



CAPDA 2025

Clinical and Physiological Data Analysis Course

September 2025

**Centre for Biomedical Cybernetics
University of Malta, Msida, Malta**



**L-Università
ta' Malta**



**Centre
for Biomedical
Cybernetics**

Eligible as a DegreePlus extracurricular activity.

We are excited to announce the 2025 edition of the Clinical and Physiological Data Analysis (CAPDA) course offered by the Centre for Biomedical Cybernetics.

This year's course covers a wide range of topics designed to provide a comprehensive understanding of clinical and physiological data acquisition and analysis, delivered by experts with practical experience in their respective field.

In addition to sessions from previous years on the following themes:

- **Electroencephalography (EEG):** Fundamental theory and practical sessions, by Dr. Natasha Padfield; and hands-on EEGLAB sessions by Dr Stefanie Türk;
- **Human Motion Capture:** Fundamental theory and practical sessions, by Dr. Ing. Carl Azzopardi;
- **Signal Processing:** Fundamentals of data acquisition and data analysis techniques, by Dr. Ing. Nathaniel Barbara;
- **Matlab Programming:** Programming for physiological data analysis, processing, and visualisation, by Dr Ing Nathaniel Barbara;

this year's course will also include a new set of sessions on magnetic resonance imaging (MRI):

- **Magnetic Resonance imaging:** Fundamental theory and practical sessions with MRI equipment, and MRI data analysis sessions, delivered by Dr Claude Bajada.

This course is intended for:

- **Individuals with a clinical background** who are interested in delving further into the details of clinical and physiological signal and image acquisition, even with no prior technical experience.
- **Individuals with a technical background** who are looking to deepen their understanding of data acquisition, analysis and processing in the context of clinical and physiological data both from a theoretical as well as a practical perspective.
- Anyone interested in acquiring fundamental insights into the theoretical and practical aspects of clinical and physiological data analysis.

Applicants are free to mix and match the sessions on offer, according to their interests. Session packages are also offered at favourable rates.

The course is also recognised as a DegreePlus activity if a minimum of 16 hours of course content are attended.

Spaces are limited, and registration is on a first-come, first-served basis. Registration can be carried out online here:

www.um.edu.mt/cbc/forms/capda2025/form

Contact us on cbc@um.edu.mt with any queries.

EEG Fundamentals

Session Description

This theoretical session will cover the fundamental aspects of EEG signal analysis starting with a basic introduction on brain anatomy, physiology and electrical activity, followed by details on the steps involved in a typical EEG signal acquisition and analysis procedure. Signal conditioning, feature extraction techniques, and temporal and spectral characteristics of EEG data will also be explored.

Topics

- Introduction on the brain and brain activity
- Modalities to record brain activity
- EEG electrode placement
- Referencing methods
- EEG spectral characteristics
- EEG temporal characteristics
- Artefacts and artefact removal

Duration

4 hours

Lecturer

Dr Natasha Padfield
Centre for Biomedical Cybernetics

EEG Practical

Session Description

This session consists of hands-on practical EEG recording sessions at the Biomedical Engineering Laboratory at the Faculty of Engineering. Participants will learn how to set up an EEG system and record data from participants. Through this session participants will become familiar with the different types of EEG setups that are nowadays available, as well as the practical considerations that have to be taken into account when recording EEG data.

Topics

- Hardware and software components of an EEG system
- Electrode setup
- Setting EEG system parameters
- Recording EEG data
- Checking quality of recorded signals
- External triggers and markers
- Artefacts in EEG data

Duration

4 hours

Lecturer

Dr Natasha Padfield
Centre for Biomedical Cybernetics

EEGLAB

Session Description

This session is aimed to familiarise participants with the use of EEGLAB, an interactive software tool used for the analysis of EEG data. Participants will become acquainted with widely used EEG components including event-related potentials (ERPs), time-frequency power, and phase coherence, through the analysis and processing of actual EEG datasets. No prior programming or EEG data analysis experience is required.

