FACULTY OF PURE AND APPLIED MATHEMATICS

SUBJECT CARD

Name of subject in Polish: Wprowadzenie do teorii oszczędnego próbkowania
Name of subject in English: Introduction to compressed sensing
Main field of study (if applicable): Applied Mathematics
Specialization (if applicable): Data engineering
Profile: academic / practical*
Level and form of studies: 2nd level / full-time /
Kind of subject: optional
Subject code
Group of courses YES

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	crediting with grade				
For group of courses mark (X) final course	X				
Number of ECTS points	3		2		
including number of ECTS points for practical classes (P)	2		2		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	1,5		1,5		

*delete as not necessary

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student knows basic facts of linear algebra and optimization.
2. Knows MATLAB package for numerical computing.

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SUBJECT OBJECTIVES

C1 Study of theory and basic concepts of compressed sensing.
C2 Study of numerical algorithms for signal recovery used in compressed sensing.
C3 Study of fundamental applications of compressed sensing.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
PEU_W01 knows fundamental theoretical results in compressed sensing
PEU_W02 knows basic algorithms for sparse recovery
PEU_W03 knows classical applications of compressed sensing

relating to skills:
PEU_U01 understand the main idea of compressed sensing
PEU_U02 be able to apply numerical methods for sparse recovery

PEU_U03 be able to demonstrate examples of compressed sensing applications

relating to social competences:
PEU_K01 can, without assistance, search for necessary information in the literature
PEU_K02 understands the need for systematic work on course material

PROGRAMME CONTENT		
Lecture		**Number of hours**
Lec 1	Introduction to compressed sensing. History, motivations and overview of applications.	2
Lec 2	Review of vector spaces.	2
Lec 3	Sparse solutions of undetermined systems.	4
Lec 4	Null space property.	2
Lec 5	Restricted isometry property.	4
Lec 6	Signal recovery by l_1 minimization.	8
Lec 7	Signal recovery algorithms.	4
Lec 8	Examples of applications for one- and two-dimensional data	4
	Total hours	**30**

Laboratory		**Number of hours**
Lab 1	Solving selected problems illustrating theory given in the lectures analytically or using MATLAB package for numerical computing	30
	Total hours	**30**

TEACHING TOOLS USED
N1. Lecture – traditional method supported by multimedia presentation N2. Computer laboratory – solving problems analytically, working on a computer using MATLAB package for numerical computations N3. Consultations N4. Student's self work – preparation for the laboratory

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	activity on the laboratory, oral presentation of results

	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02	
F2	PEK_W01, PEK_U01, PEK_K01, PEK_K02	test
P==0.5*F1+0.5*F2		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE:
[1] Ch. Hegde, R. Baraniuk, M. A. Davenport, M. F. Duarte , "An Introduction to Compressive Sensing", 2011. [2] H. Boche, R. Calderbank, G. Kutyniok, J. Vybíral, "Compressed Sensing and its Applications", Birkhaeuser, 2013.
SECONDARY LITERATURE:
[1] J. A. Tropp, S. J. Wright, "Computational Methods for Sparse Solution of Linear Inverse Problems", Proc. IEEE, Vol. 98 No. 5, 2010. [2] O. Scherzer (Editor) „Handbook of Mathematical Methods in Imaging", Springer-Verlag, 2010.
SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
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