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	Artificial Intelligence and Vision
1.7	Form of education	Full time
1.8	Subject code	10

2. Data about the subject

2.1	Subject name			***Computer Vision for Mobile Systems***			
2.2	Subject area			Artificial Intelligence			
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	1	2.5 Semester	2	2.6 Assessment	E–**e**xam, C–**c**olloq., V-**v**erif.		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	3.2 Course	2	3.3 Seminar	-	3.3 Laborator	1	3.3 Proiect	-
3.4 Total hours in the curriculum	42	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laborator	14	3.6 Proiect	-

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 (summ (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	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 seminar / laboratory / project	Computers, equipment and specific software

6. Specific competences

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	NA

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 for mobile robots 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 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

8. Contents

8.1. Lecture (syllabus)	Number of 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			
8.2. Seminars /Laboratory/Project	Number of hours	Teaching methods	Notes
Sensory and perception systems	2	Case study, Presentation, Debate	
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. 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. 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	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Exam	Written examination	50%
10.5 Seminars /Laboratory/Project	Individual presentation of a subject in the field	Oral examination	50%
10.6 Minimum standard of performance: Both, Written examination and Oral examination, marks are bigger or equal with 5			

Date of filling in:		Title Surname Name	Signature
	Lecturer	Prof. dr. eng. Sergiu Nedevschi	
	Teachers in charge of application	Prof. dr. eng. Sergiu Nedevschi	

Date of approval in the department 20.02.2024	Head of department Prof.dr.ing. Rodica Potolea
Date of approval in the faculty council 22.02.2024	Dean Prof.dr.ing. Mihaela Dinsoreanu