COURSE OUTLINE

(1) GENERAL

SCHOOL			
ACADEMIC UNIT	**Interdisciplinary Graduate Programme in the BRAIN and MIND sciences**		
LEVEL OF STUDIES	7		
COURSE CODE	**CS-472**	SEMESTER	**Spring**
COURSE TITLE	Computer Vision		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	WEEKLY TEACHING HOURS	CREDITS
lectures	4	
	2	
	6	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://www.csd.uoc.gr/~hy472

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

1. Knowledge: Having attended and successfully completed the course, students will be able to describe how specific, selected computer vision problems are addressed in the relevant literature.

2. Understanding: Having attended and successfully completed the course, students will have developed an in-depth understanding of the mechanisms used to solve specific computer vision problems and will be able to explain why these mechanisms are also adequate for solving other problems.

3. Application: Having attended and successfully completed the course, students will be able to reuse existing methodologies and tools to produce alternative solutions for specialized versions of specific computer vision problems or for the development of applications.

4. Analysis: Having attended and successfully completed the course, students will be able to critically examine specific problems and recognize them as the synthesis of a series of smaller sub-problems.

5. Synthesis: Having attended and successfully completed the course, students will be able

to combine individual tools and methodologies to solve complex computer vision problems.
6. Evaluation: Having attended and successfully completed the course, students will be able to measure and quantitatively assess the quality of computer vision problem solutions and compare these solutions with other existing ones.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision-making
- Working independently
- Team work
- Production of new research ideas
- Project planning and management
- Criticism and self-criticism

(3) SYLLABUS

1. Introduction to computer vision
2. Overview of image acquisition and processing topics (sampling, quantization, color perception, smoothing filters, derivative filters)
3. Overview of image analysis topics (edge detection, segmentation)
4. Representation, analysis, and synthesis of texture
5. Detection of points of interest (Harris corner detector)
6. Detection of regions of interest (blobs)
7. Point-of-interest descriptors (SIFT)
8. Hough transform
9. Parametric model estimation methods (least squares method)
10. Robust parameter estimation methods (LMedS, RANSAC)
11. Model–image alignment based on features
12. Camera and lens models, projective geometry
13. Camera calibration
14. Epipolar geometry
15. Stereoscopy: the correspondence problem and 3D reconstruction
16. Volumetric 3D reconstruction from multiple cameras
17. Estimation of two-dimensional motion (normal optical flow, optical flow)
18. Modeling of three-dimensional motion (motion field, ego-motion)
19. Tracking with linear dynamic models
20. Tracking with particle filters
21. Object detection (human body, face)
22. Object recognition
23. Object category recognition

(1) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Use of slides/films
Use of an online platform for posting articles
Communication via the course website and email
Use of publishers' databases/electronic repositories of scientific articles</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Tutorials</td><td>0</td></tr>
<tr><td>Study</td><td>52</td></tr>
<tr><td>Exercises/labs</td><td>52</td></tr>
<tr><td>Final project</td><td>8</td></tr>
<tr><td>Exams</td><td>4</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>168</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>Class attendance/participation
Exercises/projects
Oral/written exams

Students are informed about the evaluation process during the first lecture of the course. It is also made available on the course website.</td></tr>
</table>

(2) ATTACHED BIBLIOGRAPHY

- Selected research publications
- Rick Szeliski, *Computer Vision: Algorithms and Applications*
- David Forsyth, Jean Ponce, *Computer Vision: A Modern Approach*
- Lecture/presentation slides
- Selected online sources