Repairing and denoising scattered data for the reconstruction of manifolds embedded in high dimensions

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High dimensional data is increasingly available in many fields, and the problem of extracting valuable information from such data is of primal interest. A common assumption is that high dimensional data is an embedding of a low dimensional manifold. Often, the data suffers from presence of noise, outliers, and non-uniform sampling (which may result in 'holes' in the manifold). Standard approximation tools fail to address those problems - even in low dimensions. In our research, we propose to reconstruct the manifold's geometry by extending the Locally Optimal Projection operator (LOP) algorithm [1] to the high dimensional case. Additionally, we utilize our framework to address other challenges rising in high dimensional data: a) calculation of k-multivariate L1-medians; b) smooth manifold repairing; c) up/down data sampling. We will demonstrate the effectiveness of our framework by considering noisy data from manifolds of 2-10 dimensions embedded in $\mathbb{R}^{60}$.

Joint work with: David Levin.

References

[1] Y. Lipman, D. Cohen-Or, D. Levin, H. Tal-Ezer Parameterization-free projection for geometry reconstruction In *ACM Transactions on Graphics (TOG)*, Vol. 26, No. 3, pp. 22. ACM, 2007.