

Research projects for MSc theses

Implementation of a collaborative workflow tool for biological rhythm analysis

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Area of research

Computational Biology / Bioinformatics / Biostatistics
Biological Rhythm Research

Project summary

The majority of known organisms, from bacteria to plants and animals, show adaptations of gene expression, physiology and behavior to the 24h cycle of light and dark, expressed by cyclic dynamics persisting even in continuous light or darkness. Given the increasing technical ease with which circadian rhythms can be measured, there is growing knowledge about the importance of circadian rhythms, e.g. the sleep-wake cycle, in human health and the development and cure of rhythm-related diseases and behavioral disturbances.

In the recent past, the Systems Biodynamics Group has worked in collaboration with several chronobiological laboratories in Brazil, analyzing time series of behavior and body temperature. This collaboration was implemented in a conventional way, i.e. data and information exchange by email and data storage in local copies of freely formatted spreadsheets. Analyses were performed using the R language for Statistical Computing. This approach has proven to be effective (result could be obtained and published) but with room for improvement of efficiency (more time and energy than necessary was spent).

The objective of the present project is to compose and implement a configurable pipeline for rhythm analysis with open source software tools, improving long-distance, interdisciplinary and collaborative research in chronobiology.

The workplan consists of two principal elements: 1) the creation of a repository of curated R scripts covering a large range of processes rhythm analysis, e.g. spectral analysis, or waveform analysis. 2) the implementation of an analysis pipeline, combining the R scripts created in part 1) in a scientific workflow system, such as, e.g., Kepler or Taverna. The endpoint of this project is the reconstruction of the workflows used in former projects by means of the newly developed computational toolkit. If possible, the developed system will also be tested with newly available data from partners in Brazil.