



Master Research Internship Offer
Université de Lorraine.

Title: Advanced Transformer-based Algorithms for Time Series Classification in Condition Monitoring

Research Lab: CRAN UMR 7039, et Institut Jean Lamour CNRS UMR 7198, Université de Lorraine.

Websites: CRAN and IJL: <http://www.cran.univ-lorraine.fr/> and <https://ijl.univ-lorraine.fr/>

Scholarship Duration: 6 months

Period: April 2025-September 2025

Supervisor(s): Prof. Didier THEILLIOL and Dr. Mayank Shekhar JHA, CRAN CNRS UMR 7039 and Dr. Jean Philippe JEHL Institut Jean Lamour CNRS UMR 7198

Gratification: average 590 Euros per month + Location Room

Location: CRAN Polytech Nancy - <https://polytech-nancy.univ-lorraine.fr/>

Background: basics of Deep neural networks, Machine learning, PYTHON, Classification problems and basic pipeline construction

This research internship aims to develop state-of-the-art algorithms for the classification of time series data derived from sensor readings, focusing on distinguishing between nominal and degraded conditions. The project emphasizes the application of deep learning techniques, particularly transformers, and explores LSTMs and their recent variants as potential complementary models.

Key objectives include:

- Analysis the data to build a Pretreatment as Time Series
- Designing transformer-based architectures tailored to time series data classification problems.
- Investigating two-class and multi-class classification frameworks to support decision-making in real-world machine monitoring applications.
- Comparing the performance of transformer models against traditional architectures such as fully connected neural networks, standard deep neural networks, and LSTMs, especially in scenarios involving fault detection.

The student will be expected to:

- Collect Data, Data Pretreatment as Time Series
- Understand and apply the fundamentals of deep learning, including fully connected neural networks and recurrent networks.
- Explore the unique capabilities of transformer models, such as handling long-range dependencies, and adapt them for time series classification tasks.
- Develop and test algorithms on real or simulated sensor data, demonstrating how these models perform in identifying nominal versus faulty operational conditions.

By the end of the internship, the student will have gained experience in implementing cutting-edge deep learning techniques for time series classification and have developed an understanding of how to tailor these approaches to specific various applications in machine health monitoring and fault detection.

Keywords: Degradation / Learning / Temporal Series / Decision Making

Contact:

Prof. Didier THEILLIOL - Université de Lorraine

www.cran.univ-lorraine.fr/didier.theilliol

email : didier.theilliol@univ-lorraine.fr