COURSE PROGRAMME

1. Information about the programme

1.1 University	**University "Alexandru Ioan Cuza" of Iasi**
1.2 Faculty	**Faculty of Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Domain	**Computer Science**
1.5 Cycle	**Masters**
1.6 Programme / Qualification	**Artificial intelligence and optimization**

2. Information about the course

2.1 Course Name			Computer Vision				
2.2 Course taught by			Assoc. Prof. PhD. ANCA IGNAT				
2.3 Seminary / laboratory taught by			Assoc. Prof. PhD. ANCA IGNAT				
2.4 Year	I	**2.5** Semester	I	**2.6** Type of evaluation*	E	**2.7** Course type**	Ob

E – Exam / C – Colloquium / V – Verification

***OB – Obligatory / OP – Optionally / F – Facultative*

3. **Total hours** (estimated per semester and activities)

3.1 Number of hours per week	4	**3.2** course	2	**3.3** seminary/laboratory	2
3.4 Total number of hours	56	**3.5** course	28	**3.6** seminary/laboratory	28

Distribution	hours
Individual study using textbooks, course notes, bibliography items, etc.	42
Supplimentary study (library, on-line platforms, etc.)	28
Individual study for seminary/laboratory, homeworks, projects, etc.	35
Tutoring	0
Examination	14
Other activities	0

3.7 Total hours of individual activity*	119
3.8 Total hours per semester	175
3.9 Credit points	7

4. **Pre-requisites - Curriculum** (if necessary)

Introduction in Python
Machine Learning
Artificial Intelligence
Mathematics - Diferential and Integral Calculus
Probabilities and Statistics

5. Conditions (if necessary)

5.1 Course	Videoprojector
5.2 Seminary / Laboratory	

6. Objectives

Understanding and being able to use the basic techniques of digital image processing and computer vision for solving real-world problems.

7. Specific competencies/Learning outcomes

- Upon successful completion of this discipline, students will be able to: C1. Explain concepts, theories and models used in Computer Vision C2. Correctly use the mathematical and computer science models for solving Computer Vision problems C3. Analyze the problems that are Computer Vision related and find an adequate solution for solving them C4. Write code for implementing the identified methods that are possible solutions for solving Computer Vision related problems.
- The acquisition of professional and transversal skills, according to the specifics of the discipline, in accordance with the qualifications provided in the National Register of Qualifications in Higher Education (RNCIS) for the Informatics specialization. Look up details
- The acquisition of professional and transversal skills, according to the specifics of the discipline, in accordance with the qualifications provided in the National Register of Qualifications in Higher Education (RNCIS) for the Informatics specialization. Look up details
- Skill in critically analyzing and interpreting complex data.

8. Contents

8.1 Course	**Teaching methods**	**Remarks** (number oh hours, references)
Examples, fundamentals in image processing	exposition, debate, case studies, exercises	2, [1]-[7]
Sampling and quantization, reconstruction	exposition, debate, case studies, exercises	2, [1]-[7]
Image enhancement in the spatial domain – intensity transformations	exposition, debate, case studies, exercises	2, [1]-[7]
Image enhancement in the spatial domain – histogram processing	exposition, debate, case studies, exercises	2, [1]-[7]
Image enhancement in the spatial domain – spatial filtering	exposition, debate, case studies, exercises	2, [1]-[7]
Image enhancement in the frequency domain: Fourier transform	exposition, debate, case studies, exercises	2, [1]-[7]
Image enhancement in the frequency domain: smoothing, sharpening	exposition, debate, case studies, exercises	2, [1]-[7]
Noise reduction	exposition, debate, case studies, exercises	2, [1]-[7]
Color image processing	exposition, debate, case studies, exercises	2, [1]-[7]
Image compression	exposition, debate, case studies, exercises	2, [1]-[7]

8.1 Course	Teaching methods	Remarks (number oh hours, references)
Morphological image processing	exposition, debate, case studies, exercises	2, [1]-[7]
Feature Extraction	exposition, debate, case studies, exercises	2, [1]-[7]
Image segmentation: edge detection, thresholding, deep learning Object detection	exposition, debate, case studies, exercises	2, [1]-[7]

