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研究论文

利用概率结构稀疏模型实现信号重构的新算法

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摘要：

为更好地描述信号的结构稀疏性，构造了一种概率结构稀疏模型，并用于压缩感知信号重构问题．在对结构稀疏模型分析的基础上，不直接对信号的结构稀疏性进行描述，而是利用玻耳兹曼分布对其支撑的结构稀疏性进行先验描述，然后基于贝叶斯压缩感知理论，通过该先验分布和观测过程的高斯似然性，由观测值和观测矩阵求解信号支撑的最大后验估计，最后由信号支撑求解原信号．实验结果表明，对于已知信号支撑的稀疏信号，该方法重构性能明显优于BP和OMP法；对于一般的稀疏高斯随机信号，在高观测噪声水平和低重构误差容限条件下，其重构性能具有较大优势．

关键词： 压缩感知 结构稀疏模型 信号支撑 玻耳兹曼分布

Signal reconstruction algorithm based on the probabilistic structured sparse model

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Abstract:

In order to describe structured sparsity of the signal accurately, a probabilistic structured sparse model is constructed for signal reconstruction in compressive sensing(CS). Based on the structured sparse model, Boltzmann distribution is introduced to describe structured sparsity of the signal support rather than to describe the signal directly. Based on Bayesian CS, the maximum a posterior estimate of signal support is computed with the prior distribution and the Gaussian likelihood model of measurement, and then the signal is reconstructed using signal support. Experimental results show that, for the signal with the support known, the proposed algorithm is obviously superior to BP and OMP and that for the signal with the support unknown, its performance outperforms that of BP and OMP in the condition of a high measurement noise level and low reconstruction error tolerance.

Keywords: compressive sensing structured sparse model signal support Boltzmann distribution

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