Message Passing Aided Least Square Recovery for Compressive Sensing

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I. INTRODUCTION AND MOTIVATION

Compressive sensing (CS) have got attention as a promising signal processing technique to reduce information rate of sparse signals [1]. One line of CS related researches are to devise low complexity recovery algorithms since the conventional L1-norm based recovery algorithms still have high computational complexity for practical applications. Recently, a few researchers have made an attempt to apply probabilistic message passing (PMP) ideas to CS recovery [2], [3] since PMP has provided a successful solution for low complexity decoding while showing suboptimal performance in channel coding problems, such as low-density parity check codes [4].

Motivated by such previous works, in this paper, we propose a new least square estimation (LSE) based CS recovery algorithm by applying PMP, called PMP-LSE. It is well known that CS recovery is basically an underdetermined system and it can be reformed as an overdetermined system with the support set information (SI). Therefore, in the proposed algorithm, PMP undertakes to find the SI of the signal to reform the recovery to an overdetermined case, and then LSE completes the recovery using the SI. Mainly, PMP-LSE has two strong benefits. First, PMP-LSE shows outstanding performance with noisy measurements by removing the noise effect from elements belonging to the non-support set. Second, PMP-LSE prevents the corruption of zero elements for variety of thresholds with three PMP iterations. Figure 1 shows the MMSE performance of PMP-LSE with CS-BP [2]. Figure 1 plots the MMSE per elements as a function of SNR for three PMP iterations. Figure 1 shows that PMP-LSE outperforms CS-BP notably in low SNR region.

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