technische universität
dortmund

Bachelor and Master Thesis Topics

2022 - 2023

Prof. Dr. Emmanuel Müller

September 26, 2022

Chair of Data Science and Data Engineering

Time series representation learning using Transformers (Supervisor: Bin Li)

Goal and expectations

- reproduce one of the state-of-the-art time series representation learning model[1]
- apply the model in anomaly detection as a downstream task
- compare the anomaly detection performance with 1-2 commonly used competitor models

Requirements

- solid knowledge in time series analysis and deep learning. Experience with Transformers is a strong plus
- advanced programming skill in Python
- familiar with PyTorch and Scikit-learn

[1] Zerveas, George, et al. "A transformer-based framework for multivariate time series representation learning." Proceedings of the 27th ACM SIGKDD Conference on Knowledge Discovery & Data Mining. 2021.

Time series anomaly detection using Transformers (Supervisor: Bin Li) (Master thesis, start from Jan. 2023)

Goal and expectations

- design and implement a novel Transformer-based model for multivariate time series anomaly detection
- empirically validate the effectiveness and efficiency of the model
- systematically compare the anomaly detection performance with selected models from the same category

Requirements

- solid knowledge in time series anomaly detection and deep learning. Experience with Transformers is a strong plus
- advanced programming skill in Python
- familiar with PyTorch and Scikit-learn

Reference: Xu, Jiehui, et al. "Anomaly Transformer: Time Series Anomaly Detection with Association Discrepancy." International Conference on Learning Representations. 2021.

Copula-based anomaly detection / subspace search (Supervisor: Daniel Wilmes) (Bachelor thesis)

Goal and expectations

- Comparison and evaluation of existing approaches for copula-based anomaly detection / subspace search

Requirements

- solid knowledge in mathematics and statistics
- advanced programming skills in Python

Boosting as a collaborative game among weak learners

Goal and expectations

- understand the main concepts of collaborative game theory and their interactions with boosting methods
- investigate whether the interpretation of boosting methods as a coalitional game helps to increase interpretability

Requirements

- interest in boosting (both from a machine learning and from a statistic point of view)
- Bachelor thesis topic (possible extension to a Master thesis topic under agreements)

Supervisor: Chiara Balestra

Contribution evaluation of input variables in anomaly detection on time series data

Goal and expectations

- detect anomaly on time series data
- develop a method to quantify the importance of each feature in detecting anomalies on time series data

Requirements

- programming skills (Python)
- interest in trustworthy machine learning, anomaly detection and time series

Supervisor: Chiara Balestra, Bin Li

Motifs importance in prediction of labels in time series data

Goal and expectations

- detect motifs that are correlated with label prediction in time series data
- assign to each of the motif an importance score

Requirements

- programming skills (Python)
- interest in trustworthy machine learning, game theory and time series

Supervisor: Chiara Balestra

Overview

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