

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
1.6 Program of study / Qualification	Artificial Intelligence and Vision / Master
1.7 Form of education	Full time

2. Data about the subject

2.1 Subject name	Computer Vision for Mobile Systems			Subject code	10.00
2.2 Course responsible / lecturer	Prof. dr. eng. Sergiu Nedevschi - Sergiu.Nedevschi@cs.utcluj.ro				
2.3 Teachers in charge of seminars / Laboratory / project	Prof. dr. eng. Sergiu Nedevschi - Sergiu.Nedevschi@cs.utcluj.ro				
2.4 Year of study	I	2.5 Semester	1	2.6 Type of assessment (E - exam, C - colloquium, V – verification)	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	Seminars	-	Laboratory	1	Project	-
3.2 Number of hours per semester	42	of which:	Course	28	Seminars	-	Laboratory	14	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 (suma (3.3(a))...3.3(f)))					58					
3.5 Total hours per semester (3.2+3.4)					100					
3.6 Number of credit points					4					

4. Pre-requisites (where appropriate)

4.1 Curriculum	Artificial Vision
4.2 Competence	Operation with mathematical methods and models, techniques and technologies specific to the field of artificial vision

5. Requirements (where appropriate)

5.1. For the course	Blackboard, video projector, screen, computer
5.2. For the applications	Computers, equipment and specific software

6. Specific competence

6.1 Professional competences	C3 - Specification, analysis, modeling, design, verification, testing and validation of advanced artificial vision systems for mobile robots using field-specific tools. • C3.1 - Advanced knowledge, understanding and use of artificial vision concepts, paradigms and models for autonomous systems. • C3.2 - Advanced knowledge, understanding and nuanced use of artificial vision algorithms for autonomous systems. • C3.3 - Knowledge of sensory perception methods, object detection and recognition, tracking, representation of the environment and navigation with applications in autonomous systems. • C3.4 - Development and implementation of original solutions for problems specific to the field of artificial vision for mobile robots. C4 - Contextual integration and integrity of artificial vision systems for mobile robots. • C4.1 - Demonstration of knowledge and understanding of the specific interoperability elements of intelligent systems and artificial vision. • C4.2 - Using interdisciplinary knowledge to adapt intelligent systems and artificial vision in relation to the dynamic requirements of the application field. • C4.3 - The combined use of classical and original principles and methods to ensure the security, encryption, safety and ease of use of intelligent and artificial vision systems. • C4.4 - Use of quality, safety and security standards in information processing. • C4.5 - Realization of interdisciplinary projects, including problem identification and analysis, development of design specifications, development, functional testing and evaluation of specific quality and performance criteria. C5 - The creative combination of multidisciplinary knowledge in the field of computer science and information technology in order to research, specify, design, optimize, implement, test and evaluate original theories, algorithms, techniques, methods and methodologies specific to complex artificial vision systems for mobile robots • C5.1 – Demonstrating knowledge of research methodology, design, implementation, optimization and testing of autonomous artificial vision systems. • C5.2 - The creative combination, based on the discovery of new connections, of various modern design principles in the field of computers and information technology for artificial vision systems for mobile robots. • C5.3 - Realization of research activities with practical purpose demonstrated through functional prototypes of autonomous artificial vision based systems.
6.2 Cross competences	N/A

7. Expected Learning Outcomes

Knowledge	The student has knowledge of: • computer programming (Python) • visual presentation techniques • computer vision • digital systems
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Skills	The student is able to: • create data sets • develop statistical software • build recommender systems • manage ICT data classification
Responsibilities and autonomy	The student has the ability to work independently in order to: • develop an analytical approach • take a proactive approach • develop strategies to solve problems • be open-minded • coordinate engineering teams

8. Discipline objective (as results from the *key competences gained*)

8.1 General objective	The development of skills and abilities for the development of artificial vision systems for mobile robots in the field of intelligence and artificial vision, computers and information technology
8.2 Specific objectives	Assimilation of knowledge and skills regarding: - understanding and using artificial vision concepts, paradigms and models for autonomous systems - the nuanced understanding and use of artificial vision algorithms for mobile robots - studying, designing, implementing and evaluating autonomous artificial vision application modules - methods of sensory perception, detection and recognition of objects, tracking, representation of the environment and navigation with applications in autonomous systems

9. Contents9.1 Lectures	Hours	Teaching methods	Notes
Introduction in probabilistic robotics	2	Systematic exposure, student involvement in presentations and debates	
Review of Probabilities	2		
Recursive state estimation	2		
Gaussian filters	2		
Non-parametric filters	2		
Robot motion	2		
Measurements	2		
Mobile Robot Localization	2		
Grid and Monte Carlo Localization	2		
Occupancy Grid Mapping	2		
Objects Tracking	2		
Multi-Sensor Fusion	2		
Simultaneous Localization and Mapping	2		
Panning and Obstacle Avoidance	2		
Bibliography: 1. S. Thrun, W. Burgard, D. Fox, Probabilistic Robotics, MIT press, 2005 2. R. Siegwart, I. Nourbakhsh, “Autonomous Mobile Robots”, MIT Press, 2004 3. Convolutional Neural Networks for Visual Recognition, http://cs231n.stanford.edu/ 4. IEEE Transactions on Pattern Analyses and Machine Intelligence 5. IEEE Transactions on Image Processing 6. IEEE Transactions on Intelligent Transportation Systems 7. CVPR, ECCV, ICCV			
9.2 Applications - Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Sensory and perception systems	2		
Recursive state estimation	2		

Gaussian and non-parametric filters	2		
Mobile Robot Localization	2		
Occupancy maps	2		
Simultaneous Localization and Mapping	2		
Panning and Obstacle Avoidance	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			

**Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.*

10. 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.

11. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Exam	Written examination	50%
Seminar	Individual presentation of a subject in the field	Oral examination	50%
Laboratory	-	-	-
Project	-	-	-
Minimum standard of performance: Both, Written examination and Oral examination, marks are bigger or equal with 5			

Date of filling in: 01.09.2025	Responsible	Title First name Last name	Signature
	Course	Prof. dr. eng. Sergiu NEDEVSCI	
	Applications	Prof. dr. eng. Sergiu NEDEVSCI	

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