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Operator-based Data Fusion. Preliminary report.

The problem of data integration and fusion is a longstanding problem in many fields, ranging from remote sensing to biomedical applications. The goal is to find effective and efficient ways to integrate information from heterogeneous sources to improve outcomes of such applications as, e.g., classification or detection. In this talk we shall present a deterministic approach which exploits fused representations of certain well known data-dependent operators, such as, graph Laplacian and graph Schroedinger operators and their corresponding semigroups. It is through the eigendecomposition of these operators that we introduce the notion of fusion/integration of heterogeneous data. This requires new fusion metrics, joint diffusion embeddings of Coifman and Hirn, approximate inverses of nonlinear dimension reduction techniques, and reductions in computational complexity. This theory can be applied, e.g., to spatial-spectral fusion, or to fusion of hyperspectral satellite imagery (HSI) and LIDAR data. We experimentally verify the results of our methods by utilizing them for the HSI classification problem. (Received August 27, 2013)