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We describe a new simple method for reconstruction of sparse signals with and without noisy perturbations, termed the subspace pursuit algorithm. The algorithm has two important characteristics: low computational complexity, comparable to that of orthogonal matching pursuit techniques, and reconstruction accuracy of the same order as that of LP optimization methods. In the noiseless setting, the proposed algorithm exactly reconstructs arbitrary sparse signals, provided that the sensing matrix satisfies the restricted isometry property with a constant parameter. In the noisy setting, and for the case that the signal is not exactly sparse, it can be shown that the mean squared error of the reconstruction is upper bounded by constant multiples of the measurement and signal perturbation energies. (Received August 11, 2008)