



**Année Universitaire : 2024/2025**  
**Formulaire de dépôt de sujet de Mémoire**  
**Mastère de recherche en Système d'Information et Web**

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**Sujet de mémoire :** Anomaly detection in time series data

**Objectifs de la recherche, délimitation du sujet de mémoire et méthode de travail :**

Anomaly detection in time series data involves identifying irregular patterns or outliers that deviate from expected behavior over time. These anomalies disrupt temporal patterns signaling potential issues or opportunities. Pertinent usages of anomaly detection in time series data cover a wide range of applications like finance, manufacturing, healthcare monitoring, etc. In such contexts, anomaly detection helps preventing fraud, ensuring system reliability, and improving decision-making across various sectors.

“Approaches of anomaly detection in time series data” is a constantly active research area [1]. These methods are largely varied and include: (i) statistical methods like the Auto Regressive Integrated Moving Average (ARIMA) [2], (ii) machine and deep learning-based methods [3, 4, 5, 6 ], (iii) Reinforcement Learning [7, 8], NLP-based methods [9], etc.

The main goals of this Master of Science project include:

- Explore and synthesize the recent state of the art for anomaly detection in time series data.
- Identify the best-performing models and rank them according to pertinent performance criteria.
- Implement a pertinent selection of these models and evaluate their performances in selected contexts.
- Eventually build a visible contribution to the current literature of anomaly detection in time series data.

Here, some references are given:

[1] Shaukat, Kamran & Mahboob Alam, Talha & Luo, Suhui & Shabbir, Shakir & Hameed, Ibrahim & Li, Jiaming & Abbas, Syed & Javed, Umair. (2021). A Review of Time-Series Anomaly Detection Techniques: A Step to Future Perspectives. 10.1007/978-3-030-73100-7\_60.

[2] Kozitsin, Viacheslav & Katser, Iurii & Lakontsev, Dmitry. (2021). Online Forecasting and Anomaly Detection Based on the ARIMA Model. Applied Sciences. 11. 3194. 10.3390/app11073194.



[3] Wette, S., & Heinrichs, F. (2024). OML-AD: Online Machine Learning for Anomaly Detection in Time Series Data. *ArXiv*, *abs/2409.09742*.

[4] Deep Learning for Time Series Anomaly Detection: A Survey , Zahra Zamanzadeh Darban, Geoffrey I. Webb, Shirui Pan, Charu C. Aggarwal, Mahsa Salehi. <https://doi.org/10.48550/arXiv.2211.05244>

[5] A Survey on Graph Neural Networks for Time Series: Forecasting, Classification, Imputation, and Anomaly Detection , Ming Jin, Huan Yee Koh, Qingsong Wen, Daniele Zambon, Cesare Alippi, Geoffrey I. Webb, Irwin King, Shirui Pan. <https://doi.org/10.48550/arXiv.2307.03759>.

[6] Deep Isolation Forest for Anomaly Detection, Submitted on 14 Jun 2022 , last revised 9 Jun 2023, Hongzuo Xu, Guansong Pang, Yijie Wang, Yongjun Wang, Accepted by IEEE Transactions on Knowledge and Data Engineering (TKDE). <https://doi.org/10.1109/TKDE.2023.3270293>.

[7] RLAD: Time Series Anomaly Detection through Reinforcement Learning and Active Learning, Tong Wu, Jorge Ortiz.

[8]Time Series Anomaly Detection via Reinforcement Learning-Based Model Selection : **Jiuqi Elise Zhang, Di Wu, Benoit Boulet** , Accepted by IEEE Canadian Conference on Electrical and Computer Engineering (CCECE) 2022. <https://doi.org/10.48550/arXiv.2205.09884>

[9]Large language models can be zero-shot anomaly detectors for time series,Sarah Alnegheimish, Linh Nguyen, Laure Berti-quille, Kalyan Veeramachaneni , accepted by IEEE International Conference on Data Science and Advanced Analytics (DSAA 2024) . <https://doi.org/10.48550/arXiv.2405.14755>.

### Encadrant

Nom, prénom et signature  
**Dr. Hassenet Slimani**

### Co-encadrant

Nom, prénom et signature  
**None**

Avis du président de la commission :	El Kef, le...../...../2024  <b>La Directrice Ibtissem Cherni</b>
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