

1056-00-1188

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In this paper we revisit the singular value decomposition (SVD), the generalized singular value decomposition (GSVD), and motivate the notion of row and column energy optimization problems for signal-to-signal ratios (SSR). We present Signal Fraction Analysis (SFA), a general tool for computing subspaces for decomposing data into potentially useful features. We show its connection to GSVD. We define the row-energy and column-energy optimization problems for SSR, derive the resulting GSV value problem and distinguish this setting from the standard SVD. We extend SFA by introducing novel constraints.

The subspace approach to signal processing consists of decomposing the data into parts that reveal the essential information, or structure, of interest. Standard subspace methods arising from the consideration of the data as a single set, such as the SVD, fail to characterize, or exploit, the distinction between the data sets. In this setting it is desirable to construct a single basis for the two data that simultaneously describes each and their differences. We extend SFA by introducing novel constraints and propose two new GSVD type problems for computing subspace representation. We conclude our work comparing the subspace representation for two different data sets. (Received September 21, 2009)