2015/2016

Visual Recognition

Code: 43088

Credits: 6

Type: OB/OT/TFM Course: 1 Semester: 2

Contact

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Lecturers

Ramón Baldrich (Module coordinator and Project coordinator)
Ernest Valveny
Robert Benavente
Xavier Giró
Marçal Rossinyol
Alicia Fornés
Josep Lladós
Jordi Gonzàlez
Joost van de Weijer

Use of languages

Principal working language: English

Prerequisites

Degree in Engineering, Maths, Physics or similar

Objectives and contextualisation

In Computer Vision, visual recognition corresponds to the task of explaining the content of an image in terms of “What is there?”. This question can be addressed in many different ways, and in this Module 5 we will consider two particular types of answers: the category of the object appearing in an image, and the identification of a particular object instance. In other words: looking for cars vs. looking for “my car”. The contents will span from the Bag of Words pipeline for automatic category classification to the use of efficient large-scale techniques for instance retrieval. This module will develop the most recent and popular techniques in Computer Vision which can answer the aforementioned questions. The project to be developed during this Module will provide the students with the practical insights to the theoretical content of the module.

Skills and learning outcomes

E01 - Identify concepts and apply the most appropriate fundamental techniques for solving basic problems in computer vision.

01 - Identify the basic problems to be solved in object and scene recognition, along with the specific algorithms.

E02 - Conceptualise alternatives to complex solutions for vision problems and create prototypes to show the validity of the system proposed.

02 - Identify the best representations that can be defined for solving problems of both object and scene visual recognition.

E03 - Choose the most suitable software tools and training sets for developing solutions to problems in computer vision.

03 - Choose the learnt techniques and train them to resolve a particular visual recognition project.

E04 - Plan, develop, evaluate and manage solutions for projects in the different areas of computer vision.

04 - Plan, develop, evaluate and manage a solution to a particular visual recognition problem.

B06 - Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

05 - Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

B07 - Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.

06 - Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.

B10 - Continue the learning process, to a large extent autonomously

07 - Continue the learning process, to a large extent autonomously.

T02 - Understand, analyse and synthesise advanced knowledge in the area, and put forward innovative ideas.

08 - Understand, analyse and synthesise advanced knowledge in the area, and put forward innovative ideas.

T03 - Accept responsibilities for information and knowledge management.

09 - Accept responsibilities for information and knowledge management.

T04 - Work in multidisciplinary teams.

10 - Work in multidisciplinary teams.

Content

1. The Bag of words framework
2. Image feature detection
3. Improvements on BoW
4. Color Image Descriptors
5. CNNs for Image Classification
6. Image ranking and retrieval
7. Augmenting the retrieval efficiency
8. Part-based models for visual recognition
9. Structural matching for visual recognition
10. Applications on visual recognition

Methodology

Supervised sessions:

- **Lecture Sessions**, where the lecturers will explain general contents about the topics. Some of them will be used to solve the problems.

Directed sessions:

- **Project Sessions**, where the problems and goals of the projects will be presented and discussed, students will interact with the project coordinator about problems and ideas on solving the project (approx. 1 hour/week)
- **Presentation Session**, where the students give an oral presentation about how they have solved the project and a demo of the results.
- **Exam Session**, where the students are evaluated individually. Knowledge achievements and problem-solving skills

Autonomous work:

- Student will autonomously study and work with the materials derived from the lectures.
- Student will work in **groups** to solve the problems of the projects with deliverables:
    - Code
    - Reports
    - Oral presentations

Activities

TYPE	ACTIVITY	HOURS	LEARNING OUTCOMES
Supervised			
	Project, Presentation and Exam Sessions	10	1, 2, 3, 5, 6, 7, 8, 9, 10
Directed			

Lecture Sessions	20	1, 2, 3

Autonomous

Homework	120	1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Evaluation

The **final marks** for this module will be computed with the **following formula**:

Final Mark = 0.4 x **Exam** + 0.55 x **Project**+ 0.05 x **Attendance**

where,

Exam: is the mark obtained in the Module Exam (must be >= 3)
Attendance: is the mark derived from the control of attendance at lectures (minimum 70%)
Projects: is the mark provided by the project coordinator based on the weekly follow-up of the project and deliverables. All accordingly with specific criteria such as:

- Participation in discussion sessions and in team work (inter-member evaluations)
- Delivery of mandatory and optional exercises.
- Code development (style, comments, etc.)
- Report (justification of the decisions in your project development)
- Presentation (Talk and demonstrations on your project)

Evaluation activities

TITLE	HOURS	WEIGHTING	LEARNING OUTCOMES
Exam	3	0,4	1, 2, 5, 6, ,7 ,8, 9
Project	7	0,55	1, 2, 3, 4, ,5 ,6 ,7 ,8, 9, 10

Bibliography

Journal articles:

1. S. Lazebnik, C. Schmid, and J. Ponce, "*Beyond bags of features: Spatial pyramid matching for recognizing natural scene categories*" in IEEE Computer Society Conference.
2. A.Oliva and A. Torralba, "*Modeling the shape of the scene: a holistic representation of the spatial envelope*" International Journal of Computer Vision., vol. 42, no. 3, pp. 145–175, 2001.

Book:

1. M. Marszalek, C. Schmid, H. Harzallah, and J. van de Weijer, "*Learning object representation for visual object class recognition*" in Visual recognition Challenge Workshop, in conjuncture with ICCV, 2007.