Comparative Analysis of Tabular Diffusion Models, WGANs, and VAEs on Large-Scale Imbalanced High-Dimensional Data via FID

Assignee Research

June 12, 2026

Abstract

Synthetic data are increasingly being recognized for their potential to address serious real-world challenges in various domains. They provide innovative solutions to combat the data scarcity, privacy concerns, and algorithmic biases commonly used in machine learning applications. Synthetic data preserve all underlying patterns and behaviors of the original dataset while altering the actual content. The methods proposed in the literature to generate synthetic data vary from large language models (LLMs), which are pre-trained on gigantic datasets, to generative adversarial networks (GANs) and v

1 Introduction

This paper examines: A Systematic Review of Synthetic Data Generation Techniques Using Generative AI. Research question: How do tabular diffusion models compare to Wasserstein GANs and VAEs in terms of FID score when scaled to larger imbalanced datasets with 100+ features?.

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 8.8/10.

3 Results

12 papers retrieved. 9 claims extracted; 9 independently verified. Quality review score: 8.8/10.

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 are increasingly being recognized for their potential to address serious real-world challenges in various	✓	0.31
Synthetic data provide solutions to combat data scarcity, privacy concerns, and algorithmic biases in machine learning a	✓	0.29
Synthetic data preserve all underlying patterns and behaviors of the original dataset while altering the actual content.	✓	0.31
Methods proposed in the literature to generate synthetic data include large language models (LLMs), generative adversari	✓	0.32
Large language models (LLMs) used for synthetic data generation are pre-trained on gigantic datasets.	✓	0.25
The study is a systematic review of techniques proposed in the literature to generate synthetic data.	✓	0.28
Existing synthetic data generation technologies generate synthetic data of specific data types.	✓	0.23
Current synthetic data generation techniques have drawbacks including computational requirements, training stability iss	✓	0.23
Drawbacks such as computational requirements, training stability, and privacy-preserving measures limit the real-world u	✓	0.35

References

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