

Peak Detection using Transformers

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- Peak Detection
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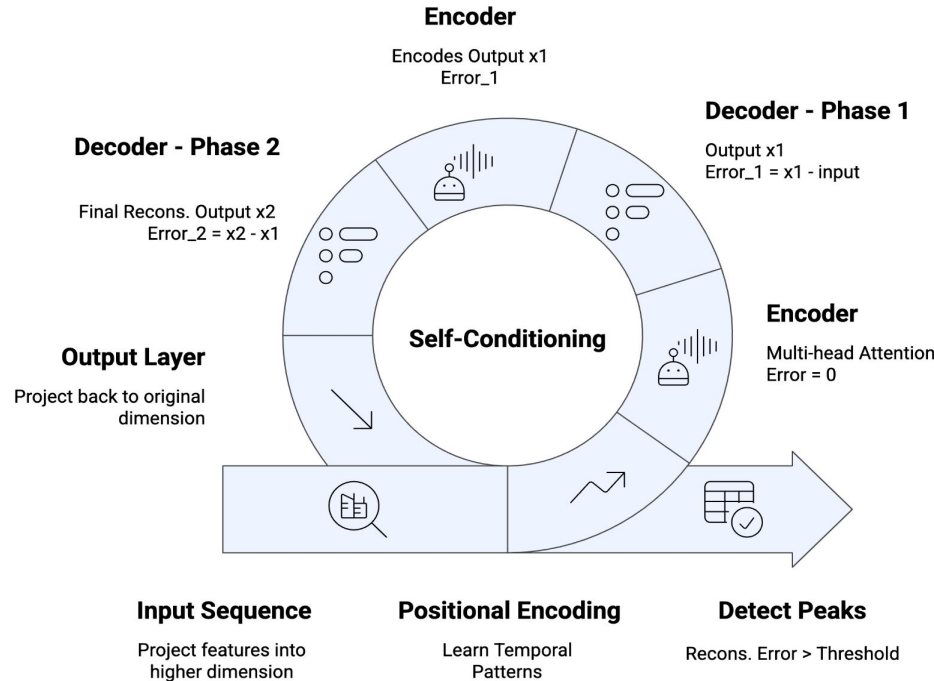


Fig : TranPD Model

- Peak = Identifying local maxima or minima
- 2017 Paper - **Attention Is All You Need!!!**
- Powers models like BERT, GPT, ViT etc.
- NLP, Computer Vision, Time-Series Forecasting

