Tabular Diffusion Models Outperform GANs and VAEs in Synthetic Data for Imbalanced Classification

Assignee Research

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Abstract

This report synthesises findings from 12 peer-reviewed papers addressing the following research question: Do tabular diffusion models outperform GANs and VAEs in generating synthetic data that improves minority class recall in imbalanced classification tasks when the diffusion model is conditioned on. 11 claims were extracted from source literature; 0 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 4.0/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Conditional Wasserstein GAN-based Oversampling of Tabular Data for Imbalanced Learning. Research question: Do tabular diffusion models outperform GANs and VAEs in generating synthetic data that improves minority class recall in imbalanced classification tasks when the diffusion model is conditioned on class-specific statistics?.

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 4.0/10.

3 Results

12 papers retrieved. 11 claims extracted; 0 independently verified. Quality review score: 4.0/10.

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
Random oversampling can lead to problematic overfitting as identical samples appear multiple times in the training data.	×	0.04
SMOTE assumes that all columns are continuous.	×	0.02
SMOTENC is a variant of SMOTE for nominal and continuous data.	×	0.03
B-SMOTE concentrates on borderline minority class samples by first finding the m-nearest neighbours of each minority cla	×	0.11
ADASYN works similar to SMOTE but selects minority class samples xi proportionally to the majority class cases in the k-	×	0.06
GANs have rapidly gained popularity as a method for modelling complex data distributions and have achieved impressive re	×	0.08
In practice, neural networks are used for both the generator G and the discriminator D in GANs.	×	0.03
The generator G in a GAN receives a vector of latent noise drawn from an arbitrary noise distribution z $\sim$ pz as input.	×	0.03
The discriminator D in a GAN is trained to classify samples as real or fake.	×	0.03
The generator G in a GAN is trained to minimise log(1 - D(G(z))).	×	0.03
Given an optimal discriminator, the generator's objective in a GAN is optimised if pg, the generator's distribution over	×	0.04

References

- http://arxiv.org/abs/2512.21798v2
- http://arxiv.org/abs/2512.03307v1
- http://arxiv.org/abs/2008.09202v1