Nonnegative Sparse Recovery under Sum-to-One Constraint via Projected Gradient Descent


Opportunity

Sparse recovery is an efficient way of reconstructing real-world sparse signals such as sound, images and video from only a few measurements. Researchers are paying increasing attention to the applications of this technique in diverse fields of electronic engineering and computer science, from image processing to gathering geophysics data. However, many approaches to recovering sparse signals lack precision and are computationally complex and time-consuming. To address these drawbacks, a novel algorithmic framework for sparse recovery has been proposed and empirically tested with financial and hyperspectral image data.
Technology

The invention is a novel approach to recovering a sparse signal that satisfies two key constraints: nonnegativity and the "sum-to-one" constraint. This is known as nonnegative sparse recovery under sum-to-one (NSR-SO). The proposed algorithmic framework has two steps, namely gradient descent and projection, which enables it to handle NSR-SO directly, without approximation. The algorithm has already been successfully applied to sparse index tracking and hyperspectral image unmixing, demonstrating both its feasibility and its superiority compared with existing NSR-SO approaches.

Advantages

- The proposed algorithm is superior to state-of-the-art NSR-SO methods in terms of prediction error and computational complexity.
- Compared with state-of-the-art methods, the algorithm offers much more precise control of sparsity via an upper bound.
- The algorithm performs better than existing methods in sparse index tracking and hyperspectral image unmixing problems.

Applications

- As a general approach to sparse recovery, the proposed algorithm has a range of important applications in science and engineering, such as medical imaging, radar, vehicular information systems, and deep learning.
- As a customized approach to sparse recovery (i.e., NSR-SO), the algorithm has specific applications in the rapidly growing markets of global algorithmic trading and hyperspectral imaging systems.
- Sparse recovery is vital to artificial intelligence (AI) solutions (e.g., predicting trends in the stock market). Therefore, the algorithm has major applications in the flourishing global AI market.