Multiscale Geometric Methods for high dimensional data near low-dimensional sets

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Abstract: We discuss a family of ideas, algorithms, and results for analyzing various new and classical problems in the analysis of high-dimensional data sets. These methods we discuss perform well when data is sampled from a probability measure in high-dimensions that is concentrated near a low-dimensional set. They rely on the idea of performing suitable multiscale geometric decompositions of the data, and exploiting such decompositions to perform a variety of tasks in signal processing and statistical learning. In particular we will discuss the problem of dictionary learning, of regression, of learning the probability measure generating the data, and efficiently computing optimal transportation plans between probability measures.

Finally, we discuss a novel multiscale decomposition for approximating and learning maps, based on multiscale compositions of a basic user-provided dictionary of simple maps.

These are joint works with P. Escande, S. Gerber, W. Liao, S. Vigogna.

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