Brain Computer Interface and Artificial Intelligence

Department: Fudan International Summer Session 2022

Course Code			
Course Title	Brain Computer Interface and Artificial Intelligence		
Credit	2	**Credit Hours**	36 credit hours + 3 tutorial hours (one credit hour is 45 minutes)
Couse Nature	□Specific General Education Courses □Core Courses ☑General Education Elective Courses □Basic Courses in General Discipline □Professional Compulsory Courses □Professional Elective Courses □Others		
Course Objectives	Master the principle, type and usage of BCI, understand the role of BCI in the basic model and algorithm of artificial intelligence application, and understand the application scenarios of BCI and its integration and application with intelligent robot, artificial intelligence, brain science, etc. Combined with classroom discussion and experimental courses, students can experience the process of brain computer interface acquiring EEG signals, and deepen their understanding of brain computer interface software and hardware.		
Course Description	The use of brain computer interface (BCI) enables users to use only human brain activities when interacting with computers and machines. This course starts with various BCI applications, including four parts: introduction to BCI (Part A), therapeutic application (Part B), emotional and artistic application (Part C), and BCI control entertainment and multimedia application (Part D). This course can supply you with a contemporary presentation of fundamentals, theories, and diverse applications of BCI, creating a valuable resource for anyone involved with the improvement of people's lives by replacing, restoring, improving, supplementing or enhancing natural output from the central nervous system. It is a useful guide for students interested in understanding how neural bases for cognitive and sensory functions, such as seeing, hearing, and remembering, relate to real-world technologies. It overviews the different methods and techniques used in acquiring and pre-processing brain signals, extracting features, and classifying users' mental states and intentions.		

Course Requirements:

Prerequisites:

Basic knowledge of computer, electronics, and biomedical engineering

Teaching Methods:

(e.g. Lectures, group discussion, etc.)

Lectures and group discussion

Instructor's Academic Background:

Xiaoyang Kang, associate professor. He received the bachelor's degree from Xidian University in 2010 and the doctor degree from Shanghai JiaoTong University in 2016. From 2016 to 2018, he conducted the postdoctoral research at the EPFL in Lausanne, Switzerland. He joined Fudan University in October 2018. A total of 27 journal and conference papers have been published, and 16 national invention patents have been authorized. He is mainly engaged in biomedical microelectronic devices and systems, neural

engineering and brain computer interaction.

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Course Schedule:

No.	Week	Content & Expected Achievement
1	1	Brain–Computer Interface An Emerging Interaction Technology
2	1	Facilitating the Integration of Modern Neuroscience into Noninvasive BCIs
3	1	Passive Brain–Computer Interfaces A Perspective on Increased Interactivity
4	1	Brain–Computer Interfaces for Motor Rehabilitation, Assessment of Consciousness, and Communication
5	2	Therapeutic Applications of BCI Technologies
6	2	Neuroprosthetics Past, Present, and Future
7	2	Design and Customization of SSVEP-Based BCI Applications Aimed for Elderly People
8	2	Affective Brain–Computer Interfacing and Methods for Affective State Detection
9	3	Toward Practical BCI Solutions for Entertainment and Art Performance
10	3	BCI for Music Making Then, Now, and Next
11	3	BCI and Games: Playful, Experience-Oriented Learning by Vivid Feedback?
12	3	Brain–Computer Interfaces for Mediating Interaction in Virtual and Augmented Reality

The design of class discussion or exercise, practice, experience and so on:

EEG data recording and EEGLAB analysis.

Grading & Evaluation:

Assessment Criteria	Percentage	Assessment Standard
Attendance	20	Attendance check in
Participation	20	Class discussion, responsible for content explanation
Assignment(s)	20	Experimental summary

	Course Paper	40	Paper integrity	

Teaching Materials & References:

No.	Title	Author(s)	ISBN	Publisher	Publication Date
1	Brain-Computer Interfaces Handbook_ Technological and Theoretical Advances	Nam, Chang S.	9781498773430	Taylor & Francis, CRC Press	2018.05
2	Application of Biomedical Engineering in Neuroscience	Sudip Paul	9789811371417	Springer Singapore	2019.10
3	Wiley Encyclopedia of Biomedical Engineering	Metin Akay	9780471249672	John Wiley & Sons, Inc.	2006.04