Impact of Noise Schedule Adaptation in ANT on Fidelity-Cost Trade-offs Across Monash Domains

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: What is the impact of varying the noise schedule adaptation mechanism in ANT on the trade-off between sample fidelity (measured by FID score) and computational cost (measured by GFLOPs) across different domains in Monash?.

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 7.0/10.

3 Results

15 papers retrieved. 10 claims extracted; 7 independently verified. Quality review score: 7.0/10.

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
On the M4 dataset, the ANT method using a cosine schedule yields a 27.8% gain compared to the linear schedule used by TS	✓	0.18
The ANT method selects an adaptive noise schedule based on statistics representing the non-stationarity of the time seri	✓	0.18
Real-world time series exhibit high non-stationarity, while white noise time series exhibit low non-stationarity.	×	0.14
A schedule that decreases the non-stationarity of time series on a linear scale corrupts the time series into random noi	✓	0.24
Diffusion step embedding (DE) is not necessary for time series diffusion models when using a linear schedule because ste	✓	0.24
A non-linear noise schedule is more robust to the total number of diffusion steps (T) compared to a linear schedule.	✓	0.26
The ANT algorithm requires no training because the dataset statistics used for schedule selection can be precomputed off	×	0.09
Without ANT, the non-stationarity of a time series decreases abruptly, whereas with ANT it decreases gradually.	✓	0.17
ANT proposes a noise schedule that minimizes the discrepancy between an ideal linear line and the non-stationarity curve	✓	0.34
Table (p3) reports a performance improvement of +25.1% for metric and +4.1% for metric when using the proposed metho	×	0.04

References

- http://arxiv.org/abs/2406.04295v2
- http://arxiv.org/abs/2410.14488v1
- http://arxiv.org/abs/2307.11494v3