PARSE - A Pursuit Algorithm for Reconstruction of Spatial Events

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Sparse representation of given data has become a popular research topic during the last years. One of the most used group of algorithms is the group of so-called Pursuit algorithms, such as Matching Pursuit or Orthogonal Matching Pursuit. These algorithms have a greedy strategy which allow a fast implementation. The idea of these methods is, that a given data should be sparse in some domain, i.e. it can be written as the sum of only a small number of elements. However, for multidimensional data this may not be given for all dimensions. While one can still apply Pursuit algorithms to some dimensions, the correlation of data in different cartesian dimensions is usually not taken into account.

We present a Pursuit algorithm that overcomes this problem. We consider data that is given in time as well as in spatial dimensions. Sparsity in time dimension is assumed whereas the data is correlated in its space dimensions. This correlation produces "spatial events". PARSE - Pursuit Algorithm (for) Reconstruction (of) Spatial Events - is able to reconstruct and denoise the spatial events. Moreover, it derives a sparse representation of the given data d as a sum of only few spatial events, i.e.

$$d(x,t) \approx \sum_{k=1}^{L} a_k(x) g(t - \tau_k(x)),$$

with the dictionary function g, the Event Region functions a_k and the Event Appearance functions τ_k.