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	16.20

2. Data about the subject

2.1 Subject name				**Advanced in Computer Vision**		
2.2 Course responsible/lecturer				Prof. dr. eng. Sergiu Nedevschi - Sergiu.Nedevschi@cs.utcluj.ro		
2.3 Teachers in charge of seminars				Prof. dr. eng. Sergiu Nedevschi - Sergiu.Nedevschi@cs.utcluj.ro		
2.4 Year of study	II	2.5 Semester	1	2.6 Assessment	E–exam, C–colloq., V-verif.	E
2.7 Subject category	Formative category: DD–**d**eepening, SD–**s**ynthesis, CD–**c**omplementary					SD
	Optionality: MD-**m**andatory, ED-**e**lective, OD-**o**ptional					OD

3. Estimated total time

3.1 Number of hours per week	3	of which	Course	2	Seminar	1	Laboratory	-	Project	-
3.2 Total hours in the curriculum	42	of which	Course	28	Seminar	14	Laboratory	-	Project	-
3.3 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										-

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

4. Pre-requisites (where appropriate)

4.1 Curriculum	Image processing and computer vision
4.2 Competence	Operation with mathematical methods and models, techniques and technologies specific to the field of image processing

5. Requirements (where appropriate)

5.1 For the course	Blackboard, video projector, 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	The development of skills and abilities for the development of artificial vision systems in the field of intelligence and artificial vision, computers and information technology
7.2 Specific objectives	Assimilation of knowledge and skills regarding: - understanding and using artificial vision concepts, paradigms and models - the nuanced understanding and use of artificial vision algorithms - studying, designing, implementing and evaluating artificial vision application modules - image processing and pattern recognition methods

8. Contents

8.1. Lecture (syllabus)	Hours	Teaching methods	Notes
Introduction	2	Systematic exposure, student involvement in presentations and debates.	
Image Classification	2		
Neural Networks and Backpropagation	2		
Convolutional Neural Networks	2		
Training Neural Networks	2		
Convolutional Neural Networks Architecture	2		
Detection and Segmentation	2		
Introduction in Projective Geometry	2		
Stereo Vision	2		
Structure from motion and epipolar geometry	2		
Multiple View Geometry	2		
Similarity Measures and Point-feature Extraction	2		
Optical Flow	2		
Detection and Segmentation in the 3D Space	2		

Bibliography:

1. Convolutional Neural Networks for Visual Recognition, http://cs231n.stanford.edu/
2. David Forsyth, Jean Ponce „Computer Vision A Modern Approach", Prentice Hall, USA, 2002
3. IEEE Transactions on Pattern Analyses and Machine Intelligence
4. IEEE Transactions on Image Processing
5. IEEE Transactions on Intelligent Transportation Systems
6. CVPR, ECCV and ICCV papers

8.2 Applications - Seminars / Laboratory / Project	Hours	Teaching methods	Notes
Machine Learning Topics-1	2		
Machine Learning Topics-2	2		
Deep Learning Based Computer Vision	2		

Detection, classification, semantic segmentation from images and image sequences	2		
Stereovision and depth from monocular images	2		
Optical flow, motion flow	2		
Detection, classification, semantic segmentation of 3D Point Clouds	2		

Bibliography:

1. Convolutional Neural Networks for Visual Recognition, http://cs231n.stanford.edu/
2. David Forsyth, Jean Ponce „Computer Vision A Modern Approach", Prentice Hall, USA, 2002
3. IEEE Transactions on Pattern Analyses and Machine Intelligence
4. IEEE Transactions on Image Processing
5. IEEE Transactions on Intelligent Transportation Systems
6. CVPR, ECCV and ICCV papers

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	50%
Applications (**Seminars** /Laboratory/Project)	Individual presentation of a subject in the field	Oral examination	50%
Minimum standard of performance: Both, Written examination and Oral examination, marks are bigger or equal with 5			

Date of filling in:	**Responsible**	**Title First name Last name**	**Signature**
26.02.2025	Course	Prof. dr. eng. Sergiu NEDEVSCHI	
	Applications	Prof. dr. eng. Sergiu NEDEVSCHI	

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