Discovery Thread: Target Detection and Registration

Consider the datasets assigned to your team:

- 'ObservedDataSet1.dist' , 'ObservedDataSet2.dist' , 'ObservedDataSet3.dist'
- 'Target1.coord' , 'Target2.coord' , 'Target3.coord' , 'Target4.coord'

composed of three observed data sets and four targets. The two file formats are similar to those in your team homeworks. Specifically, the '*.dist' files have the format:

```
line 1: n m
line 2: i1 j1 d(i1,j1)
line 3: i2 j2 d(i2,j2)
line 4: i3 j3 d(i3,j3)
...
line m+1: im jm d(im,jm)
```

where n denotes the number of vertices of a geometric graph, m denotes the number of available edge distances. Lines 2 to $m+1$ list these distances: $i1, j1, i2, j2, ..., im, jm$ denote vertices (from 1 to n), and $d(i1, j1)$, $d(i2, j2)$, ... , $d(im, jm)$ represent the distances respectively between these pairs of vertices, $(i1, j1)$, $(i2, j2)$, and so on.

The '*.coord' files have the format:

```
line 1: x1 y1 z1
line 2: x2 y2 z2
line 3: x3 y3 z3
line 4: x4 y4 z4
...
line n: xn yn zn
```

where n denotes the number of vertices (points) of a 3D geometric graph, and each line constains the (x, y, z) coordinates of these points.

All your data files refer to geometric graphs with same number of vertices (nodes) n. The number of edges (pairwise distances) in 'ObservedDataSet's may vary from 0 to a maximum of $n(n-1)/2$.

Your project should perform the following tasks:

For each observed data set, 'ObservedDataSet1.dist' to 'ObservedDataSet3.dist':

1. Produce a 3D embedding of the gemetric graph using either the full data embedding algorithm, or the gemetric graph partial data embedding algorithm. For the latter algorithm try a few values for ε_G parameter; choose the parameter that minimizes the matching error computed at part 3).

2. Determine the optimal full alignment transformation to each of the target graphs, 'Target1.coord' ... 'Target4.coord'.

3. Compute the alignment errors and present the results in a $3x4$ table: each entry (i, j) should contain the alignment error of matching the observed data i to target j.

4. For observed data set i, determine the target $\hat{j}$ that has the smallest alignment error. Create a movie (.avi file) that contains the continuous transformation from the embedding produced at 1) to the optimal target graph $\hat{j}$. Use the procedure described in Homework 3 for graph visualization, continuous transformation, and video creation.