Master Internship Position

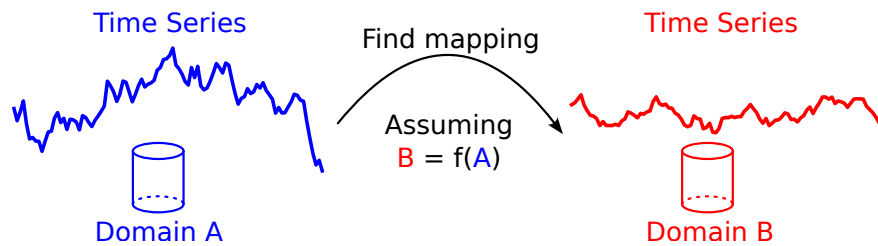## Series-2-Series Transformation

Figure 1: Given two sets of time series one from each domain with one domain conditioned on the other, can we find the mapping through a machine learning model ?

1 Information about the internship

- **Supervisors:**
    - Ali Ismail Fawaz (https://hadifawaz1999.github.io)
    - Maxime Devanne (https://maxime-devanne.com)
    - Germain Forestier (https://germain-forestier.info)

- **Location:** UHA/IRIMAS EA 7499, Mulhouse, France

- **Duration:** 6 months (starting from February or March 2026)

- **Salary:** 670€ monthly

- **Funding:** S2ST project - Internal IRIMAS UHA

- **Keywords:** Time Series, Series to Series, Machine Learning

2 Context

Time series are ordered sequences of observations collected over time, in which each value corresponds to a measurement taken at a specific temporal instant. Such data appear in numerous domains, including health monitoring, finance, climatology, and sensor networks. Classical tasks in time–series analysis include

forecasting future values [1], classification and pattern recognition [2], and reconstruction or imputation of missing measurements [3]. However, one task remains comparatively underexplored: *series-to-series transformation*. Instead of predicting a future continuation of a signal or assigning a label, the objective is to learn a mapping that transforms an entire input time series into an output time series belonging to a different domain. This concept naturally extends sequence-to-sequence (Seq2Seq) learning architectures [4], but its systematic study for heterogeneous time–series domains is still limited.

The S2ST project aims to fill this gap by developing methods for cross-domain series-to-series transformation (Figure 1). The central question is: given a time series generated in one domain, how can we generate its corresponding representation in another domain, when the two domains are linked by a functional or topological relationship? For instance, electroencephalogram (EEG) recordings could be transformed into kinematic movement trajectories. Such a capability would enable the generation of motor-control signals directly from neural activity, with potential applications in brain–computer interfaces and thought-controlled prosthetic devices.

The goal of the project is to develop, analyze, and evaluate series-to-series transformation methods capable of predicting an entire time series in one domain from a time series originating in a different domain.

3   Goals

The primary objective of the internship is to explore and implement machine-learning methods for series-to-series transformation, i.e., the generation of a complete target time series from an input time series. To achieve this overarching goal, the intern's work will focus on the following points:

- **Identify and select** relevant datasets from various domains that are suitable for series-to-series transformation tasks; for instance, EEG–motion datasets such as *WayEEG-GAL* [5] provide paired neural and kinematic time series, making them particularly well-suited for studying cross-domain transformations.

- **Preprocess and structure** these datasets, establishing standardized benchmark protocols for fair and reproducible evaluation such as the work of [6, 2];

- **Develop and assess** regression-based time-series models capable of performing continuous series-to-series prediction, with evaluation based on accuracy, temporal consistency and robustness

4 Profile of applicant

The candidate must fit the following requirements:

- Registered in Master 2 or last year of Engineering School (or equivalent) in **Computer Science**

- Advanced skills in **Python programming** are mandatory

- Good skills in **Machine Learning & Deep Learning** using related libraries (scikit-learn, Tensorflow, Pytorch, etc.) are required

- Knowledge and/or a first experience in **time series analysis** will be appreciated

5 Research environment

The proposed internship will be carried out within the MSD (Modeling and Data Science) team from the IRIMAS Institute. It will be part of the S2ST project. starting in 2026 for 1 year.

6 Application

For further information or for applying, candidates should send a **CV, academic records, personal projects (e.g. github repo) and a motivation letter** to ali-el-hadi.ismail-fawaz@uha.fr, maxime.devanne@uha.fr and germain.forestier@uha.fr.

References

[1] Z. Mariet and V. Kuznetsov, "Foundations of sequence-to-sequence modeling for time series," in *The 22nd international conference on artificial intelligence and statistics*, pp. 408–417, PMLR, 2019.

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[3] W. Cao, D. Wang, J. Li, H. Zhou, L. Li, and Y. Li, "Brits: Bidirectional recurrent imputation for time series," *Advances in neural information processing systems*, vol. 31, 2018.

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[6] A. Ismail-Fawaz, M. Devanne, S. Berretti, J. Weber, and G. Forestier, "Deep learning for skeleton based human motion rehabilitation assessment: A benchmark," *arXiv preprint arXiv:2507.21018*, 2025.