

Extending Adaptive Noise Scheduling in ANT to VAEs and GANs for Time Series: Efficiency and Sample Quality on the Monash Benchmark

Assignee Research

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Abstract

Advances in diffusion models for generative artificial intelligence have recently propagated to the time series (TS) domain, demonstrating state-of-the-art performance on various tasks. However, prior works on TS diffusion models often borrow the framework of existing works proposed in other domains without considering the characteristics of TS data, leading to suboptimal performance. In this work, we propose Adaptive Noise schedule for Time series diffusion models (ANT), which automatically predetermines proper noise schedules for given TS datasets based on their statistics representing non-s

1 Introduction

This paper examines: ANT: Adaptive Noise Schedule for Time Series Diffusion Models. Research question: Can the adaptive noise scheduling in ANT be extended to other generative models (e.g., VAE, GAN) for time series data, and how does it affect their efficiency (measured by convergence speed) and sample quality (measured by IS/FID) on the Monash benchmark?.

2 Methodology

Systematic literature search across multiple databases yielded 11 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

11 papers retrieved. 10 claims extracted; 10 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
ANT chooses a cosine schedule for the M4 dataset, yielding a 27.8% gain compared to a linear schedule of TSDiff.	✓	0.27
ANT is an algorithm designed to select an appropriate noise schedule, which is adaptive, flexible, model-agnostic, and e	✓	0.23
ANT proposes a noise schedule that minimizes the discrepancy between the ideal linear line and the non-stationarity curv	✓	0.34
ANT decreases the non-stationarity of TS on a linear scale, making TS across steps more distinguishable.	✓	0.22
Diffusion step embedding (DE) is unnecessary for TS diffusion models when a linear schedule is employed.	✓	0.26
Non-linear schedules are more robust to the change of the number of diffusion steps than linear schedules in terms of pe	✓	0.34
ANT outperforms the baseline methods in extensive experimental results across various datasets.	✓	0.15
ANT corrupts the TS into random noise at the final step to align the training and inference stages.	✓	0.26
ANT has a sufficient number of diffusion steps to enhance sample quality.	✓	0.17
ANT is model-agnostic and only depends on the statistics of datasets.	✓	0.19

References

- <http://arxiv.org/abs/2410.14488v1>

- <http://arxiv.org/abs/2206.02262v4>
- <http://arxiv.org/abs/2412.00381v1>