1. Isomap
    a. Residual Error as a function of Isomap Dimensions

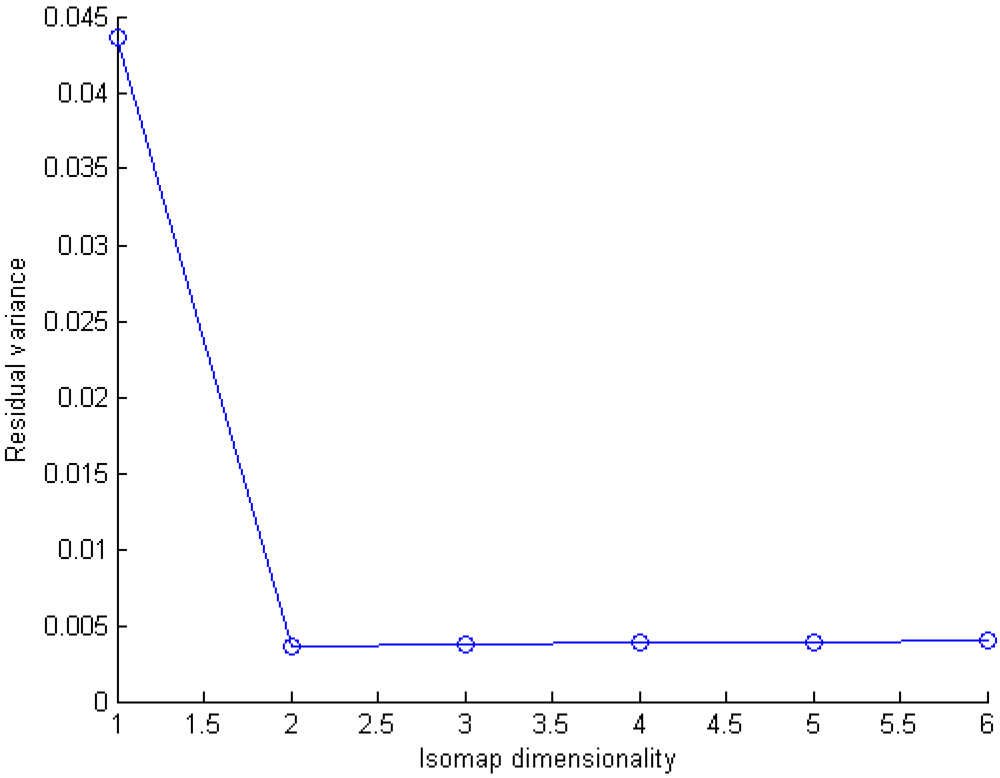


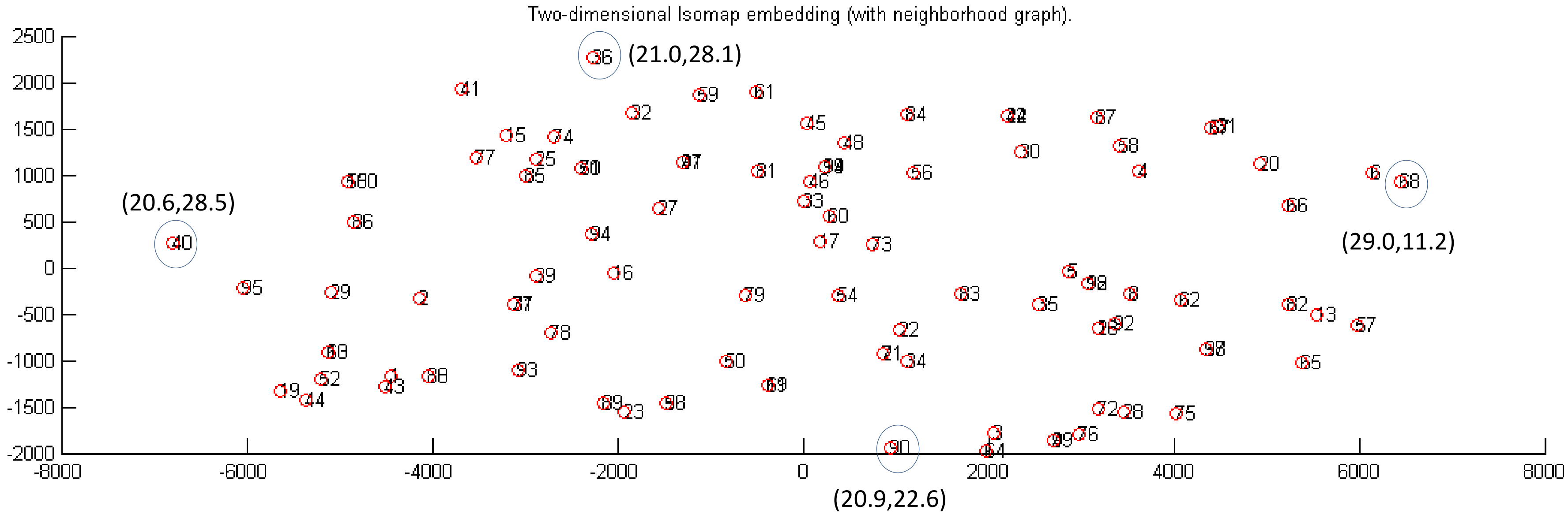
Figure 1: Residual Error vs. Dimensionality Reduction

    b. We find that between 1 and 2 dimensions, the error reduces sharply. On increasing the dimensionality beyond 2, the error remains almost constant. This tells us that a two dimensional representation is the most compact representation without losing significant details, in case of isomaps.

