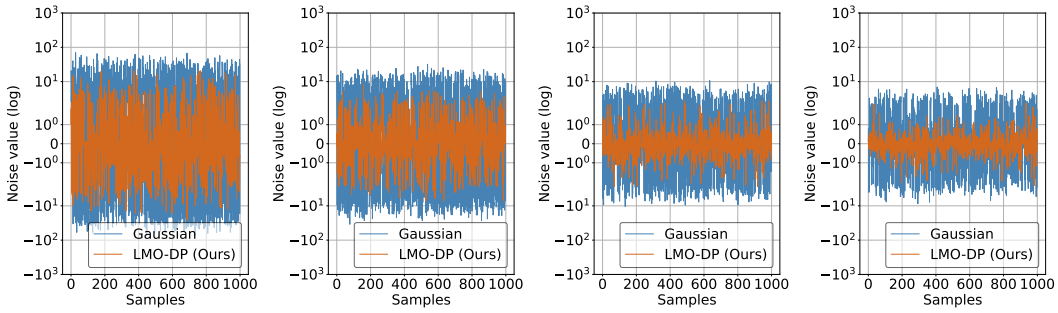
A SUPPLEMENTARY DOCUMENT

A.1 LMO-DP NOISE VS GAUSSIAN NOISE

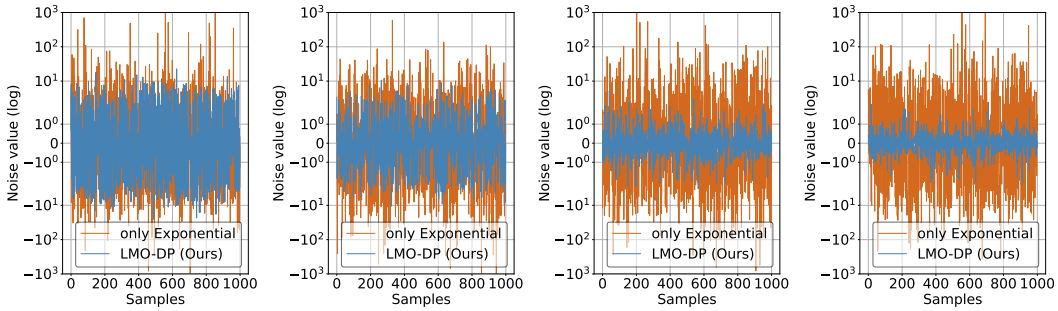


(a) $\epsilon = 0.3$ (b) $\epsilon = 0.7$ (c) $\epsilon = 2$ (d) $\epsilon = 3$

Figure A.1: LMO-DP vs Gaussian. (a) average reduction rate 95.13%. (b) average reduction rate 92.19%. (c) average reduction rate 87.71%. (d) average reduction rate 87.31%. The results demonstrate that the LMO-DP noise significantly outperforms the Gaussian noise; LMO-DP performs even better for smaller ϵ since the avearge reduction rate slightly declines as ϵ increases.

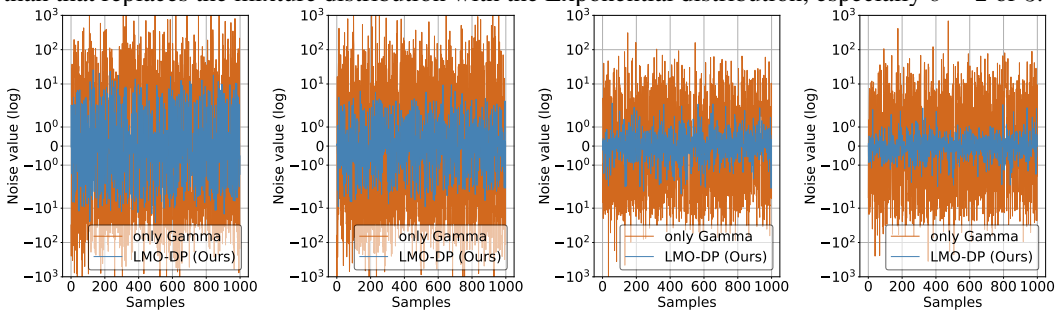
A.2 ABLATION STUDY

A.2.1 ONE DISTRIBUTION VS. MIXTURE DISTRIBUTION IN LMO-DP



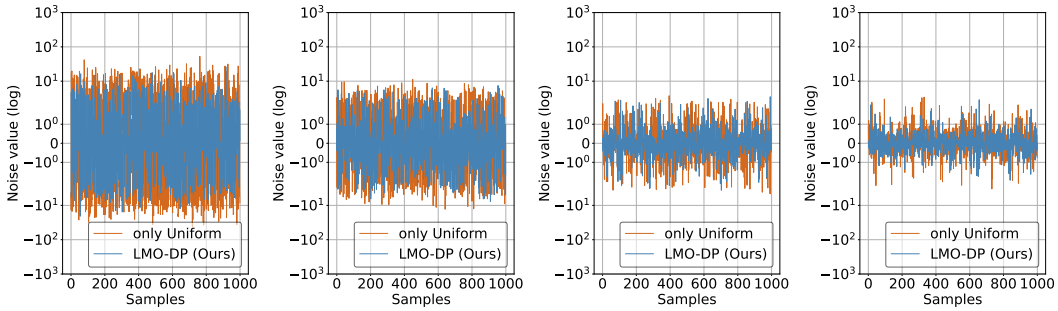
(a) $\epsilon = 0.3$ (b) $\epsilon = 0.7$ (c) $\epsilon = 2$ (d) $\epsilon = 3$

Figure A.2: Exponential distribution vs mixture distribution (with the same remaining setting). The noise generated by the mixture distribution (as the second-fold) in LMO-DP is significantly smaller than that replaces the mixture distribution with the Exponential distribution, especially $\epsilon = 2$ or 3.



