Project Proposal

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1 Problem Statement

The solutions [1,2] to the problem of tomographic reconstruction with given radon projections under unknown angles are based on Locally Linear Embedding. We will implement both the solutions and compare their results based on noise toleration and number of projections given. We wish to highlight the difference in the two implementations, as [1] tries to define closeness of projections in the Euclidian distance sense and [2] defines it in the angular sense.

2 Research Papers

1. R. Coifman et al, Graph Laplacian Tomography From Unknown Random Projections, IEEE Transactions on Image Processing, 2008
2. Y. Fang, S. V. N. Vishwanathan, M. Sun, and K. Ramani, "sLLE. Spherical Locally Linear Embedding with Applications to Tomography, " in CVPR, 2011, pp. 1077-1129

3 Online Available Datasets

1. The MR images are chosen from the Whole Brain Atlas
   `http://www.med.harvard.edu/AANLIB/`
2. The cryoEM density images are available from the EM database
   `http://www.pdbj.org/emnavi/`

Note: Above both are used in 2nd research paper.

4 Testing

1. For testing our implementation, we will use the images in the datasets available to synthetically generate radon projections in several angles.

2. We will then add zero mean Gaussian noise to the projections and shuffle them, so as to mimic actual tomographic projections taken medical applications and to remove any underlying arrangement of the projections based on projection angle.

3. We will compare the tomographic reconstruction obtained by our project with the original image and report the sum squared distance as error.

4. Various experiments will be conducted varying the number of projections, noise magnitude etc.