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Alexander Cloninger and **Wojciech Czaja***, Department of Mathematics, University of Maryland, College Park, MD 20742, and **Timothy Doster**. *The Preimage Problem for Laplacian Eigenmaps*. Preliminary report.

Nonlinear dimensionality reduction has become an important part of machine learning and harmonic analysis, due to the influx of big data in many applications. For many techniques, such as, e.g., Laplacian Eigenmaps, this leads to analysis in a new feature space, which is the target space of the dimension reduction process. On the one hand, such space may be very useful for direct comparison of heterogeneous sensing modalities. On the other hand, however, its non-physical nature may cause difficulties in certain applications. Hence, our goal in this talk is to present an algorithm for fast, approximate inversion of Laplacian Eigenmaps. In our construction we rely on Nystroem extension principle, L1 regularization, and multidimensional scaling. We shall illustrate the usefulness of our algorithm in such applications as heterogeneous data fusion or image inpainting. (Received September 15, 2013)