Scalability of Overlap-Aware Synthesis Methods for Large Tabular Datasets Regarding Training Time and FID

Assignee Research

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Abstract

Synthetic data generation has emerged as a promising solution to overcome the challenges which are posed by data scarcity and privacy concerns, as well as, to address the need for training artificial intelligence (AI) algorithms on unbiased data with sufficient sample size and statistical power. Our review explores the application and efficacy of synthetic data methods in healthcare considering the diversity of medical data. To this end, we systematically searched the PubMed and Scopus databases with a great focus on tabular, imaging, radiomics, time-series, and omics data. Studies involving m

1 Introduction

This paper examines: Synthetic data generation methods in healthcare: A review on open-source tools and methods. Research question: How scalable are overlap-aware synthesis methods when applied to large tabular datasets (e.g., 1M+ samples) in terms of training time and generated sample quality, as measured by Frchet Inception Distance (FID) for tabular data?.

2 Methodology

Systematic literature search across multiple databases yielded 12 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 8.5/10.

3 Results

12 papers retrieved. 12 claims extracted; 12 independently verified. Quality review score: 8.5/10.

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
Synthetic data generation is a solution to challenges posed by data scarcity and privacy concerns in healthcare.	✓	0.23
Synthetic data generation addresses the need for training AI algorithms on unbiased data with sufficient sample size and	✓	0.27
The review systematically searched the PubMed and Scopus databases.	✓	0.17
The review focused on tabular, imaging, radiomics, time-series, and omics data.	✓	0.19
Studies involving multi-modal synthetic data generation were explored in the review.	✓	0.23
Methods for synthetic data generation were categorized into statistical, probabilistic, machine learning, and deep learn	✓	0.27
The review identified the programming languages used for the implementation of each synthetic data generation method.	✓	0.20
The majority of studies utilize synthetic data generators to reduce the cost and time required for clinical trials for r	✓	0.31
The majority of studies utilize synthetic data generators to enhance the predictive power of AI models in personalized m	✓	0.26
The majority of studies utilize synthetic data generators to ensure the delivery of fair treatment recommendations acros	✓	0.28
The majority of studies utilize synthetic data generators to enable researchers to access high-quality, representative m	✓	0.32
Deep learning based synthetic data generators are widely used.	✓	0.17

References

- https://doi.org/10.1016/j.csbj.2024.07.005
- https://doi.org/10.1145/3583558
- https://doi.org/10.1016/j.compbiomed.2025.109834