Multivariate Time Series Analysis for Medical interpretation

Postdoctoral research project summary

Longitudinal data are a common type of data in the medical field. Such data are collected, for example, to analyze the progression of a disease and its consequences for patients, with the goals of understanding disease evolution, characterizing patient profiles, alerting healthcare professionals in the event of patient deterioration, and enabling more personalized, earlier, and more effective care.

The objective of this postdoctoral project is to analyze patient barometers (scores ranging from 0 to 10) collected weekly by the Analgesia Foundation through a digital health platform (the eDOL smartphone application). The aim is to study the impact of treatment modifications (discontinuation, initiation, dosage changes), changes in quality of life (e.g., onset of financial hardship, work stoppage), and the emergence of comorbidities (other chronic diseases) on patient trajectories [1,2].

The project is structured around four main research areas:

- Creation of an algorithm capable of segmenting a patient's longitudinal score data into variable-length sequences. These sequences should represent patient states classified as improved, stable, or deteriorated according to predefined clinical criteria.
- Investigation of relationships between the detected states and treatment changes, comorbidities, and quality-of-life modifications using linked clinical data from the eDOL database and the French National Health Data System (SNDS) (the data linkage has already been completed).
- Identification of similar patient trajectories through the use of clustering techniques adapted to the specific characteristics of the data.
- Development of a predictive algorithm capable of forecasting dynamic changes in patient trajectories based on patient characteristics, health status changes, and modifications in care management.

The longitudinal data involved in this project present several methodological challenges, including: handling missing values; accounting for scale limitations over time; modeling placebo effects following treatment initiation and, conversely, tolerance effects (loss of treatment efficacy) after several months; Assigning specific labels (e.g., new treatment, comorbidity, socioeconomic hardship, work stoppage) to events with defined start and end dates on a given patient-reported measure. Assigning labels with start and end dates across all patient-reported measures may also generate conflicts. Indeed, some natural relationships between measures - such as increased pain leading to poorer sleep quality - may not always be observed in the data. Such conflicts could potentially be addressed using belief function theory (evidence theory).

In addition to the research component, the postdoctoral researcher will be required to complete training on the use of SNDS data through a MOOC and an online certification test.

Application deadline: June 30, 2026

Required profile and skills:

- PhD in Computer Science, Data Science, or a related field involving data analysis (Python programming, proficiency with JupyterLab, GitHub, etc.).
- Ability to work independently, collaborate within a team, and a strong interest in applied healthcare research.

- Experience with SNDS data analysis would be an asset.

Location:
The postdoctoral position will be based at LIMOS, in Clermont-Ferrand. The project is funded through the AI4health project, a chair of the MIAI cluster, and is conducted in collaboration between the LIMOS, the Analgesia Fondation located at the CHU of Clermont-Ferrand, and the LISTIC in Annecy. Regular meetings with both partner institutions are planned.

Practical Informations:
- Duration: 24 months (structured as a one-year contract renewable once)
- Desired start date: October 2026
- Salary: 2700 euros gross per month
- Contacts:
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  - LISTIC : Didier Coquin didier.coquin@univ-smb.fr

[1] N. Kerckhove et al. eDOL, a new mHealth application and web platform for the self-monitoring and the medical follow-up of chronic pain patients: feasibility study. Journal of Medical Internet Research, 2022.
[2] A. Soubeiga, V. Antoine, A. Corteval, N. Kerckhove, S. Moreno, I. Falih, J. Phalip. Clustering and Interpretation of time-series trajectories of chronic pain using evidential c-means. Expert System and Applications 260: 125369, 2025.