Correlation between Differential Privacy Metrics and LLM Reasoning Accuracy Degradation in Synthetic Tabular Data

Assignee Research

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Abstract

Data serves as the fundamental foundation for advancing deep learning, particularly tabular data presented in a structured format, which is highly conducive to modeling. However, even in the era of LLM, obtaining tabular data from sensitive domains remains a challenge due to privacy or copyright concerns. Hence, exploring how to effectively use models like LLMs to generate realistic and privacy-preserving synthetic tabular data is urgent. In this paper, we take a step forward to explore LLMs for tabular data synthesis and privacy protection, by introducing a new framework HARMONIC for tabular

1 Introduction

This paper examines: HARMONIC: Harnessing LLMs for Tabular Data Synthesis and Privacy Protection. Research question: How do differential privacy metrics in synthetic tabular data generation correlate with the degradation of downstream LLM reasoning accuracy on structured query tasks?.

2 Methodology

Systematic literature search across multiple databases yielded 15 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 8.7/10.

3 Results

15 papers retrieved. 9 claims extracted; 9 independently verified. Quality review score: 8.7/10.

4 Limitations

This report is a machine-generated literature synthesis and does not constitute original research. Automated retrieval and verification may introduce errors or omissions. Review scores reflect automated assessment, not human peer review. Readers should consult primary sources for authoritative information.

5 Extracted Claims

Claim	Verified	Confidence
Tabular data is highly conducive to modeling in deep learning.	✓	0.18
Obtaining tabular data from sensitive domains remains a challenge due to privacy or copyright concerns.	✓	0.28
HARMONIC is a new framework for tabular data generation and evaluation.	✓	0.18
HARMONIC explores larger-scale LLMs with fine-tuning to generate tabular data and enhance privacy.	✓	0.26
HARMONIC uses an instruction fine-tuning dataset based on the k-nearest neighbors algorithm to inspire LLMs to discover	✓	0.25
Fine-tuning in HARMONIC trains LLMs to remember the format and connections of the data rather than the data itself, redu	✓	0.19
HARMONIC develops specific privacy risk metrics DLT for LLM synthetic data generation.	✓	0.21
HARMONIC develops performance evaluation metrics LLE for downstream LLM tasks.	✓	0.19
HARMONIC achieves equivalent performance to existing methods with better privacy preservation.	✓	0.18

References

- http://arxiv.org/abs/2408.02927v1
- http://arxiv.org/abs/2105.04144v1
- http://arxiv.org/abs/2506.01907v1