GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Brain-Computer Interfaces, PG_00064472		
Field of study	Mechanical Engineering		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2023/2024
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	English
Semester of study	3	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Kropiwnicki	
	Teachers	prof. Alexandru Ianosi	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	0.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	0.0	0.0	30

Subject objectives

The lecture introduces the basics of neurology, signal processing, machine learning and EEG measurements and experiments as part of the creation and use of brain-computer interfaces.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W11] possesses organized knowledge useful in understanding ex-technical conditioning connected with performing the profession of an engineer and taking it into consideration in engineering practice; possesses well-established knowledge within the range of intellectual property, management and organization of manufacturing processes, including the management and life-cycle of a product	The student explains the functional, economic and social limitations and conditions for the use of solutions related to brain-computer interfaces in technology.	[SW2] Assessment of knowledge contained in presentation
[K7_K82] is equipped to participate actively in lectures, seminars and laboratory classes conducted in foreign language	The student understands the need for self-education and improvement, including in the area of new technologies and interdisciplinary applications of technology	[SK2] Assessment of progress of work
[K7_U02] is able to communicate in English in professional matters within the area of technical science and, particularly, of construction and operation of machines	The student is able to communicate in English in professional matters in the area of brain – computer interfaces.	[SU1] Assessment of task fulfilment

Subject contents

Basic neuroscience; Underlying brain structures; Functions of nervous tissue; Anatomy of the brain; Electrode placement; Signal conditioning; Signal processing; Fourier transform; Wavelet transform; Hjorth parameters; Principal component analysis; Independent component analysis; Common spatial patterns; Basic machine learning techniques; Types of BCIs; Invasive and Semi-invasive BCI; Sensory Restoration.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Preparation of the study and presentation	50.0%	100.0%

Recommended reading	Basic literature	- Cohen, M. X. (2014). Analyzing neural time series data: Theory and practice. The MIT Press. - Geron, A. (2019). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems. O'Reilly Media - Wolpaw, J.R & Wolpaw, E.W. (Eds.) (2012). Brain Computer Interfaces Principles and Practice. Oxford University Press
	Supplementary literature	- Bear, M. F., Connors, B. W., & Paradiso, M. A. (2016). Neuroscience: Exploring the brain (4th edition). Wolters Kluwer.
	eResources addresses	Adresy na platformie eNauczanie: Brain-Computer Interfaces, W, MiBM II st., sem. 03, letni 23/24 (PG_00064472) - Moodle ID: 38847 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=38847
Example issues/ example questions/ tasks being completed	- Describe succinctly the principles behind a motor-imagery based BCI paradigm. - Explain 2 methods for assesing the performance of a BCI system. - Which area of the brain is the EEG signal sampled from for a steady-state VEP BCI paradigm? - What is the P300 wave and why is it significant for building a BCI? - Enumerate and briefly explain 3 challenges for designing a BCI system.	
Work placement	Not applicable	