Tran-PD: Peak Detection via Reconstruction Error

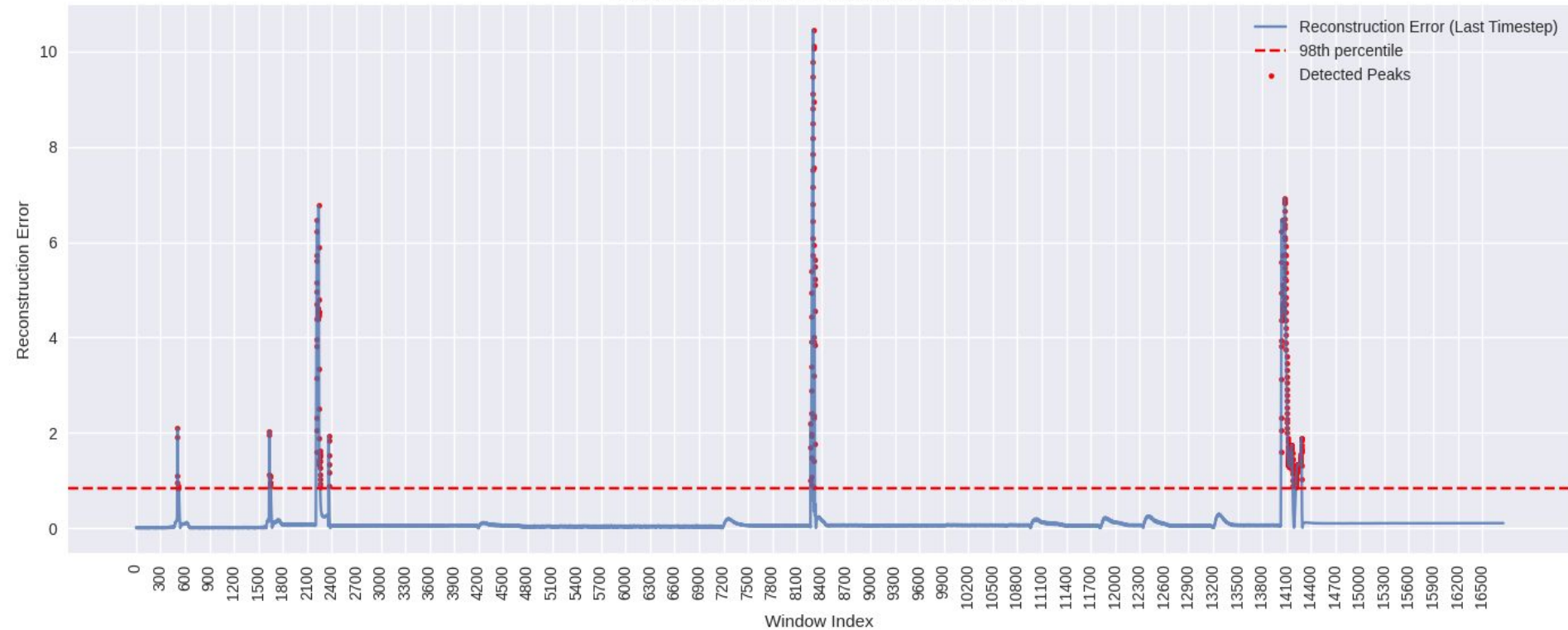


Fig : Reconstruction Error Plot - **336 Peaks Detected**

Tran-PD: Peak Detection via Reconstruction Error

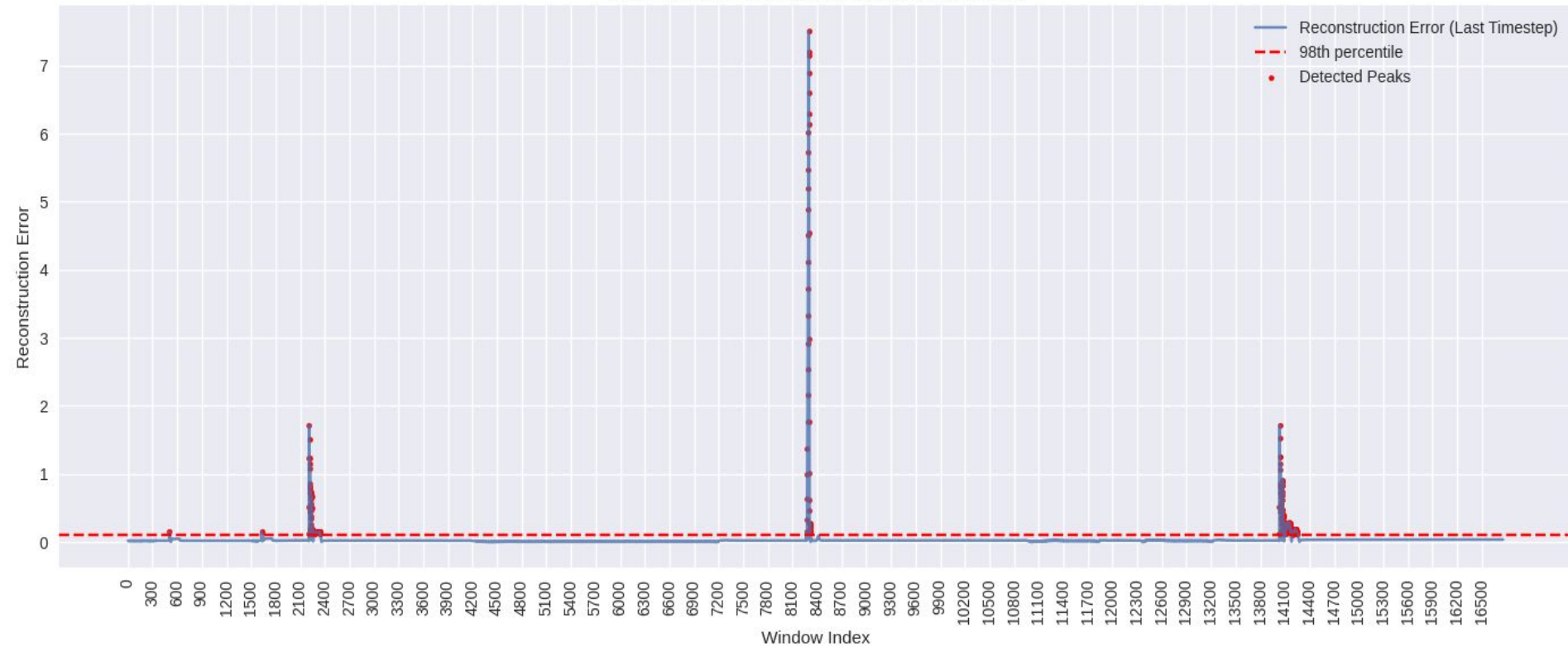


Fig : Reconstruction Error Plot - **336 Peaks Detected**

Tran-PD: Peak Detection via Reconstruction Error

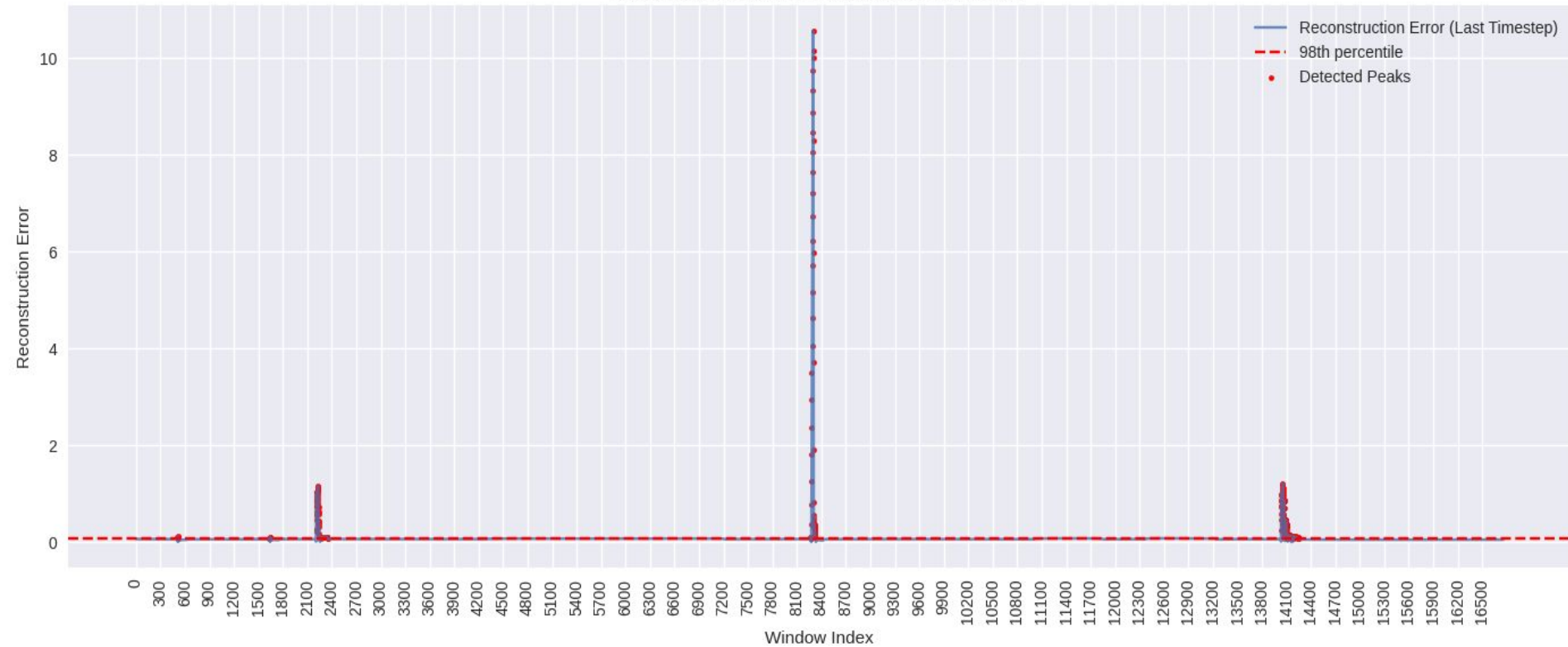


Fig : Reconstruction Error Plot - **336 Peaks Detected**

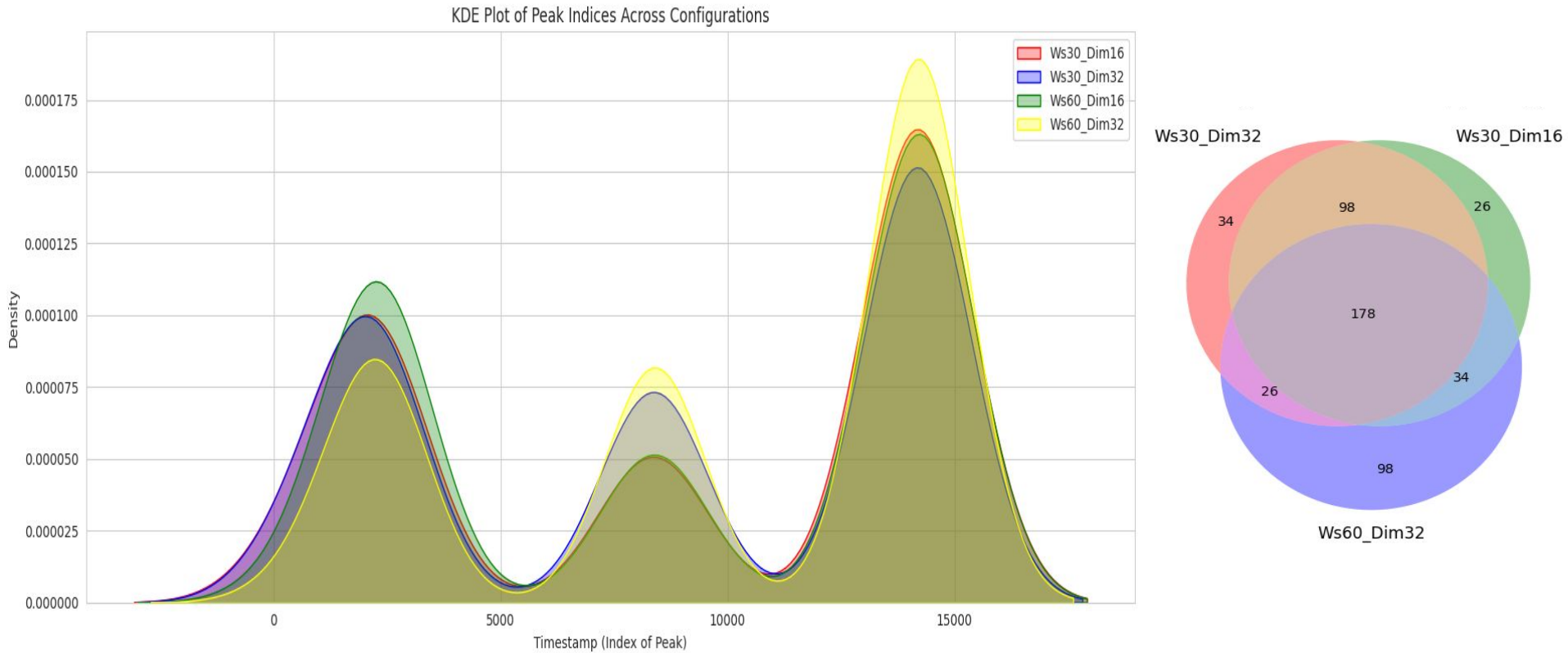


Fig : Peak Analysis Across Configurations

Measure	Peak	Non-Peak
Count	336	16447
Mean	0.74	0.11
Min	0.15	0.00
Max	8.55	0.15

Fig : Statistical Analysis of Reconstruction Error

