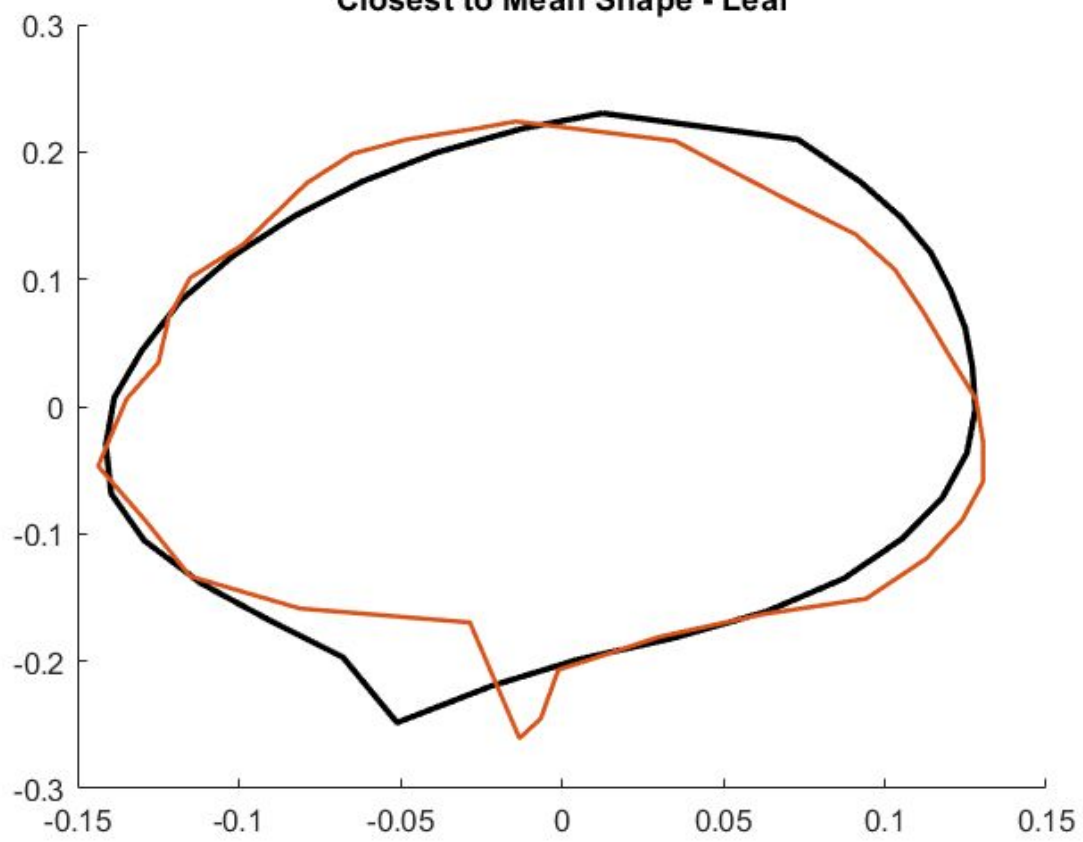
**Second mode of Variation - Leaf**



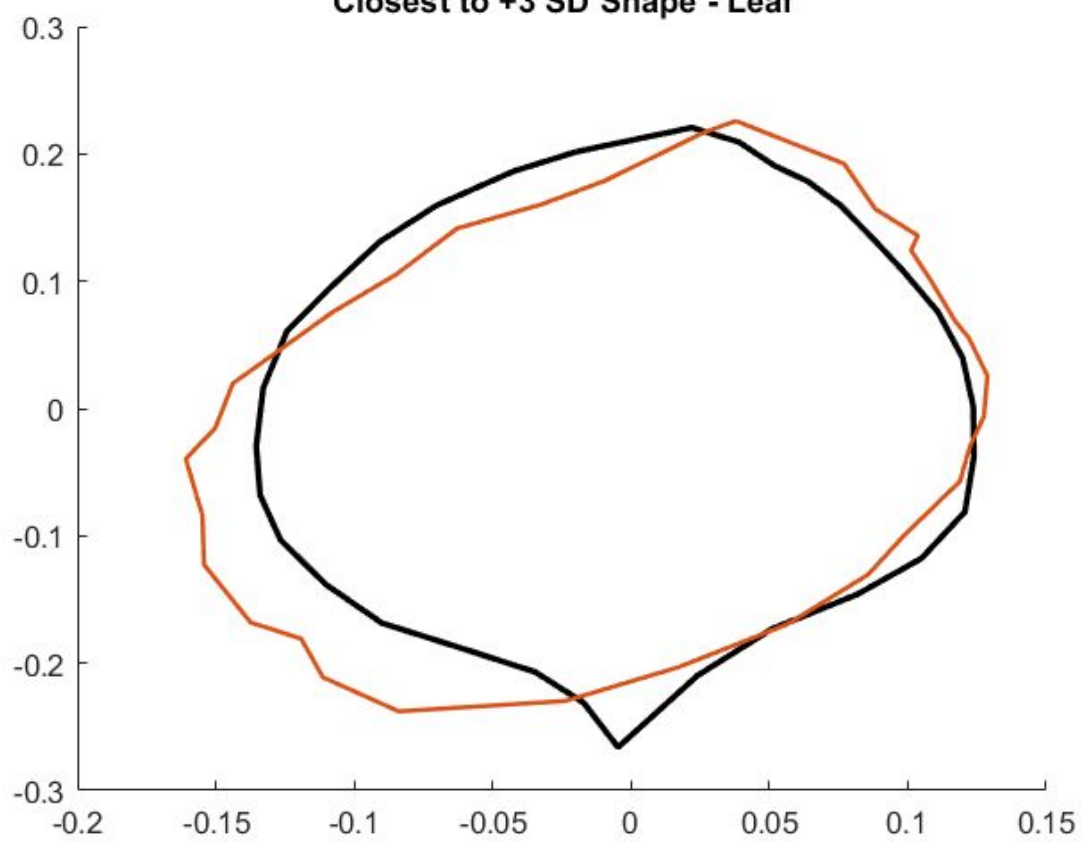


The following plots are the pointsets which were most similar(ranked against L2 norm) with the mean, +3 SD away from the top mode of variation and -3 SD away from the top mode of variation respectively (black curve is the reference curve):

**Closest to Mean Shape - Leaf**



**Closest to +3 SD Shape - Leaf**





**Closest to -3 SD Shape - Leaf**

