

academic year 2023-2024 welcome session & master presentation mcv.uab.cat

Maria Vanrell

Welcome session

- 1. aim of the master
- 2. about computer vision
- 3. about the master
- 4. about the partners
 - UAB-CVC
 - UOC
 - UPC
 - UPF
 - UB
- 5. about the students

aim of the master

What?

To give to the students updated knowledge about Computer Vision

from basic techniques to state-of-art methods

Why?

<u>Computer Vision is an AI technology</u> whose development and applicability is exponentially growing

new jobs, start-up opportunities, PHD studentships

How?

Joining the expertise in the field of 5 universities which are living in Barcelona

a big concentration of companies and research institutions

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about computer vision

close to 50 years of research in the field



CV raise in parallel with AI, 1950s ...

From Wikipedia:

1956

"[...] The Dartmouth Summer Research Project on Artificial Intelligence was a 1956 summer workshop widely considered [1][2][3] to be the founding event of <u>artificial intelligence</u> as a field.

The project lasted approximately six to eight weeks and was essentially an extended <u>brainstorming</u> session. Eleven mathematicians and scientists originally planned to attend; not all of them attended, but more than ten others came for short times. [...]"

AI birth (Darmouth Workshop)

Published list of attendees

- Ray Solomonoff
- Marvin Minsky
- John McCarthy
- Claude Shannon
- Trenchard More
- Nat Rochester
- Oliver Selfridge
- Julian Bigelow
- W. Ross Ashby
- W.S. McCulloch
- Abraham Robinson
- Tom Etter
- John Nash
- David Sayre
- Arthur Samuel
- Kenneth R. Shoulders
- Shoulders' friend
- Alex Bernstein
- Herbert Simon
- Allen Newell



Vision as a Summer Project, 1966

from MIT AI Memos (1959-2004) we can find <u>Papert, Seymour</u> (1966-07-01). "<u>The Summer Vision Project</u>"

[...] The primary goal of the project is to construct a system of programs which will divide a vidisector picture into regions such as likely objects, likely background areas and chaos. We shall call this part of its operation FIGURE-GROUND analysis. It will be impossible to do this without considerable analysis of shape and surface properties, so FIGURE-GROUND analysis is really inseparable in practice from the second goal which is REGION DESCRIPTION. The final goal is OBJECT IDENTIFICATION which will actually name objects by matching them with a vocabulary of known objects.



Important fidings in neurophysiology, 1959

From Wikipedia:

"[...] The Hubel and Wiesel experiments greatly expanded the scientific knowledge of sensory processing. In one experiment, done in 1959, they inserted a <u>microelectrode</u> into the <u>primary visual cortex</u> of an anesthetized cat. They then projected patterns of light and dark on a screen in front of the cat. They found that some <u>neurons</u> fired rapidly when presented with lines at one angle, while others responded best to another angle. They called these neurons "<u>simple cells</u>." Still other neurons, which they termed "<u>complex cells</u>," responded best to lines of a certain angle moving in one direction. These studies showed how the visual system builds an image from simple stimuli into more complex representations [...]





Marr's Theory, 1982

Vision must be considered as <u>an information processing system</u>, that is built at different stages





CV field explodes with multiple computational approaches

Different optimization method to extract important features that requires regularization methods to solve the ill-posed nature

Pros:

Application of a rich diversity of mathematical models ... (Markov models, Wavelets, graphical models, neural networks...)

Cons:

A lot of hand-crafted design and parameter setting Not a unified methodology to deal with visual information



CV seriously start to work on Image annotation (2005)

The Pascal VOC Project (EU funded) provided a serious datasets for object class

recognition [http://host.robots.ox.ac.uk/pascal/VOC/]

- Standardized image datasets
- A common set of tools to access data
- Standardize evaluation and comparison of methods
- Ran challenges to evaluate methods (from 2005-2012)









(d) Person layout



Deep Convolutional Networks (2012)

There is an important increase in performance accuracy in the Pascal Challenge

ImageNet Classification with Deep Convolutional Neural Networks A. Krizhevsky, I. Sutskever and G.E. Hinton. NEURIPS 2012

From flat descriptors to hierarchical descriptors

Increase the power of representation of visual information

From hand-crafted to learned descriptors

CNN is trained with large datasets using graphical Cards and all parameter are all set in the training processs Deep CNNs



