UCLouvain

lsinc1114

2026

Analysis of biological data

5.00 credits	30.0 h + 30.0 h	Q1

This learning unit is not open to incoming exchange students!

Teacher(s)	Jodogne Sébastien ;
Language :	French
Place of the course	Charleroi
Prerequisites	This teaching unit assumes that the student has skills about the Java programming language (as for instance targeted in courses LSINC1402 and LEPL1402), about linear algebra (as for instance targeted in courses LSINC1112 and LINFO1112), as well as about Web technologies (as for instance targeted in courses LSINC1002 et LINFO1002).
Main themes	This teaching unit proposes an introduction to the spatial and temporal analysis of neurophysiological signals, particularly electroencephalograms (EEG), as well as to the analysis of medical images. It is focused on the development of algorithms that are applicable to such data, as well as on the deployment of these algorithms as Web applications.
Learning outcomes	**At the end of this learning unit, the student is able to :** In consideration of the reference table AA of the program "Bachelor degree in Computer Science", this course contributes to the development, to the acquisition and to the evaluation of the following experiences of learning: • AA1.I3, AA1.I6, AA1.G2, AA1.G3 • AA 2.4 • AA 4.4, AA4.6 • AA5.3 • S1.I6, S1.G3, • S2.4 • S4.4 • S5.5 More specifically, at the end of the course, the student will be able to: • understand the fundamental methods for the preprocessing and filtering of signals and images; • apply techniques for the extraction of information from time series of electroencephalograms, as well as from medical images; • implement algorithms for the processing of 1D and 2D signals in a compiled language (Java); • create Web applications that rely on scientific computations executed on a remote server.

Evaluation methods	• First session:
	  • Written examination (closed-book).
	  • Continuous assessment of the homeworks counting as a bonus.
	  • The final grade is computed as follows: final_grade_over_20 = max(homeworks_over_5 + exam_over_15, exam_over_20).
	• Second session:
	  • Oral on-site examination only (the homeworks are not taken into account anymore).
	Continuous assessment is based on assignments/homeworks, with a single overall mark awarded at the end of the last assignment/homework. Failure to comply with the methodological instructions communicated by the teacher, particularly with regard to the use of online resources or collaboration between students, in an assignment/homework will result in an overall mark of 0 for the continuous assessment.
	In particular, the use of generative AI tools and any collaboration is strictly prohibited during the assignments/homeworks. The distribution or exchange between students of (fragments of) code is not allowed by any means (GitHub, Facebook, Discord...), and this even after the deadline for submission of assignments/homeworks.

Teaching methods	• Lectures in auditorium. • Individual weekly online homework using the INGInious platform. • Question-and-answer sessions with a teaching assistant during the slots reserved for practical sessions.

Content	• Biological data:
	  • Time series for neurophysiological data, notably electroencephalograms (EEG).
	  • Introduction to the acquisition of medical images (radiographs and CT-scans).

	• Introduction to the analysis of 1D and 2D signals:
	  • Time-domain and frequency-domain analysis, and feature extraction.
	  • Fast Fourier Transform (FFT).
	  • Independent component analysis.
	  • Principal component analysis.
	  • Image processing (gray-level mappings, convolution, non-linear filters and morphology).
	  • Image segmentation.
	• Development of scientific applications in client/server mode:
	  • Interoperability standards for EEG and medical imaging (European Data Format, DICOM...).
	  • Data rendering using the HTML5 canvas.
	  • Design of REST APIs using the Java programming language.

Inline resources	Moodle UCLouvain -> https://moodle.uclouvain.be/course/view.php?id=5834
Faculty or entity in charge	SINC

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Additional module in computer science	APPSINF	5		
Additional module in life sciences and health for computer scientists	APPSCVS	5		