

DESCRIPTION/Syllabi of Curricula/Module

Short Name of the University/Country code Date (Month / Year)	DSEA/P11 Sept 2020
TITLE OF THE MODULE	Code
Methods of image processing and computer vision	2.2.7

Teacher(s)	Department
Coordinating: Liudmyla Vasylieva, PhD Others: Lina Bohadanova, PhD	Department of Computer and Information Technology (CIT)

Study cycle (BA/MA)	Level of the module (Semester number)	Type of the module (compulsary/elective)
MA	2st semester (first year) for Masters	Elective

Form of delivery (theory/lab/exercises)	Duration (weeks/months)	Language(s)
Lectures, exercises	18 weeks	Ukrainian / English

Prerequisites	
Prerequisites: study of the cycle of bachelor's degree disciplines in the specialty 122 "Computer Science"	Co-requisites (if necessary):

ECTS (Credits of the module)	Total student workload hours	Contact hours	Individual work hours
5,5	165	72	93
Aim of the module (course unit): competences foreseen by the study programme			
The goal of the discipline is the formation of cognitive, affective, and psychomotor competencies in the field of image processing and computer vision. Students should be able: - to provide the analysis of large data arrays, based on the information and data logical models, by using neural network technologies to solve data processing problems in subject areas. - to provide extraction of models from data and support of engineering activities, including through data processing, by applying methods and algorithms of deep learning, including using machine learning methods to solve classification and forecasting problems.			
Learning outcomes of module (course unit)	Teaching/learning methods (theory, lab, exercises)	Assessment methods (written exam, oral exam, reports)	
Knowledge: - advanced conceptual and methodological knowledge in the specialty 122 "Computer Science" and related specialties related to the receipt, transmission, and processing of information for various purposes, in technical, organizational, technical, and medical systems; - the ability to develop and research mathematical methods, models, and algorithms for data processing, apply mathematical methods to justify, optimize and make managerial and technical decisions adequate to the conditions in which informatization objects operate in various subject areas (technical, organizational, and technical, medical purposes, and etc.).	Working with lecture notes and basic literature on relevant topics	Knowledge test	
Skills: - possession of the skills of using a systematic approach, as a modern general scientific methodology for the integrated study of large and complex objects (systems) in the analysis, modeling, preparation, and conduct of an experiment, taking into account the peculiarities of systems of technical,	Lectures, practical training, consultations	Active attendance of lectures, individual project and presentation	

organizational, technical, medical purposes, etc. ; - the ability to plan, design and carry out scientific research at the stage of conceptual formulation of the problem before critical assessment and consideration of the results and data obtained, including the ability to select or develop the necessary equipment, software, modern programming technologies, and research methods on systems of technical, organizational, technical, medical appointments and the like. - possession of skills in analysis, the use of mathematical methods for statistical processing, verification of the adequacy and interpretation of data obtained as a result of the study, including using artificial intelligence methods, and linking them with the relevant theory in the subject areas of technical, organizational, technical, medical appointments and the like.		
Competences: study subject literature, share knowledge, work in groups	Lectures, practical training, consultations	Individual project and presentation

Themes	Contact work hours							Time and tasks for individual work	
	Lectures	Consultations	Seminars	Practical work	Laboratory work	Placements	Total contact work	Individual work	Tasks
1. Digital image processing (including biomedical). Packed matrix images. 24-bit binary RGB pixel representation. HLS and HSV color models. Addition and measurement of noise. Binary conversion and quantization.	6			6			12	15	Study exam/ complete design of practical work

1D histograms. Threshold processing. Inversion.									
2. Digital image processing (including biomedical). Geometric transformations of images. Functions of morphological processing.	6			6			12	15	Study exam/ complete design of practical work
3. Digital image processing (including biomedical). Image edge detection. Segmentation.	6			6			12	16	Study exam/ complete design of practical work
4. General characteristics of image recognition methods in computer vision systems.	4			2			6	10	Study exam/ complete design of practical work
5. K-means method, and mean-shift method for object recognition	4			2			6	10	Study exam/ complete design of practical work
6. Methods of tracking objects	4			2			6	10	Study exam/ complete design of practical work
7. The use of convolutional neural networks to detect objects and highlight features	6			12			18	17	Study exam/ complete design of practical work
Total	36			36			72	93	

Assessment strategy	Weight in %	Deadlines	Assessment criteria
Written theory exam	40%	during the semester / exam	good response to questions
Practical exam on a computer	60%	during the semester / exam	the work is done completely without mistakes or minor errors

Author	Year of issue	Title	No of periodical or volume	Place of printing. Printing house or internet link
Compulsory literature				
Rafael C. Gonzalez, Richard E. Woods	2017	Digital Image Processing (4th Edition)		ISBN: 0133356728
Jeff Schewe	2015	The Digital Negative: Raw Image Processing in Lightroom, Camera Raw, and Photoshop (2nd Edition)		ISBN: 0134033175
Mark Nixon	2012	Feature Extraction and Image Processing for Computer Vision, Third Edition		ISBN: 0123965497
Maria Petrou, Costas Petrou	2010	Image Processing: The Fundamentals		ISBN: 047074586X
Wilhelm Burger, Mark J. Burge	2009	Principles of Digital Image Processing: Core Algorithms (Undergraduate Topics in Computer Science)		ISBN: 1848001940
Prateek Joshi	2019	Artificial Intelligence with Python		ISBN: 978-5-907114-41-8
Forsyth D.A., Ponce J.	2012	Computer Vision: A Modern Approach		ISBN: 013608592X 9780136085928 9780132848640
Linda G. Shapiro, George Stockman	2001	Computer Vision		ISBN: 978-0-13-030796-5
Haykin S.	1999	Neural Networks and Learning Machines.		ISBN-13: 978-0-13-147139-9 ISBN-10: 0-13-147139-2
Additional literature				
Ravishankar Chityala, Sridevi Pudipeddi	2014	Image Processing and Acquisition using Python (Chapman & Hall/CRC Mathematical and		ISBN: 1466583754

		Computational Imaging Sciences Series)		
John R. Jensen	2015	Principles of Digital Image Processing: Fundamental Techniques (Undergraduate Topics in Computer Science)		ISBN: 013405816X
Julien Danjou	2018	Serious Python Black-Belt Advice on Deployment, Scalability, Testing, and More		ISBN 978-1-59327-878-6
Simon J. D. Prince	2012	Computer Vision: Models, Learning, and Inference		ISBN 978-1-107-01179-3