SYLLABUS

1. Data about the program of study

1.1 Institution	The Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Computer Science
1.4 Field of study	Computer Science and Information Technology
1.5 Cycle of study	Master of Science
1.6 Program of study / Qualification	Data Science / Master
1.7 Form of education	Full time
1.8 Subject code	11.00

2. Data about the subject

2.1 Subject name				***Image Processing and Computer Vision***		
2.2 Course responsible / lecturer				Prof. dr. eng. Oniga Florin		
2.3 Teachers in charge of laboratories				Lect. dr. eng. Mureşan Mircea-Paul		
2.4 Year of study	I	2.5 Semester	2	2.6 Assessment	E–exam, C–colloq., V-verif.	E
2.7 Subject category	Formative category: DA – advanced, DS – speciality, DC – complementary					DS
	Optionality: DI – imposed, DO – optional (alternative), DF – optional (free choice)					DI

3. Estimated total time

3.1 Number of hours per week	3	of which:	Course	2	Seminar	1	Laboratory	-	Project	-
3.4 Total hours in the curriculum	42	of which:	Course	28	Seminar	14	Laboratory	-	Project	-
3.7 Individual study:										
(a) Manual, lecture material and notes, bibliography										23
(b) Supplementary study in the library, online and in the field										23
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										10
(d) Tutoring										-
(e) Exams and tests										2
(f) Other activities										-

3.8 Total hours of individual study (sum (3.7(a)…3.7(f)))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	-
4.2 Competence	Mathematical methods and models that can be applied in image processing.

5. Requirements (where appropriate)

5.1 For the course	Video projector, blackboard, screen, computer
5.2 For the seminar / laboratory / project	Computers, equipment and specific software

6. Specific competences

6.1 Professional competences	**C1 -** Working with advanced mathematical methods and models, engineering and computing specific techniques and technologies **C3 –** Innovative design of artificial intelligence and computer vision systems and related software and hardware using the specific tools.

	C5 - Creative pooling of multidisciplinary knowledge in the field of computers and information technology for research, design, optimization, implementation and testing of theories, algorithms and original methods specific to artificial intelligence and computer vision systems.
6.2 Cross competences	**N/A**

7. Discipline objectives (as results from the *key competences gained*)

7.1 General objective	Development of skills and abilities for the design of image processing and computer vision systems in the context of data science
7.2 Specific objectives	Assimilation of knowledge and skills in the context of data science regarding: - Understanding and using concepts, paradigms, and models of image processing and computer vision. - Studying, designing, implementing, and evaluating modules of applications for image processing and computer vision. - Image processing and computer vision methods.

8. Contents

8.1 Lectures	Hours	Teaching methods	Notes
Introduction	2	Interactive presentation, student involvement in presentations and debates, ad-hoc quizzes.	
Machine Learning Basics	2		
Deep Learning Basics	2		
Computer vision – Deep Learning	2		
Image Classification	2		
Object Detection 1	2		
Object Detection 2	2		
Semantic Segmentation	2		
Instance Segmentation	2		
Vision Transformer	2		
Image Generation	2		
Visualization & Understanding	2		
Student presentation – individual activities 1	2		
Student presentation – individual activities 2	2		

Bibliography:

1. CS231n: Convolutional Neural Networks for Visual Recognition, http://cs231n.stanford.edu/
2. CS 198-126: Modern Computer Vision Fall 2022 (UC Berkeley)
3. David Forsyth, Jean Ponce „Computer Vision A Modern Approach", Prentice Hall, USA, 2002
4. Gonzalez, R. C., & Woods, R. E. (2007). Digital Image Processing (3rd ed.). Pearson.
5. Szeliski, R. (2010). Computer Vision: Algorithms and Applications. Springer.
6. IEEE Transactions on Pattern Analyses and Machine Intelligence
7. IEEE Transactions on Image Processing
8. CVPR, ECCV and ICCV papers

8.2 Applications - Seminars / Laboratory / Project	Hours	Teaching methods	Notes
Advanced Image Preprocessing Techniques for Detection and Segmentation	2	Experiments and implementation using specific software tools (Python, Pytorch, Anaconda, Jupyter Notebook)	
Feature Extraction, Object Detection and Classification using Advanced Engineering Approaches	2		
Object Detection and Classification using Data Driven Approaches	2		
Semantic Segmentation Models	2		
Multi-Task Networks	2		
Image synthesis using Diffusion Models	2		

Image Annotation	2		

Bibliography:

1. Dey, S. (2017). Python Image Processing Cookbook. Packt Publishing.
9. Scientific papers IEEE Transactions on Pattern Analyses and Machine Intelligence, IEEE Transactions on Image Processing, CVPR, ECCV and ICCV papers etc.

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

It is carried out through periodic meetings with representatives of the economic environment

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Exam	Written examination. Additional bonus points for activity during lectures and individual (optional) presentations	50%
Applications (Seminars /**Laboratory**/Project)	Testing the practical abilities of designing and implementing solutions to specific problems. Attendance and activity.	Lab assessment (continuous evaluation of activity, written and oral verification), optional individual activity assessment.	50%
Minimum standard of performance: Both, Written examination and Lab examination, marks are bigger or equal to 5			

Date of filling in: 26.02.2025	**Responsible**	**Title, First name Last name**	**Signature**
	Course	Prof.dr.eng. Florin ONIGA	
	Applications	Lecturer.dr.eng. Mircea-Paul MUREȘAN	

Date of approval in the department 17.09.2025	Head of department, Prof.dr.eng. Rodica Potolea
Date of approval in the faculty council 19.09.2025	Dean, Prof.dr.eng. Vlad Mureșan