Since 2012 ... CV field is installed in a permanent growing Image Classification performance is still improving results





about computer vision

after 50 years we are installed in the AI era





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Campus Bellaterra



Computer Vision Center Google earth

Imagery Date: 8/5/2011 41°30'03.67" N 2°06'31.71" E elev 130 m

eye alt

Administration Image © 2013 Institut Cartogràfic de Catalur Escola d'Enginyeria

UAB







UB

Campus Edifici Històric

ÚRL Facultat de Filosofia

> Universitat de Barcelona

talunya 😋

1 year program (60 ECTS: European Credit Transfer System)

troduction to human and CV	6	UPC	
otimization and Inference techniques for CV	6	UPF	6 ECTS
achine Learning techniques for CV	6	UAB	
) Vision	6	UPF	
sual Recognition	9	UAB-UB	
deo Analysis	9	UPC-UB	
search Dissemination and Transfer	9	UOC	J LCTJ
aster Dissertation	9	ALL	
of a s d	timization and Inference techniques for CV chine Learning techniques for CV Vision ual Recognition eo Analysis search Dissemination and Transfer ster Dissertation	timization and Inference techniques for CV 6 chine Learning techniques for CV 6 Vision 6 ual Recognition 9 eo Analysis 9 search Dissemination and Transfer 9 ster Dissertation 9	timization and Inference techniques for CV 6 UPF chine Learning techniques for CV 6 UAB Vision 6 UPF all Recognition 9 UAB-UB eo Analysis 9 UPC-UB eearch Dissemination and Transfer 9 UOC ster Dissertation 9 ALL

Total: 60

1 ECTS = 25 Hours of student work

1 year program (2 Semesters)

	Courses	ECTS	Univ.	
C1	Introduction to human and CV	6	UPC	
C2	Optimization and Inference techniques for CV	6	UPF	1 st
C3	Machine Learning techniques for CV	6	UAB	Semester
C4	3D Vision	6	UPF	
C5	Visual Recognition	9	UAB-UB	2nd
C6	Video Analysis	9	UPC-UB	Semester
C7	Research Dissemination and Transfer	9	UOC	Annual
C8	Master Dissertation	9	ALL	Annual

1 year program (Contents)

	Courses	ECTS	Univ.	
C1	Introduction to human and CV	6	UPC	
C2	Optimization and Inference techniques for CV	6	UPF	Techniques
C3	Machine Learning techniques for CV	6	UAB	
C4	3D Vision	6	UPF	Vicion
C5	Visual Recognition	9	UAB-UB	VISION
C6	Video Analysis	9	UPC-UB	Порісніз
C7	Research Dissemination and Transfer	9	UOC	Transversal Skills
C8	Master Dissertation	9	ALL	Project
	Total:	60		

1 year program (Methodology)

	Courses	ECTS	Univ.	
C1	Introduction to human and CV	6	UPC	
C2	Optimization and Inference techniques for CV	6	UPF	
C3	Machine Learning techniques for CV	6	UAB	Project-based
C4	3D Vision	6	UPF	methodology
C5	Visual Recognition	9	UAB-UB	
C6	Video Analysis	9	UPC-UB	
C7	Research Dissemination and Transfer	9	UOC	Online Activities
C8	Master Dissertation	9	ALL	Individual work
	Total:	60		

1 year program (Coordinators)

	Courses	ECTS	Univ.	
C1	Introduction to human and CV	6	UPC	Philippe Salembier
C2	Optimization and Inference techniques for CV	6	UPF	Coloma Ballester
C3	Machine Learning techniques for CV	6	UAB	Ramon Baldrich
C4	3D Vision	6	UPF	Gloria Haro
C5	Visual Recognition	9	UAB-UB	Joan Serrat
C6	Video Analysis	9	UPC-UB	Javier Ruiz
C7	Research Dissemination and Transfer	9	UOC	David Merino
C8	Master Dissertation	9	ALL	
	Total:	60	M. Vanrell & J.R. Casas (I C. Ballester X. Baró (UO S. Escalera (♥ & R. Baldrich (UAB) UPC) (UPF) (UB)

1 year program (Methodology)

