The Performance of Orthogonal Multi-matching Pursuit under RIP

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The orthogonal multi-matching pursuit (OMMP) is a natural extension of orthogonal matching pursuit (OMP). We denote the OMMP with the parameter M as $\mathrm{OMMP(M)}$ where $M \geq 1$ is an integer. The main difference between OMP and $\mathrm{OMMP(M)}$ is that $\mathrm{OMMP(M)}$ selects M atoms per iteration, while OMP only adds one atom to the optimal atom set. In this paper, we study the performance of orthogonal multi-matching pursuit (OMMP) under RIP. In particular, we show that, when the measurement matrix A satisfies $(9s, 1/10)$-RIP, there exists an absolutely constant $M_0 \leq 8$ so that $\mathrm{OMMP(M_0)}$ can recover s-sparse signal within s iterations. We furthermore prove that, for slowly-decaying s-sparse signal, $\mathrm{OMMP(M)}$ can recover s-sparse signal within $O(\frac{s}{M})$ iterations for a large class of M. In particular, for $M = s^a$ with $a \in [0, 1/2]$, $\mathrm{OMMP(M)}$ can recover slowly-decaying s-sparse signal within $O(s^{1-a})$ iterations. The result implies that OMMP can reduce the computational complexity heavily.