(a) $\epsilon = 0.3$ (b) $\epsilon = 0.7$ (c) $\epsilon = 2$ (d) $\epsilon = 3$

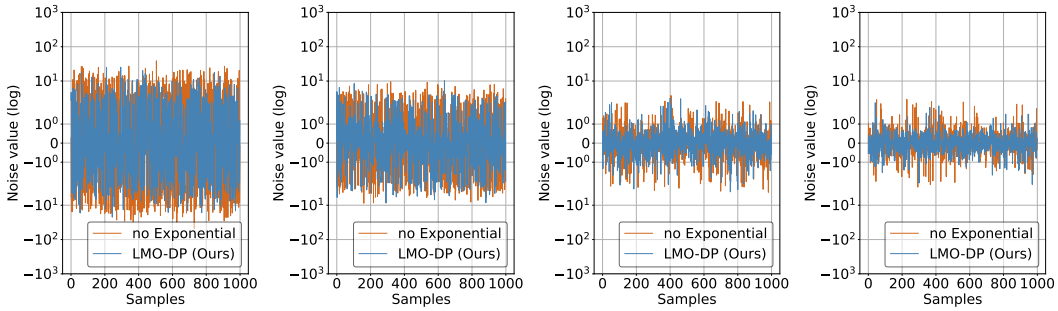
Figure A.3: Gamma distribution vs mixture distribution (with the same remaining setting). The noise generated by the mixture distribution (as the second-fold) in LMO-DP is significantly smaller than that replaces the mixture distribution with the Gamma distribution for all ϵ.



(a) $\epsilon = 0.3$ (b) $\epsilon = 0.7$ (c) $\epsilon = 2$ (d) $\epsilon = 3$

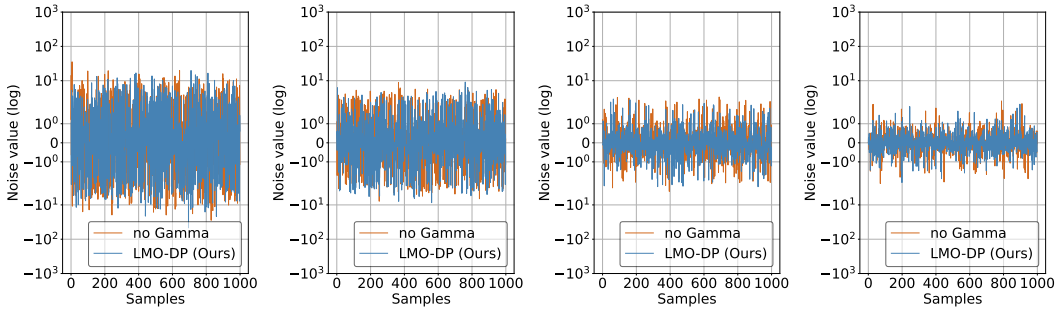
Figure A.4: Uniform distribution vs mixture distribution (with the same remaining setting). The noise generated by the mixture distribution (as the second-fold) in LMO-DP is slightly smaller than that replaces the mixture distribution with the uniform distribution. **The results demonstrate that uniform distribution contributes more to the subopitmal noise**.

A.2.2 Mixture of Two Distributions vs. Mixture of Three Distribution in LMO-DP



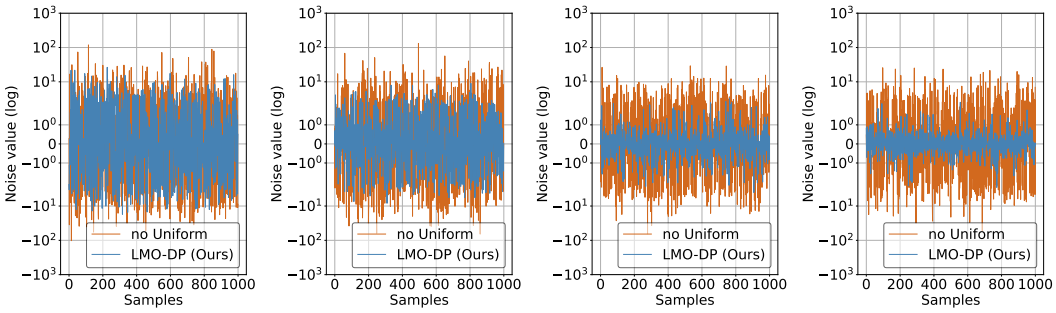
(a) $\epsilon = 0.3$ (b) $\epsilon = 0.7$ (c) $\epsilon = 2$ (d) $\epsilon = 3$

Figure A.5: Mixture of Gamma and uniform distributions vs mixture of three distribution (with the same remaining setting). The noise generated by the mixture of three distributions (as the second-fold) in LMO-DP is slightly smaller than that removes the exponential distribution.



(b) (c) (c) (d)

Figure A.6: Mixture of Exponential and uniform distributions vs mixture of three distribution (with the same remaining setting). The noise generated by the mixture of three distributions (as the second-fold) in LMO-DP is slightly smaller than that removes the Gamma distribution.



(b) (c) (c) (d)

Figure A.7: Mixture of Gamma and exponential distributions vs mixture of three distribution (with the same remaining setting). The noise generated by the mixture of three distributions (as the second-fold) in LMO-DP is smaller than that removes the uniform distribution, especially for large ϵ. **The results again demonstrate that uniform distribution contributes more to the subopitmal noise**.