Topics

- Introduction to EEGLAB
- Importing and plotting EEG data
- Pre-processing EEG data
- Event related potentials (ERPs)
- Independent component analysis (ICA)
- Time-frequency (TF) analysis
- Computing and visualising TF power and inter-trial phase coherence

Duration

5 hours

Lecturer

Dr. Stefanie Türk
Inspire Foundation

MATLAB

Session Description

This session will provide participants with an introduction to MATLAB, a programming software application that is widely used for the analysis and processing of biomedical signals and images. This session consists of hands-on laboratory sessions during which participants will become familiar with the MATLAB environment and will acquire basic MATLAB programming skills for signal processing and data visualisation purposes.

Topics

- Introduction to MATLAB
- Working with vectors, matrices and multidimensional arrays
- Scripts and functions
- Importing and exporting data
- Plotting and visualising data
- Conditional statements
- Basic physiological data analysis
- Statistical tests using MATLAB

Duration

8 hours

Lecturer

Dr Ing. Nathaniel Barbara
Centre for Biomedical Cybernetics

Human Motion Fundamental

Session Description	This session focuses on the comprehensive study of human motion capture systems. Participants will delve into the specifics of optical motion tracking systems, wireless EMGs, and force plates, gaining a robust understanding of the hardware, data processing techniques, and applications of each system in human movement analysis.
Topics	<ul style="list-style-type: none">• Human motion terminology and naming conventions• Motion capture systems• Optical motion tracking systems• System Calibration and data processing• Wireless EMGs in human motion capture• Force plates in human motion capture
Duration	4 hours
Lecturer	Dr Ing. Carl Azzopardi Centre for Biomedical Cybernetics

Human Motion Practical

Session Description	This module will provide participants with hands-on practical experience in a laboratory session. Participants will learn first hand how to calibrate a motion analysis system and how to prepare a subject for analysis. During this practical session, static and dynamic trial capture and the motion capture pipeline will be explored, processed and prepared for visualisation and analysis.
Topics	<ul style="list-style-type: none">• System calibration• Subject labelling• EMG application• Static and Dynamic Trial Capture• Motion Capture Pipeline Processing• Visualisation of Data and Analysis Results
Duration	3 hours
Lecturer	Dr Ing. Carl Azzopardi Centre for Biomedical Cybernetics

MRI Fundamentals

Session Description	<p>This theoretical session aims to build a solid foundation in understanding the principles and applications of Magnetic Resonance Imaging (MRI) in neuroscience. Participants will explore the basics of brain anatomy and function, the science behind Nuclear Magnetic Resonance (NMR), and the techniques involved in generating MRI images. The session will also delve into functional MRI (fMRI) and Diffusion MRI (dMRI), highlighting their unique contributions to brain research.</p>
Topics	<ul style="list-style-type: none">• Brain anatomy and function• Basic principles of Nuclear Magnetic Resonance (NMR)• Contrast mechanisms and image resolution• Image reconstruction• Functional MRI (fMRI)• Diffusion MRI (dMRI)
Duration	3 hours
Lecturer	Dr Claude Bajada Faculty of Medicine and Surgery

MRI Practical

Session Description	<p>This practical session offers a hands-on experience in an MRI facility, designed to complement the theoretical knowledge gained in the MRI Fundamentals module. Students will tour the MRI facility, observe the scanning process, and see real-time applications of the concepts discussed in the theoretical section. This immersive experience aims to bridge the gap between theory and practice, providing a comprehensive understanding of MRI technology and its applications in brain imaging.</p>
Topics	<ul style="list-style-type: none">• MRI facility tour• Equipment and setup overview• Safety protocols and procedures• Recap of key ideas from the theoretical module• Observation of scanning process
Duration	2 hours
Lecturer	Dr Claude Bajada Faculty of Medicine and Surgery

MRI Data Analysis

Session Description

This analysis session is designed to equip students with practical skills in handling and analysing MRI data. In this session, students will work with a real dataset, learning the essential steps of data management, pre-processing, and analysis.

