INTRODUCTION TO MACHINE AUDITION

Faculty of Computer Science				
Study programme:	**Computer Science**		Degree level:	**Engineer's degree full-time programme**
Specialization	**---**		Diploma path:	**2026/2027W - 2026/2027S**
Module name:	**Introduction to Machine Audition** (Introduction to Machine Audition)			
Module type:	**obligatory**	**Semester: 1**	ECTS:**4**	Module ID:**FCS-00099**
No. of hrs in semester:	Lecture (L) - **15** Classes(C) - **0** Specialization workshop (SW) - **45** Project (P) - **0** Laboratory classes (LC) - **0** Seminar (S) - **0**			
Prerequisites	-			

Aims and objectives:	To introduce students to modern machine audition methods. Upon completion of this module students should be able to characterize selected methods and to implement them using high-level programming environments such as MATLAB or Python.		
Forms of teching activities::	lecture, specialization workshop,	Assessment:	Evaluation must be relevant to the intended learning outcomes:
		Lecture: a test; Specialization workshop: a written report and oral defense of the computer-based projects	
Module content:	Lectures 1. Machine audition – Key concepts and topic overview 2. Speech and speaker recognition 3. Music information retrieval: music genre recognition, harmony, rhythm, and timbre characterization; pitch detection 4. Automatic audio classification 5. Computational audio scene analysis, blind audio signals separation 6. Auditory cognition, emotions recognition 7. Automatic audio event localization Specialization workshop 1. Implementation of algorithms for conditioning and pre-processing of speech and audio signals 2. Implementation of an algorithm for audio feature extraction 3. Implementation of a selected algorithm from the domain of speech recognition, audio classification, music information retrieval, or emotions recognition 4. Implementation of a simple real-time audio analysis method		
Teaching methods:	project method, demonstration, programming, informative lecture,		

Learning outcomes

Symbol	Specify min. 4, max. 8 learning outcomes in the following order: knowledge – skills – competence. Each learning outcome must be verifiable	Reference to the programme learning outcomes of education
E1	will be able to enumerate, characterize and compare the fundamental methods used in machine audition	
E2	will be familiar with modern trends in machine audition. They will know the capabilities and limitations of the state-of-the art algorithms.	
E3	will acquire fundamental skills in audio signal conditioning, processing and analysis.	
E4	will be able to implement audio feature extraction algorithms.	
E5	will be able to implement selected machine audition algorithms using high-level programming environments (e.g. MATLAB, Python).	
E6	will be able to implement simple real-time machine audition algorithms.	

No. of learning outcome	Methods of assessing the learning outcome	Type of teaching activities (if more than one) during which the outcome is assessed
E1	Test	L
E2	Test	L
E3	Written reports and oral defense of the computer-based projects	Sw
E4	Written reports and oral defense of the computer-based projects	Sw
E5	Written reports and oral defense of the computer-based projects	Sw
E6	Written reports and oral defense of the computer-based projects	Sw

Student's workload (in hours)	**1** - Lecture attendance	15 x 1	15
	2 - Specialization workshops	15 x 3	45
	3 - Preparation for specialization workshops	None	10
	4 - Writing project reports	None	10
	5 - Self-study and preparations for the test		15
	6 - Tutorials		5
		TOTAL:	**100**

Quantitative indicators	Student's workload - activities that require direct teacher participation: (1)+(2)+(6)	65	**ECTS**
			2.6
	Student's workload connected with practical classes (2)+(4)+(5)+(3)	80	3.2

Basic references:	

	1. V. Pulkki, M. Karjalainen, Communication Acoustics : An Introduction to Speech, Audio and Psychoacoustics, John Wiley & Sons, 2015. 2. T. Giannakopoulos, A. Pikrakis, Introduction to Audio Analysis: A MATLAB Approach. Elsevier, 2014.		
Further reading	1. Z. Raś and A. Wieczorkowska, Advances in Music Information Retrieval. Studies in Computational Intelligence, Springer-Verlag, Berlin, 2010. 2. A. Bregman, Auditory Scene Analysis. Cambridge: MIT Press, 1990.		
Unit:	Department of Digital Media and Computer Graphics	Lecturer/ instructor	
Date of issuing the programme:	31st March 2026	Author of the programme:	dr hab. inż. Sławomir Zieliński

L - lecture, C - classes, LC - laboratory classes, P-project, SW - specialization workshop, S - seminar