

On Rate Requirements for Achieving the Centralized Performance in Distributed Estimation

Abstract:

We consider a distributed parameter estimation problem, in which multiple terminals send messages related to their local observations using limited rates to a fusion center which obtains an estimate of a parameter related to the observations of all terminals. It is well known that if the transmission rates are in the Slepian–Wolf region, the fusion center can fully recover all observations and hence can construct an estimator having the same performance as that of the centralized case. One natural question is whether Slepian–Wolf rates are necessary to achieve the same estimation performance as that of the centralized case. In this paper, we show that the answer to this question is negative. We establish our result by explicitly constructing an asymptotically minimum variance unbiased estimator that has the same performance as that of the optimal estimator in the centralized case while using information rates less than the conditions required in the Slepian–Wolf rate region. The key idea is that, instead of aiming to recover the observations at the fusion center, we design universal schemes enabling the fusion center to compute a sufficient statistic using rates outside of the Slepian–Wolf region.