Errata on "Quantifying Differential Privacy in Continuous Data Release under Temporal Correlations"

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In this errata, we report the differences between "Quantifying Differential Privacy in Continuous Data Release Under Temporal Correlations" [1] and its previous conference version [2]. In both works [1], [2], we studied the problem of Differential Privacy (DP) in the context of continuous data release: the privacy loss of a traditional DP mechanism at each time point (event-level DP) may increase over time under temporal correlations. In the preliminary version [2], we provided theoretical analysis on such unexpected privacy loss and designed an algorithm for quantifying it. However, the algorithm may not be applicable in real-time applications due to its high computational complexity. Hence, in its extended version [1] in TKDE, our major effort is to design faster algorithms for quantifying the privacy leakage in real-time. The new contributions of [1] are summarized below.

- *A new privacy leakage quantification algorithm in $O(n^2 \log n)$ time* where n is the dimension of the data (Section 4.3 "Quasi-quadratic Algorithm" [1]). We introduced two theorems and two algorithms exploiting the common computational tasks given different inputs.
- *A further enhanced privacy leakage quantification algorithm in $O(\log n)$ time* where n is the dimension of the data (Section 4.4 "Sub-linear Algorithm" [1]). By proving two new theorems, we are able to extract more common computations, so that we can precompute them offline and quantify the privacy leakage in sub-linear time.
- *A new algorithm for finding the supremum of privacy leakage and redesigned algorithms for allocating privacy budgets at each time point* (Section 5 "Bounding Temporal Privacy Leakage" [1]). The main problem of our previous budget allocation algorithms (Algorithm 2 and 3 in [2]) is that it is not clear how to find a converged α^B or α^F. We designed Algorithms 7 and 8 in [1] to solve this problem.
- *Extended experiments* (Section 6.1 "Runtime of Privacy Quantification Algorithms" [1]). We added new experimental results of the new algorithms on larger data sizes. To improve the reproducibility of our paper, the code is implemented in Matlab and open sourced in Github.[1]

References

[1] Y. Cao, M. Yoshikawa, Y. Xiao, and L. Xiong, "Quantifying differential privacy in continuous data release under temporal correlations," *IEEE Trans. Knowl. Data Eng.*, vol. 31, no. 7, pp. 1281–1295, Jul. 2019.
[2] Y. Cao, M. Yoshikawa, Y. Xiao, and L. Xiong, "Quantifying differential privacy under temporal correlations," in *Proc. IEEE 33rd Int. Conf. Data Eng.*, 2017, pp. 821–832.

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1. https://github.com/brahms2013/TPL