UCLouvain

lsinc1114

2022

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 acquired skills about the Java programming language (as for instance targeted in course LSINC1402), about signal processing (as for instance targeted in the first part of course LSINC1113), about linear algebra (as for instance targeted in course LSINC1112), and about the design of interactive Web sites (HTML5, JavaScript and CSS, as for instance targeted in course LSINC1402). *The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
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 :** AA 1.I3, 1.I6, 1.G2, 1.G3 - AA 2.4 - AA 4.4, 4.6 - AA 5.3 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:
	  • Oral examination.
	  • 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 examination only (the homeworks are not taken into account anymore).

Teaching methods	• Lectures in auditorium. • Individual weekly online homework using the INGInious platform. • Remote 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
Bachelor in Computer Science	SINC1BA	5	LSINC1101 AND LSINC1111 AND LSINC1002	