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Sparse Recovery and Outliers Detection for Dependent Data

Learning non-linear systems from noisy, limited, and/or dependent data is an important task across various scientific fields including statistics, engineering, computer science, mathematics, and many more. In this work, we study the problem of learning nonlinear functions from sparse corrupted and dependent data. The learning problem is recast as a sparse linear regression problem where we incorporate both the unknown coefficients and the corruptions in a basis pursuit framework. The main contribution of our paper is to provide a reconstruction guarantee for the associated ℓ_1-optimization problem where the sampling matrix is formed from dependent data. Specifically, we prove that the sampling matrix satisfies the null space property and the stable null space property, provided that the data is compact and satisfies a suitable concentration inequality. We show that our recovery results are applicable to various types of dependent data such as exponentially strongly α-mixing data, geometrically $\mathcal{C}$-mixing data, and uniformly ergodic Markov chain.