Dimensionality	Error
1	0.1157
2	0.0076
3	0.0063
4	0.0065
5	0.0066

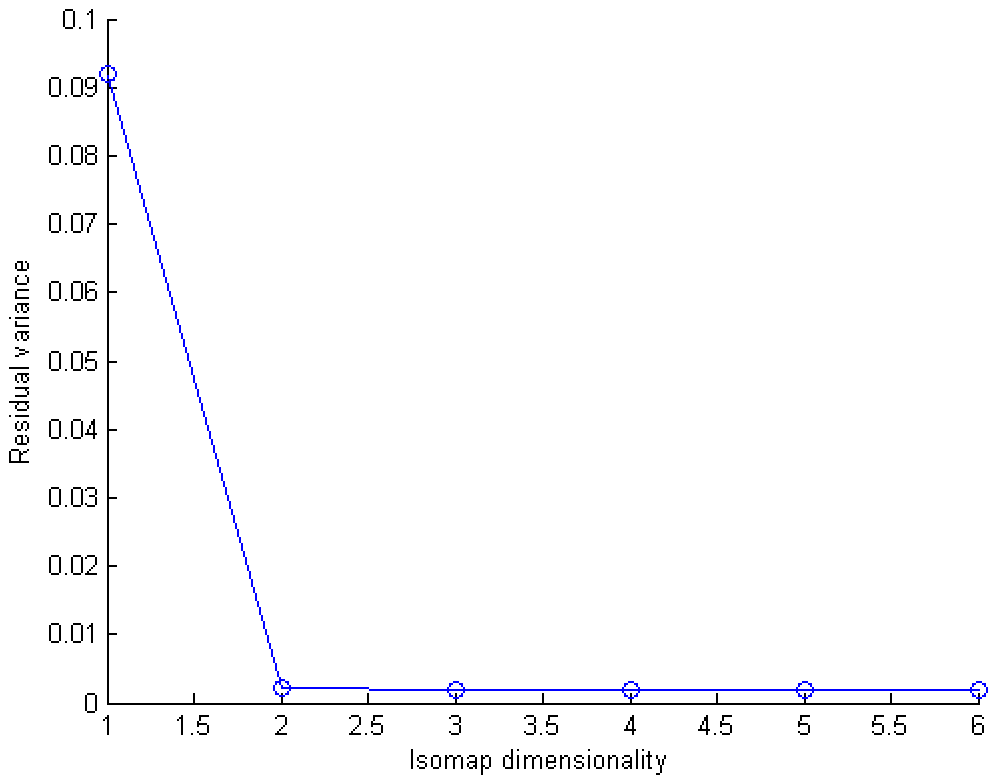
    c. (Graph On Next Page)
    The boundary points of y2 do seem to correlate with the boundary points of theta1, but there seems to be no correlation between y1 and theta2.

d.



Two-dimensional Isomap embedding (with neighborhood graph).
(21.0,28.1)
(20.6,28.5)
(29.0,11.2)
(20.9,22.6)
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
-8000
-6000
-4000
-2000
0
2000
4000
6000
8000

d.



As is observed in the previous case, the errors fall sharply as we increase the dimensionality to 2, after which it stays fairly constant.

Dimensionality	Error
1	0.0921
2	0.0022
3	0.0018
4	0.0017
5	0.0020

e.

Point	Theta1	Theta2	Y1	Y2
1	21.70828	23.28976	-4446.37	-1164.78
2	20.96372	26.44559	-4134.2	-323.693
3	25.77304	19.94295	2052.108	-1777.25
4	26.92194	10.45338	3621.8	1054.848
5	28.73904	16.16286	2861.85	-28.5388
6	24.46046	12.61411	6139.903	1035.406
7	27.3252	7.879244	862.8481	-921.558
8	23.94294	21.59286	3520.12	-270.021
9	28.45035	13.06541	2700.069	-1856.02
10	27.15539	4.504699	-5113.08	-907.918

11	24.55825	7.640685	-371.229	-1255.06
12	25.45228	12.36145	3068.719	-159.259
13	25.68585	23.49548	5542.463	-507.344
14	28.67719	4.586599	232.9345	1098.584
15	22.75509	12.45213	-3208.81	1439.484
16	29.24095	9.477505	-2046	-51.5238
17	27.89461	4.657732	182.8565	288.9545
18	20.82206	27.99078	3190.657	-644.981
19	20.25575	12.82847	-5638.95	-1320.33
20	23.82182	9.27291	4927.76	1130.816

There seems no obvious correlation in the mapping of theta1 and theta2 to y1 and y2 as is evident from the table above.