COMPUTER VISION

1. GENERAL

SCHOOL	ENGINEERING		
SECTION	INFORMATICS & COMPUTER ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE		**SEMESTER OF STUDY**	8th
COURSE TITLE	COMPUTER VISION		

INDEPENDENT TEACHING ACTIVITIES *in case the credits are awarded in distinct parts of the course e.g. Lectures, Laboratory Exercises, etc. If the credits are awarded uniformly for the entire course, indicate the weekly teaching hours and the total number of credits.*	**WEEKLY HOURS TEACHING**	**CREDIT UNITS**
Lectures	3	
Laboratory	1	
Add rows if needed. The organization of teaching and the teaching methods used are described In detail at 4.	**4**	**5**

COURSE TYPE *Background, General Knowledge, Scientific Area, Development Skill*	Scientific Area, Skills Development
PREREQUISITES COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATION:	Greek
THE COURSE IS OFFERED TO ERASMUS STUDENTS	Yes (in English)
ONLINE COURSE PAGE (URL)	

2. LEARNING OUTCOMES

Learning Outcomes

The learning outcomes of the course are described, the specific knowledge, skills and abilities of an appropriate level that students will acquire after the successful completion of the course.

Consult Appendix A

- *Description of the Level of Learning Outcomes for each course of study according to the European Higher Education Area Qualifications Framework*
- *Descriptors of Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B*
- *Summary Guide for writing Learning Outcomes*

After attending the course the student will be able to:

- describes qualitatively and mathematically the basic concepts and techniques of computer image analysis and vision.
- Understand the manipulation techniques and basic algorithms of computer vision and pattern recognition (for vision applications) and possess specialized combined knowledge skills for self-reliant computer vision problem-solving
- implements these methods in computing environments such as MATLAB, OpenCV and/or Python.
- design and implement appropriate classification algorithms and clustering for object detection and recognition, image segmentation and scene comprehension

General Skills

Taking into account the general competencies that the graduate must have acquired (as listed in the Diploma Supplement and listed below) which of them is the subject aimed at?

Search, analysis and synthesis of data and information, using the necessary	*Project planning and management*
	Respect for diversity and multiculturalism

Technologies *Adapting to new situations Decision making* *Autonomous work* *Teamwork* *Working in an international environment Working in an interdisciplinary environment* *Generating new research ideas*	*Respect for the natural environment* *Demonstrate social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism* *Promotion of free, creative and inductive thinking*

- Search, analysis and synthesis of data and information, using the necessary tools and especially: Analysis, design and development of artificial vision algorithms.
- Decision Making: A combination of techniques for complex problems.
- Autonomous work: Knowledge of development tools.
- Teamwork: Ability to dialogue and collaborate to develop complex algorithms.
- Production of new research ideas.
- Promotion of free, creative and inductive thinking

3. COURSE CONTENT

Basic principles of image formation and operation of digital cameras, human vision, light and color.

Elements of projective geometry.

Review of filters in the field of space and frequency.

Detection of angles, edges and other geometric features (Harris, Canny algorithms).

Image segmentation.

Descriptors (HOG, SIFT, SURF), features extraction and matching.

Pattern recognition & machine learning methods for computer vision applications: supervised, semi-supervised and unsupervised learning, classification and classifiers (e.g. Naive Bayes, k-Nearest Neighbors, neural networks), clustering algorithms (k-means, DBSCAN), deep learning (convolutional neural networks, deep recursive neural networks, etc.), Principal Component Analysis. Object detection and recognition: algorithms and applications.
Object tracking.

Stereoscopic vision, reconstruction of three-dimensional shape, structure assessment by motion (Structure from Motion).

Applications of computer action in various fields: security, transport, robotics, biomedicine, remote sensing, biometrics.

Basic computational tools in MATLAB, OpenCV or Python.

4. TEACHING AND LEARNING METHODS - ASSESSMENT

HOW TO DELIVER *Face-to-face, Remote education , etc.*	In the classroom face to face. Presentation of the theory with slides, demonstration of algorithms with specialized software and hardware.
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT* in *Teaching, in*	Teaching using ICT, Electronic Communication for assignment or submission of Assignments through its e-learning platform
Laboratory Training, in Communication with students	Department. Use of e-mail and announcements on the electronic platform learning to communicate with students.

TEACHING ORGANIZATION *The way and methods of teaching* are described *in detail.* *Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliography* Study *& Analysis, Tutorial, Practice* (placement), *Clinical Practicum, Art Workshop, Interactive teaching, Educational visits, Project preparation, Writing of work / assignments, Artistic creation, etc.* *The student's* study hours *for each learning activity as well as* the *hours of unguided study* are listed *so that the total workload at semester level corresponds to ECTS standards*	**Activity**	**Workload Semester**
	Lectures	39
	Practice exercises	13
	Elaboration of papers	30
	Independent Study	44
	Course Total (25 hours of load working per credit unit)	**125**
STUDENT EVALUATION *Description of the evaluation process Assessment Language, Assessment Methods, Formative or Inferential, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment,* Report */Report, Oral Exam, Public Presentation, Laboratory Work, Clinical Patient Examination, Artistic Interpretation,* Other */Other Explicitly defined* assessment *criteria* are indicated and *if and where they are accessible to students.*	• Written final exam (60%) • Semester assignments (programming/computational assignments in MATLAB or C/C++ (OpenCV) or Python, analytical papers, bibliographic papers) (40%)	

5. RECOMMENDED-BIBLIOGRAPHY

- Suggested Bibliography :

1. S. Theodoridis, A. Pikrakis, K. Koutroumbas, D. Cavouras, "Introduction to pattern recognition with MATLAB" (Eudoxus code: 13256624).
2. Didactic notes.
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer 2010

- Additional bibliography

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press, 2004
2. Adrian Rosebrock, Deep Learning for Computer Vision with Python, 2017.
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer 2006.
4. Sinmon J.D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012

-Related Scientific Journals :

- International Journal of Computer Vision, Springer
- IEEE Transactions on Pattern Analysis and Machine Intelligence
- Computer Vision and Image Understanding, Elsevier
- Proceedings of the IEEE International Conference on Computer Vision (ICCV)
- Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR)