

STTS-EAD: Improving Spatio-Temporal Learning Based Time Series Prediction via Embedded Anomaly Detection

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Abstract : Dealing with anomalies is a crucial preprocessing step for multivariate time series prediction. However, existing methods that separate anomaly preprocessing and model training into two stages have certain limitations. Specifically, these methods fail to leverage auxiliary information necessary to distinguish latent anomalies related to spatiotemporal factors during the preprocessing stage. Instead, they solely rely on data distribution for detection which may lead to incorrect processing of many samples that are beneficial for training. To address this, we propose STTS-EAD, an end-to-end method that seamlessly integrates anomaly detection into the training process of multivariate time series forecasting and aims to improve Spatio-Temporal learning based Time Series prediction via Embedded Anomaly Detection. Our proposed STTS-EAD leverages spatio-temporal information for forecasting and anomaly detection, with the two parts alternately executed and optimized for each other. To the best of our knowledge, STTS-EAD is the first to integrate anomaly detection and forecasting tasks in the training phase for improving the accuracy of multivariate time series forecasting. Extensive experiments on a public stock dataset and two real-world sales datasets from a renowned coffee chain enterprise show that our proposed method can effectively process detected anomalies in the training stage to improve forecasting performance in the inference stage and significantly outperform baselines.

Keywords : multivariate time series, anomaly detection, time series forecasting, spatiotemporal feature learning

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