Courses		ECTS	Univ.			
C1	Introduction to human and CV	6	UPC			
C2	Optimization and Inference techniques for CV	6	UPF			
C3	Machine Learning techniques for CV	6	UAB	Project-based		
C4	3D Vision	6	UPF	methodology		
C5	Visual Recognition	9	UAB-UB			
C6	Video Analysis	9	UPC-UB			
C7	Research Dissemination and Transfer	9	UOC	Online Activities		
C8	Master Dissertation	9	ALL	Individual work		

1 year program (Project Coordinators)

	Courses	ECTS	Univ.	
C1	Introduction to human and CV	6	UPC	Ramon Morros
C2	Optimization and Inference techniques for CV	6	UPF	Karim Lekadir
C3	Machine Learning techniques for CV	6	UAB	Ramon Baldrich
C4	3D Vision	6	UPF	Gloria Haro
C5	Visual Recognition	9	UAB-UB	Ernest Valveny-Julio Silveira
C6	Video Analysis	9	UPC-UB	Javier Ruiz-Albert Clapés
C7	Research Dissemination and Transfer	9	UOC	
C8	Master Dissertation	9	ALL	
	Total	60		

1 year program (Project Coordinators)

	Courses	ECTS	Univ.	
C1	Introduction to human and CV	6	UPC	Ramon Morros
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C4	3D Vision	6	UPF	Gloria Haro
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C7	Research Dissemination and Transfer	9	UOC	
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	Total	60		

Project 1. Museum Painting Retrieval



Project 2. Removing Objects in Natural and Urban Scenes



Picture from: Komodakis and Tziritas, IEEE Trans Image Proc, 2007

Project 3. Image classification



Project 4. 3D recovery of urban scenes









Project 5. Deep Learning for Classification, Detection and Segmentation



Project 6. Road Traffic Monitoring



Schedule:

	Monday	Tuesday	Wednesday	Thursday	Friday		
Courses:	C1-C3-C5	C2-C4-C6	C1-C3-C5	C2-C4-C6			
4pm-5pm	Lecture	Lecture	Lecture	Lecture			
5pm-6pm	Lecture	Lecture	Lecture	Lecture			
6pm-7pm	[Lecture]	[Lecture]	[Lecture]	[Lecture]			
7pm-8pm	Project Follow-up			Project Follow-up			
	3 or 4 hours						
	Number of he	Number of hours per day depends on the Lecture Topic					
	Total amount Hours/Course = 6 per week						

6 hours/week (1 follow-up, 5 theoretical) within the schedule but can change a bit depending on the course and the contents
C



Schedule>.

C



C7. Research Dissemination and Transfer

C8. Master Dissertation

Congratulations to 2022 Graduated Students. Two Master Dissertations of our students, *Marcos V. Conde and Juan A. Rodriguez*, have been accepted for publication at <u>WACV'23</u>:

