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Strong Data Processing Inequalities for Locally Differentially Private Mechanisms

We investigate the strong data processing inequalities of locally differentially private mechanisms under a specific f -divergence, namely the E_γ -divergence. More specifically, we characterize an upper bound on the E_γ -divergence between PK and QK , the output distributions of an ε -LDP mechanism K , in terms of the E_γ -divergence between the corresponding input distributions P and Q . Interestingly, the tightest such upper bound in the binary case turns out to have a non-multiplicative form. We then extend our results to derive a tight upper bound for general f -divergences. As an application of our main findings, we derive a lower bound on the locally private Bayesian estimation risk that is tighter than the available divergence-based bound in the literature.