CS 736 : Assignment — Shape Analysis

Instructor : Suyash P. Awate

Maximum Marks: 100
Due Date : 20 Jan 2019, Sunday, 11:55 pm

Please read, carefully, the submission instructions.
Items with **0 marks** are a necessary part of the assignment, without which the assignment won't be graded.

1. (40 marks) Shape Analysis on Simulated Shapes (in 2D).

   Download the dataset of shapes from `assignmentShapeAnalysisData.zip` that contains 2D elliptical shapes represented as pointsets.

   Implement an algorithm (covered in class lectures) for computing the shape mean and the principal modes of shape variation.

   Implement the following functionality as part of the shape-analysis algorithm:

   (a) (4 marks) Code to align two pointsets of equal cardinality via similarity transformations.
   (b) (4 marks) Code to find the optimal shape mean, within every iteration.
   (c) (4 marks) Code to find all the modes of shape variation.

   Report the following:

   (a) (0 marks) Show a plot of the initial pointsets, as given in the dataset. Randomize the color for each pointset, to show all 2D pointsets in one graph.
   (b) (8 marks) Show a plot of computed shape mean, together with all the aligned pointsets.
   (c) (8 marks) Show a plot of the variances (eigenvalues; sorted) along each principal mode of shape variation.
   (d) (12 marks) Show a plot of the computed shape mean, all aligned pointsets, as well as two other pointsets depicting the principal modes of shape variation around the mean ($\pm$ 2 standard deviations around the mean).

2. (30 marks) Shape Analysis on Human Hand Shapes (in 2D).

   Download the dataset of shapes from `assignmentShapeAnalysisData.zip` that contains 2D hand-outline shapes represented as pointsets.

   Repeat all the analysis in the first question.

3. (30 marks) Shape Analysis on Human Wrist-Bone Shapes (in 3D).

   Download the dataset of shapes from `assignmentShapeAnalysisData.zip` that contains 3D bone shapes represented as pointsets.

Repeat all the analysis in the first question.

To visualize 3D shapes, you may use the patch() function in Matlab. You will also need information about the triangular facets in the 3D mesh representation, which is provided in the mat file.