week	date	time	Lecture	Lecturer	Univ.	room
	Mon. Oct. 2nd	16:00-17:00	Human Visual system and perception	Javier Vázquez	UAB	UPC
	Mon. Oct. 2nd	17:00-18:00	Human Visual system and perception	Javier Vázquez	UAB	Campus Nord
	Mon. Oct. 2nd	18:00-19:00	Project Introduction	R. Morros & J. Ruiz	UPC	room A3-101
	Wed. Oct. 4th	16:00-17:00	Human Visual system and perception	Javier Vázquez	UAB	Google meet
	Wed. Oct. 4th	17:00-18:00	Human Visual system and perception	Javier Vázquez	UAB	room
• • • • • •						
	Mon. Oct. 9th	16:00-17:00	Image processing assessment and pixel-based processing	Philippe Salembier	UPC	UPC
	Mon. Oct. 9th	17:00-18:00	Image processing assessment and pixel-based processing	Philippe Salembier	UPC	Campus Nord room A3-101
2	Mon. Oct. 9th	18:00-19:00	Project Introduction	R. Morros & J. Ruiz	UPC	
				100-100-000 1000 from 1000		
	Wed. Oct. 11th	16:00-17:00	Morphological and nonlinear filtering	Philippe Salembier	UPC	Google meet
	Wed. Oct. 11th	17:00-18:00	Morphological and nonlinear filtering	Philippe Salembier	UPC	room
			Space-frequency representation			
	Mon. Oct. 16th	2+A16:A21	Fourier transform and linear filtering	Javier Ruiz	UPC	UPC
	Mon Oct 16th	17.00-18.00	Space-frequency representation,			Campus Nord
	WON. Oct. 10th	17.00-18.00	Fourier transform and linear filtering	Javier Ruiz	UPC	room A3-101
3	Mon. Oct. 16th	18:00-19:00	Project Introduction	R. Morros & J. Ruiz	UPC	
	2		Space frequency representation			
	Wed. Oct. 18th	16:00-17:00	Fourier transform and linear filtering	Javier Ruiz	UPC	Google meet
	Wed Oct 18th	17.00-18.00	Space-frequency representation,			room
	Wed. Oct. 15th	17.00-10.00	Fourier transform and linear filtering	Javier Ruiz	UPC	
			Space-frequency representation			
	Mon. Oct. 23rd	16:00-17:00	Fourier transform and linear filtering	Javier Ruiz	UPC	UPC
	Mon Oct 22rd	17.00 19.00	Space-frequency representation,			Campus Nord
4	101011. Oct. 2510	17.00-18.00	Fourier transform and linear filtering	Javier Ruiz	UPC	room A3-101
	Wed Oat 25th		1101451110214			
	wed. Oct. 25th		HOWEWORK			
	Mon. Oct. 30th	16:00-17:00	Feature extraction	Ramon Morros	UPC	LIPC
	Mon. Oct. 30th	17:00-18:00	Feature extraction	Ramon Morros	UPC	Campus Nord
5	Mon. Oct. 30th	18:00-19:00	Project Introduction	R. Morros & J. Ruiz	UPC	room A3-101
		4				
-	Wed. Nov. 1st		HOLIDAY			
	Man New Cil	16.00 17.00				
	won. Nov. 6th	19:00-17:00	Grouping, segmentation and classification	Ramon Morros	UPC	Nord
	Mon. Nov. 6th	17:00-18:00	Grouping, segmentation and classification	Ramon Morros	UPC	room A3-101
6					-	
	Wed. Nov. 8th	16:00-17:00	Grouping, segmentation and classification	Ramon Morros	UPC	Google meet
	Wed. Nov. 8th	17:00-18:00	Grouping, segmentation and classification	Ramon Morros	UPC	room
		10.00.10.00				
7	Mon. Nov. 13th	16:00-19:00	Project Presentations	R. Morros & J. Ruiz	UPC	A3-101
	Mon Nov 20th		HOMEWORK			
- I	1000.2011	I	HOWEWORK	1	1	1

C1. Introduction to human and computer vision

We kept old schedule:

4 Theory hours/week

1 Follow-up session

We removed free days



Changes for the Academic Year 2023-2024. This master will be improved by incorporating a new partner, Universitat de Barcelona (*Campus Edifici històric*) updating contents, <<u>New Program</u>>, and schedule, <<u>New</u> Schedule>.

Congratulations to 2022 Graduated Students. Two Master Dissertations of our students, *Marcos V. Conde* and Juan A. Rodriguez, have been accepted for publication at <u>WACV'23</u>: C6. Video Analysis