This hands-on experience will provide students with a solid foundation in data analysis techniques, preparing them to conduct their own research using MRI data.

Topics

- Introduction to the MRI Dataset
- Overview of the provided MRI dataset
- Loading and organising MRI data
- Data Pre-processing
- Data Analysis

Duration

4 hours

Lecturer

Dr Claude Bajada
Faculty of Medicine and Surgery

Signal Processing

Session Description

This session will introduce participants to fundamental signal processing concepts that are of relevance for physiological signal analysis. The steps involved in the analogue-to-digital conversion of physiological signals, together with the fundamental technical aspects that have to be considered when analysing signals in the time and frequency domain, will be covered.

An overview of more advanced signal analysis techniques is also included.

Topics

- Analogue to digital conversion
- Analogue signal filtering
- Digital signal filtering
- Temporal analysis
- Spectral analysis
- Interaction measures
- Classification methods

Duration

7 hours

Lecturer

Dr Ing. Nathaniel Barbara
Centre for Biomedical Cybernetics

Programme

	Mon 1 st Sept	Tue 2 nd Sept	Wed 3 rd Sept	Thu 4 th Sept	Fri 5 th Sept	Sat 6 th Sept
09:30 – 11:30 (2 hrs)	EEG Fund. I (EBCL)	EEG Fund. II (EBCL)	MATLAB I (EBCL)	Human Motion Fund. I (EBCL)	Human Motion Fund. II (EBCL)	MRI practicals (MRI3) <i>multiple 2hr sessions with small groups</i>
11:30 – 13:00						
13:00 – 16:00 (3 hrs)	MRI Theory (EBCL)	Sig. Proc. I (EBCL)		MATLAB II (EBCL)	EEG Prac. (BE Lab)	

	Mon 8 th Sept	Tue 9 th Sept	Wed 10 th Sept	Thu 11 th Sept	Fri 12 th Sept
09:30 – 11:30 (2 hrs)	EEGLAB I (EBCL)	MRI Data Analysis I (EBCL)	MRI Data Analysis II (EBCL)	Sig. Proc. II (EBCL)	Sig. Proc. III (EBCL)
11:30 – 13:00					
13:00 – 16:00 (3 hrs)	EEGLAB II (EBCL)	Human Motion Prac. (BE Lab)	MATLAB III (EBCL)		

EBCL
Computer Lab,
Engineering Building,
UM

BE Lab
Biomedical
Engineering Lab,
Engineering Building,
UM

MRI3
MRI 3, Level -1,
Mater Dei Hospital

Online registration: www.um.edu.mt/cbc/forms/capda2025/form/

Session	Hrs	Fee
EEG Fundamentals	<i>4 hrs</i>	€60
EEG Practical	<i>3 hrs</i>	€75
EEGLAB	<i>5 hrs</i>	€75
Human Motion Fundamentals	<i>4 hrs</i>	€60
Human Motion Practical	<i>3 hrs</i>	€75
MRI Fundamentals	<i>3 hrs</i>	€45
MRI Practical	<i>2 hrs</i>	€50
MRI Data Analysis	<i>4 hrs</i>	€60
Signal Processing	<i>7 hrs</i>	€105
MATLAB	<i>8 hrs</i>	€120

Package	Fee
<p>EEG Package <i>EEG Fundamentals, EEG Practical, EEGLAB, Signal Processing, and MATLAB sessions. 27 hrs - recognised DegreePlus activity.</i></p>	€400
<p>Human Motion Package <i>Human Motion Fundamentals, Human Motion Practical, Signal Processing, and MATLAB sessions. 22 hrs - recognized DegreePlus activity.</i></p>	€320
<p>MRI Package <i>MRI Fundamentals, MRI Practical, MRI Data Analysis modules, Signal Processing, and MATLAB sessions. 23 hrs - recognised DegreePlus activity.</i></p>	€340
<p>Complete Package <i>All modules. 43 hrs - recognised DegreePlus activity.</i></p>	€650

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