Bibliography

1. E.R. Davies, Computer vision: principles, algorithms, applications, learning, 5-th ed., Academic Press (2017)
2. D.A.Forsyth & J. Ponce, Computer vision: a modern approach, Prentice Hall (2002)
3. R. Klette, Concise computer vision (Vol. 233). London: Springer (2014)
4. R. Szeliski, Computer vision: algorithms and applications. Springer Nature (2022).
5. R.C. Gonzales, R.E. Woods, Digital Image Processing, Pearson India, 2018, 4th ed.
6. R. Shanmugamani, Deep Learning for Computer Vision: Expert techniques to train advanced neural networks using TensorFlow and Keras, Packt Publishing Ltd. (2018).
7. J. Brownlee, Deep learning for computer vision: image classification, object detection, and face recognition in python, Machine Learning Mastery (2019).

8.2 Seminary / Laboratory	Teaching methods	Remarks (number oh hours, references)
Elementary notions in image processing – reading, writing an image, skin detection	Problem description: algorithm and examples	2, [1,2,3]
Intensity Transformation	Problem description: algorithm and examples	2, [1,2,3]
Spatial filtering: average, median, sharpening	Problem description: algorithm and examples	2, [1,2,3]
Histogram processing	Problem description: algorithm and examples	2, [1,2,3]
Fourier transform	Problem description: algorithm and examples	2, [1,2,3]
Frequency domain filtering	Problem description: algorithm and examples	2, [1,2,3]
Noise reduction	Problem description: algorithm and examples	2, [1,2,3]
Color image processing	Problem description: algorithm and examples	2, [1,2,3]
Morphological image processing	Problem description: algorithm and examples	2, [1,2,3]
Image segmentation: thresholding	Problem description: algorithm and examples	2, [1,2,3]
Feature extraction - texture, keypoints	Problem description: algorithm and examples	2, [1,2,3]
Image segmentation: deep learning	Problem description: algorithm and examples	2, [1,2,3]
Object recognition – deep learning	Problem description: algorithm and examples	2, [1,2,3]

Bibliography

1. R.C. Gonzales, R.E. Woods, S.L. Eddins, Digital Image Processing Using MATLAB, Prentice Hall, 2003
2. J. Brownlee, Deep learning for computer vision: image classification, object detection, and face recognition in python, Machine Learning Mastery (2019)
3. OpenCV library - https://opencv.org/

9. Coordination of the contents with the expectations of the community representatives, professional associations and relevant employers in the corresponding domain

The content of the course is designed to address the necessities of the employers from the IT industry.

10. Assessment and examination

10.1 Continuous assessment		Percentage (min. 30%)		60
Course	Assessment type			Oral assessment
	Percentage			20
	Failure to pass the continuous assessment results in failure to pass the final assessment			No
	Assessment methods	Details	Percentage	with reexamination
		Case study	100	No
Seminary / Laboratory	Assessment type			Oral assessment
	Percentage			80
	Failure to pass the continuous assessment results in failure to pass the final assessment			Yes
	Assessment methods	Details	Percentage	with reexamination
		Project	20	No
		Case study	30	No
		Essay	50	No

10.2 Final assessment	Percentage (max. 70%)	40
	Assessment type	Final written assessment

10.3 Special notes (special situations is assessment)

10.4 Minimum performance standard

Understanding the methods specific to Computer Vision for solving problems related with this field
Knowing and being able to use a Computer Vision library for solving problems that involve digital images
Has to have the skills of justifying the chosen methods for solving a given Computer Vision problem

The final score must be greater or equal than 45% of the maximal final score.

Date, **Course coordinator,**
Assoc. Prof. PhD. ANCA IGNAT

Seminary coordinator,
Assoc. Prof. PhD. ANCA IGNAT

Aproval date in the department,

Head of the departament,
Assoc. Prof. PhD. ANDREI ARUSOAIE