C8. Master Dissertation

C7. Research Dissemination and Transfer



C2. Optimization for Introduction to Human and Computer Vision

week	date	time	lecture	lecturer	Univ.	room
	Tue. Oct. 3rd	16:00-17:00	Introduction to optimization problems and energy minimization methods. Examples and overview of a variational formulation.	Coloma Ballester	UPF	room 52.321 Roc Boronat building
	Tue. Oct. 3rd	17:00-18:00	Numerical techniques for variational problems (I): Gateaux derivative, Euler-Lagrange equation and Gradient methods.	Coloma Ballester	UPF	room 52.321 Roc Boronat building
	Tue. Oct. 3rd	18:00-19:00	Numerical techniques for variational problems (II): Gateaux derivative, Euler-Lagrange equation and Gradient methods.	Coloma Ballester	UPF	room 52.321 Roc Boronat building
1						
	Thu. Oct. 5th	16:00-17:00	Numerical techniques for variational problems (III): Gradient methods. Applications: denoising, image inpainting and Poisson editing.	Coloma Ballester	UPF	zoom room aula global UPF
	Thu. Oct. 5th	17:00-18:00	Review and complements of numerical linear algebra (I): least squares methods, singular value decomposition and applications.	Pablo Arias	UPF	zoom room aula global UPF
	Thu. Oct. 5th	18:00 - 19:00	Project Introduction	Karim Lekadir	UPF	zoom room aula global UPF
	Tue. Oct. 10th	16:00-17:00	Review and complements of numerical linear algebra (II): least squares methods, singular value decomposition and applications.	Pablo Arias	UPF	room 52.S27 Roc Boronat building
2	Tue. Oct. 10th	17:00-18:00	The Backpropagation strategy for gradient computation. Gradient descent optimization algorithms useful for deep learning strategies (I)	Pablo Arias	UPF	room 52.S27 Roc Boronat building
	Tue. Oct. 10th	18:00-19:00	The Backpropagation strategy for gradient computation. Gradient descent optimization algorithms useful for deep learning strategies (II)	Pablo Arias	UPF	room 52.S27 Roc Boronat building
	Thu. Oct. 12th		HOLIDAY			
	Tue. Oct. 17th	16:00-17:00	Convex optimization (I). Convex sets and convex functions. Convex optimization.	Pablo Arias	UPF	room 54.084 Tallers building
	Tue. Oct. 17th	17:00-18:00	Convex optimization (II). Constrained optimization. Karush– Kuhn–Tucker optimality conditions.	Pablo Arias	UPF	room 54.084 Tallers building
3	Tue. Oct. 17th	18:00-19:00	Convex optimization (III). Constrained optimization. Karush– Kuhn–Tucker optimality conditions.	Pablo Arias	UPF	room 54.084 Tallers building
	Thu. Oct. 19th	17:00-18:00	Segmentation with variational models. The Mumford and Shah Functional and the Level sets framework.	Karim Lekadir	UPF	zoom room aula global UPF
	Thu. Oct. 19th	18:00-19:00	Project follow-up	Karim Lekadir	UPF	zoom room aula global UPF
4	Tue. Oct. 24th		HOMEWORK			
	Thu. Oct. 26th		HOMEWORK			
	Tue. Oct. 31st	16:00 - 17:00	Convex optimization (IV): Duality principles and methods. Subgradient methods. Interior point methods. Non-convex problems and convex relaxation.	Coloma Ballester	UPF	room 52.321 Roc Boronat building
	•					

We moved to the new schedule:

- 6 Theory hours/week
- 1 Follow-up session

We have a free week (October 23th)

Important note:

Follow-up sessions has to be online for this year, but not presentations.

Prof. Karim Lekadir can not be in person for the follow-ups.

Teaching 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.
- **Project follow-up 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
- Homework, student will work in groups to solve the problems of the projects with deliverables:
 - Code
 - Reports
 - Oral presentations

C7. Research Dissemination and Transfer

	Courses	ECTS	Univ.
C1	Introduction to human and CV	6	UPC
C2	Optimization and Inference techniques for CV	6	UPF
C3	Machine Learning techniques for CV	6	UAB
C4	3D Vision	6	UPF
C5	Visual Recognition	9	UAB-UB
C6	Video Analysis	9	UPC-UB
C7	Research Dissemination and Transfer	9	UOC
C8	Master Dissertation	9	ALL
	Total:	60	

Important note: Starts on October 18th

Contents

Project Planification and Development

Project Planning Data Analysis Ethics in Research: Debate

Writing Scientific texts in Latex

Introduction to Latex: edition of basic text Advanced Latex: Standard text edition Writing scientific texts: simplifying a scientific document Writing Scientific Texts: introduction to computer vision (C1) Writing of Scientific Texts: machine learning techniques for computer vision (C3 or C4) Literature review and composition of the state-of-the-art

Oral presentation

Oral Presentation: "Introduce yourself" Oral Presentation: "Machine learning for computer vision"

Research management and dissemination

Publishing Research Results: quiz test Entrepreneurship Public Funding of Research Projects Intellectual property, patents, copyright and trademarks

Methodology: Online Asynchronous. Access to Materials and Agenda of Activities with Deliveries

FULL TIME option



PART TIME option

1st YEAR:

October	November	December	Febi	ruary		Μ	ау	June	July or September
C1. Introducti and CV	on to human	C3. Machine Learning techniques for CV		C5. V	isual Recognition				
C7. Research	C7. Research Dissemination and Transfer								

2nd YEAR:

October	November	December	Febr	uary		м	ау	June	July or September
C2. Optimization and Inference techniques for CV		C4. 3D Vision		C6. Video Analysis					
C8. Master Dissertation									