Measure	W = 120, D= 64	W = 120, D= 32	W = 120, D= 16	W = 60, D= 32	W = 60, D= 16	W = 30, D= 32	W = 30, D= 16
No. of Peaks	336	336	336	336	336	336	336
Threshold	0.82	0.11	0.08	0.23	0.15	0.17	0.06
Mean RE	0.12	0.03	0.07	0.12	0.13	0.03	0.02
Min RE	0	0.00	0	0	0	0	0 - perfect zero
Max RE	10.44	7.50	10.55	8.558	8.559	9.33	9.40

Table : Statistical Analysis of Reconstruction Error

1. Regression Analysis
2. Implement Adaptive Thresholding Mechanism
3. Multivariate Peak Detection
4. Peak Forecasting
5. regression using Loss and without Loss try to predict current and later on all cure=rent features
6. z score vs DLM - Prediction power (R^2)

1. S. Tuli, G. Casale, and N. R. Jennings, "TranAD: Deep Transformer Networks for Anomaly Detection in Multivariate Time Series Data," *Proc. VLDB Endowment (PVLDB)*, 2022. Available: <https://doi.org/10.48550/arXiv.2201.07284>
2. Z. Z. Darban, G. I. Webb, S. Pan, C. C. Aggarwal, and M. Salehi, "Deep Learning for Time Series Anomaly Detection: A Survey," *arXiv preprint arXiv:2211.05244*, 2024]. Available: <https://doi.org/10.48550/arXiv.2211.05244>
3. <https://github.com/imperial-qore/TranAD>
4. <https://www.geeksforgeeks.org/data-analysis/peak-signal-detection-in-real-time-time-series-data/>
5. <https://stackoverflow.com/questions/22583391/peak-signal-detection-in-realtime-timeseries-data>



Thank You For Your Attention!