

APPLIED VIDEO SEQUENCES ANALYSIS

1. SYLLABUS INFORMATION

1.1. Course title

Applied Video Sequences Analysis

1.2. University

Universidad Autónoma de Madrid

1.3. Semester

First year, second semester

2. COURSE DETAILS

2.1. Course nature

Compulsory

2.2. ECTS Credit allotment

6

2.3. Recommendations

The following skills are necessary for this class:

- Math: Linear algebra, vector calculus, and probability.
- Image processing: image representation, pixels, histograms, image features, gradients/edges, spatial filtering.
- Programming: A good working knowledge for C programming. C++ programming is a plus although it is not formally required by this course.

Related subjects that may be helpful for this course:

- Machine Learning: theory and applications [Aprendizaje Automático: teoría y aplicaciones]
- Applied Bayesian Methods [Métodos bayesianos aplicados]
- People detection and Biometrics [Biometría]

2.4. Faculty data

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3. COMPETENCES AND LEARNING OUTCOMES

3.1. Course objectives

The main objective of video analysis for video-surveillance is the extraction of useful semantic information: detection of people presence and trajectory, detection of irregular events, etc. The general objective of this course is to present automatic videosurveillance systems (with single or multiple cameras), to describe the practical application of generic video analysis techniques in this domain, and to present specific video-surveillance applications: people detection and tracking, abandoned/stolen object detection, etc.

3.2. Course contents

The contents of the course are as follows:

1. Introduction to video processing systems
2. Foreground/Objects detection and segmentation
 - Background subtraction: parametric models
 - Background subtraction: non-parametric models
 - Shadow detection
 - Specific object detectors
3. Video object tracking
 - Target modeling and Template matching
 - Mean-shift tracking
 - Kalman and Particle Filters
 - Multi-target tracking

3.3. Course bibliography

1. S.A. Velastin, P. Remagnino, "Intelligent Distributed Video Surveillance Systems", IET, 2006
 2. O. Javed, M. Shah, "Automated Multi-camera Surveillance: Algorithms and Practice", Springer 2008
 - T. Bouwmans, F. Porikli, B. Hörferlin, A. Vacavant. "Background modeling and Foreground Detection for video surveillance: Traditional and Recent Approaches, Benchmarking and Evaluation". CRC Press, Taylor and Francis Group. 2014
 3. E. Maggio, A. Cavallaro, "Video Tracking: Theory and Practice", Wiley, 2011.
- Selected papers in relevant journals and conferences for topics covered in the course

4. TEACHING-AND-LEARNING METHODOLOGIES AND STUDENT WORKLOAD

4.1. List of training activities

| Activity | | Hours | % | Hours | % |
|--|--|-------|-------|-------|--------|
| Presential | Lecture sessions | 24 | 16% | 56 | 37,33% |
| | Practical programming sessions | 28 | 18,6% | | |
| | Tests and exams | 4 | 2,6% | | |
| Non-presential | Weekly study of lectures | 24 | 16% | 94 | 62,66% |
| | Practical work (programming and reporting) | 60 | 40% | | |
| | Preparation of tests and exams | 10 | 6,6% | | |
| TOTAL WORKLOAD: 25 hours x 6 ECTS | | 150 | 100% | | |

5. EVALUATION PROCEDURES AND WEIGHT OF COMPONENTS IN THE FINAL GRADE

5.1. Regular assessment

In the **ordinary exam period**, we will consider the following scheme for overall evaluation:

$$\text{Grade} = 40\%TE + 60\%PR$$

TE is the grade obtained from theoretical lectures. TE grade is obtained as follows:

$$TE = 50\%TE1 + 50\%TE2$$

where TE1 and TE2 are two exams, each one corresponding to approximately half of the lectures' content.

PR is the grade obtained from lab assignments. PR grade is obtained as follows:

$$PR = 25\%PR1 + 25\%PR2 + 25\%PR3 + 25\%PR4$$

where PR1...PR4 correspond to four lab assignments distributed along the course.

The grading range is from 0.0 to 10.0. The maximum grade to be obtained is 10.0 and each of the parts (labs and exam) will be also graded with the same grading range. In order to pass the course, it is necessary to have a pass grade (equal or greater than 5.0) in the overall evaluation, as well as a pass grade (equal or greater than 4.0) in the two individual parts (TE and PR).

The grades of the individual parts are kept for the extraordinary exam period.

5.2. List of evaluation activities

| Type | Evaluation activity | Percent (overall grade) |
|----------|-----------------------------|-------------------------|
| Lectures | Unique exam | 40% |
| Project | Unique practical assignment | 60% |