C8. Master Dissertation

	Courses	ECTS	Univ.
C1	Introduction to human and CV	6	UPC
C2	Optimization and Inference techniques for CV	6	UPF
C3	Machine Learning techniques for CV	6	UAB
C4	3D Vision	6	UPF
C5	Visual Recognition	9	UAB-UB
C6	Video Analysis	9	UPC-UB
C7	Research Dissemination and Transfer	9	UOC
C8	Master Dissertation	9	ALL

Total: 60

C8. Master Dissertation

January-March, Project proposals are made available, they can be seen at:

- Academic: <u>https://mcv.uab.cat/show_academic_proposals/</u>
- Company: <u>https://mcv.uab.cat/show_company_proposals/</u>

April, Selection period is open

Students should discuss with academic supervisors and companies and select a project.

End of April, Project assignment

Students take a decision

May-September (or July) - Master project development

Project carries 225 hours of work and should be completed between May and September.

Defence of the thesis (July or September)

Call 1: July 1st / Call2: September 1st

Step 1. Informing M9 coordinators about your intention of defending your MSc thesis

Step 2. Submitting your dissertation (pdf report)

Step 3. Oral presentation

Evaluation

	Courses	ECTS	Univ.
C1	Introduction to human and CV	6	UPC
C2	Optimization and Inference techniques for CV	6	UPF
C3	Machine Learning techniques for CV	6	UAB
C4	3D Vision	6	UPF
C5	Visual Recognition	9	UAB-UB
C6	Video Analysis	9	UPC-UB
C7	Research Dissemination and Transfer	9	UOC
C8	Master Dissertation	9	ALL
	Total:	60	

Evaluation C1-C6

The final marks for modules M1-M6 are computed with a formula, such as:

Final Mark = 0,4 x Exam + 0,55 x Project + 0,05 x Attendance

Exam: is the mark obtained in the Module Exam (must be equal or greater than 3)

Attendance: is the mark derived from the control of attendance at lectures

(must be at least 70%)

- **Project:** is the mark provided by the project coordinator based on the weekly control of the project through the project sessions and deliverables accordingly with specific criteria of the projects, such as:
 - Participation in discussion sessions and in team work (intra-group evaluations)
 - 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.

Special Exercises can allow you to get extra points ot increase the Exam Mark, but only if Exam Mark is greater than 3.

Evaluation

		Courses	ECTS	Univ.
	C1	Introduction to human and CV	6	UPC
	C2	Optimization and Inference techniques for CV	6	UPF
	C3	Machine Learning techniques for CV	6	UAB
	C4	3D Vision	6	UPF
	C5	Visual Recognition	9	UAB-UB
_	C6	Video Analysis	9	UPC-UB
	C7	Research Dissemination and Transfer	9	UOC
	C8	Master Dissertation	9	ALL
		Total:	60	

Evaluation C7

The final Mark in this course will be computed by the following weighted formula on the whole evaluation activities:



Evaluation

	Courses	ECTS	Univ.
C1	Introduction to human and CV	6	UPC
C2	Optimization and Inference techniques for CV	6	UPF
C3	Machine Learning techniques for CV	6	UAB
C4	3D Vision	6	UPF
C5	Visual Recognition	9	UAB-UB
C6	Video Analysis	9	UPC-UB
C7	Research Dissemination and Transfer	9	UOC
C8	Master Dissertation	9	ALL
	Total:	60	

Evaluation C8

The final Mark of the dissertation is computed by the following weighted formula:

Final Mark = 0,25 x Supervisor Evaluation + 0,75 x Committee Evaluation

Supervisor Evaluation Criteria:

- Technical Competences
- Attitude
- Innovation and Research capabilities

Committee Evaluation Criteria:

- Written report
- Work carried out
- Oral presentation

Plagiarism and irregularities:

Notwithstanding other disciplinary measures deemed appropriate, and in accordance with the academic regulations in force, **assessment activities will receive a zero whenever a student commits academic irregularities** that may alter such assessment.

Assessment activities graded in this way and by this procedure **will not be re-assessable**. If passing the assessment activity or activities in question is required to pass the subject, the awarding of a zero for disciplinary measures will also entail a direct fail for the subject, with no opportunity to re-assess this in the same academic year.

