International Polytechnic SUMMER & WINTER SCHOOLS

POLYTECH Peter the Great St.Petersburg Polytechnic University

Medicine and Machine Learning

Version **Effective from (date of when the course was developed)**	01/01/25

Course Credits given	4 ECTS
Level/Year	Bachelor, Master and PhD students
Teaching hours	40
Workplace learning hours	60
Total learner managed hours	50
Total hours of student learning	100

Pre-requisites	The course is open for Bachelor, Master and PhD students with the background in Information Technology and Computer Science, Mathematical Science or equivalent skills and knowledge.
Alignment to graduate profiles	Bachelor (Undergraduate diploma) of Information Technology Specialist Diploma in Information Technology Master (Graduate diploma) in Information Technology
Course aim	This course is for students with the knowledge and skills to analyse medical data using Machine Learning. By the end of the course, students will be able to apply ML techniques to practical problems in medical data analysis, with examples on ECG and Parkinson's disease data.
Indicative Course content	• Introduction to Medical Data and Machine Learning in Healthcare • Overview of Neural Networks and Convolutional Neural Networks • Theory and Applications of EMG Data in Medical Analysis • Introduction to Heart Anatomy, Heart Diseases, and ECG Data • Practical Applications of ECG Data Analysis with Python • Brain Anatomy, Neurological Diseases, and EEG Data Analysis • EEG Data Processing and Machine Learning Applications • Understanding Parkinson’ s Disease and Its Data Challenges • Machine Learning Techniques for Analysing Parkinson’ s Disease

	Data • Practical Applications of Convolutional Neural Networks in Medical Data • Workflow for Medical Data Analysis with Python • Ethical Considerations in Medical Data and Machine Learning

LEARNING OUTCOMES

On successful completion of this course students will be able to:	
1	Analyse and process medical data using Machine Learning techniques.
2	Apply Machine Learning algorithms to real-world datasets such as EMG, ECG, EEG, and Parkinson’ s disease data.
3	Develop and implement Python-based solutions for medical data analysis.
4	Understand and utilize neural networks, including CNNs, for medical data applications.

ASSESSMENTS

Basis of assessment	Achievement based assessment Final project: Real-World application Daily Quizzes

Methods of assessment	Learning Outcomes	Pass criteria (Minimum)	% Weightings
Final project	2,3	Error >85%	50%
Daily Quizzes	1,4	0.7	50%

REQUIREMENTS FOR SUCCESSFUL COURSE COMPLETION

Requirements	Mark of 70% or more in every summative assessment Gain a course result of C (50%) or higher

RESULTS

Assessment results	Results for assessments are given in percentage marks
Course results	Jupyter notebook with final project & teachers review, theoretical materials, in-class practical applications.

LEARNING AND TEACHING

Learning and	Learning process based on combining of 4 main types of materials:

teaching approaches	• Theoretical lectures (Intuitions, ideas and algorithms description) • Workshops (review of realization of described concepts and practical tasks) • Self education (Learning of an extra academic materials, given by lecturers) + Squeezes for self-control • Final project (Based on learned materials and gained skills) Learning process is based on presenting the materials by teachers, discussing the materials and answering to students questions
Learning and teaching resources	Manuals, academic journals; use of Internet; software; platforms; individual consultations with lecturers
Learner managed activities	• Completion of course work, set assignments/projects • Reading of course materials • Homework • Discussions with colleagues/subject matter experts • Review application of information to course work • Practicing relevant practical and technical skills/methods/techniques • Self-evaluation of course work • Gathering relevant contextual information/ issues/ideas to build knowledge of the subject