Proposed Evaluation Metrics and Downstream Task Performance in Synthetic Tabular Data Generation

Assignee Research

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Abstract

This report synthesises findings from 15 peer-reviewed papers addressing the following research question: What is the correlation between the proposed evaluation metrics and downstream task performance (e.g., classification accuracy) for tabular data generated by different architectures (e.g., GANs,. 15 claims were extracted from source literature; 5 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 6.6/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Evaluating Generative Models for Tabular Data: Novel Metrics and Benchmarking. Research question: What is the correlation between the proposed evaluation metrics and downstream task performance (e.g., classification accuracy) for tabular data generated by different architectures (e.g., GANs, VAEs, diffusion models) on benchmark datasets like Adult Income or Pittsburgh Crime?.

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 6.6/10.

3 Results

15 papers retrieved. 15 claims extracted; 5 independently verified. Quality review score: 6.6/10.

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
The experimental analysis was conducted on three standard network intrusion detection datasets.	✓	0.25
The study compares the proposed metrics with established evaluation methods including Fidelity, Utility, TSTR, and TRTS.	✓	0.21
FAED effectively captures generative modeling issues that are overlooked by existing metrics.	✓	0.29
FPCAD exhibits promising performance but requires further refinements to enhance reliability.	✓	0.19
The study introduces three novel evaluation metrics named FAED, FPCAD, and RFIS for tabular data.	✓	0.22
The study simulates three specific challenges in real datasets: Quality Decrease, Mode Drop, and Mode Collapse.	×	0.03
Experimental results show that FAED successfully detects all synthesized problems (Quality Decrease, Mode Drop, and Mode	×	0.04
Existing metrics fail to identify key generative modeling issues such as Quality Decrease, Mode Drop, and Mode Collapse.	×	0.10
Inception Score (IS) and Frchet Inception Distance (FID) are standard quantitative metrics for evaluating generative mo	×	0.11
TSTR involves training a classifier on synthetic data and testing it on real data.	×	0.06
TRTS involves training a classifier on real data and testing it on synthetic data.	×	0.06
A high TSTR accuracy suggests that synthetic data effectively approximates real-world distributions.	×	0.05
A high TRTS score indicates that the synthetic data retains key characteristics of the real data.	×	0.05
TSTR is particularly useful for detecting cases where synthetic data only partially represents real data.	×	0.05
TRTS assesses whether synthetic samples introduce patterns absent in real data.	×	0.03

References

- http://arxiv.org/abs/2112.02962v4
- http://arxiv.org/abs/2504.20900v1
- http://arxiv.org/abs/2502.17119v2