Irregularities contemplated in this procedure include, among others:

- the total or partial copying of a practical exercise, report, or any other evaluation activity,
- allowing others to copy,
- unauthorized and/or non-cited use of Al tools (such as, Copilot, ChatGPT or equivalent) to solve exercises or projects or any assessed activity,
- presenting teamwork that has not been entirely done by the members of the team,
- presenting any materials prepared by a third party as one's own work, even if these materials are translations or adaptations, including work that is not original or exclusively that of the student,

• having communication devices (such as mobile phones, smart watches, etc.) accessible during theoretical-practical assessment tests (individual exams).

Communication

Courses

C1	Introduction to human and CV	
C2	Optimization and Inference techniques for CV	
C3	Machine Learning techniques for CV	
C4	3D Vision	1
C5	Visual Recognition	
C6	Video Analysis	
C7	Research Dissemination and Transfer	
C8	Master Dissertation	

Moodle rooms at UAB Virtual Campus at CV.uab.cat





Benvinguda al Campus Virtual

Canvi de curs acadèmic a Campus (2023-2024)

Ja teniu disponibles les vostres aules del curs 2023-24 al tauler del Campus Virtual. Podreu continuar accedint-hi a les dels cursos 2021-22 i 2022-23 des del menú Cursos.

NIUs no personals

Com a conseqüència de la política de la UAB en relació a l'accés dels NIUs no personals a diferents serveis, a partir de setembre aquests NIUs també deixaran de tenir accés al Campus Virtual. Fins al dia del canvi hi podran accedir, però no en podran gestionar les aules.

És per aquest motiu que us recomanem que, si és el cas, us assegureu que la vostra aula té un o més NIUs personals assignats, per tindre-hi accés a partir del setembre.

 \rightarrow

Your subjects

Preferences 3₽

Latest news

Messaging (moodle)

C1. Introduction to Human and Computer Vision [MO64870] (23-24) →

- C2. Optimisation techniques for Computer Vision [MO65058] (23-24) →
- GEI Coordinació professorat [MO60966] (23-24)



App UAB, the University in your pocket



workshops begins on 18 September

Come to know your library!

Utilities				
🔩 Moodle classroom management				
⑦ Moodle: Help for teachers				
勐 Virtual Campus in figures				
Courses				
Current course				

Previous academic year (22-23)

Previous academic year (21-22)

Shortcuts

At Escola d'Enginyeria Email Surveys Academic year calendar



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 ✓ Gene News ✓ Cont 	C1. Introduction to Human and Computer Vision [MO64870] ts	
Coord Lect Calen	tors and Lecturers Course Settings Participants Grades Reports More ~ 2023	
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QS Te V Evalu Evalua	•W5 • ion • Contacts • Contacts • PAGE Coordinators and Lecturers	
	✓ Lectures FILE Calendar 2023	

About UAB e-mail address

You can access your account at: correu.uab.cat with the UAB NIU and password

Once logged in, you should

• At the top of the page, select **Settings** > **View all Outlook settings**.

INIPORTANT

- Select Mail > Forwarding.
- Select Enable forwarding, enter the forwarding email address

If you have technical problems with your account or

Campus Virtual you can contact to cas@uab.cat

Communication

Courses

C1	Introduction to human and CV	
C2	Optimization and Inference techniques for CV	
C3	Machine Learning techniques for CV	
C4	3D Vision	
C5	Visual Recognition	
C6	Video Analysis	LIOC Virtual Campus for C7
C7	Research Dissemination and Transfer	
C8	Master Dissertation	- www.uoc.edu

UOC Virtual	Campus for C7		You Will receive your login				
			information from UOC at your				
< → C O	https://www.uoc.edu/portal/en/index.html		contact e-mail given to UAB				
UOC UOC Corp	C UOC Alumni Join our team porate	News	Contact The UOC in EN C				
Universitat Obert de Catalunya	^a Learning. Transform	ning.					
About us: a pione online university	ering Research and innovation Open kn	owledge Global impact #2030Agenda	Course offering				
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2023/2024	The	ey are different fro	m the				
Con	ntrasenya	UAB NIU/passw	ord!!!				
Ha	s oblidat la contrasenva?						
Don't miss these videos fu	Entra Ves a uoc.edu						
techniques for studying!							
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lr	mportant: C7 co	urse starts on	October 18th				
What will h			0				
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Welcome session

- 1. aim of the master
- 2. about computer vision
- 3. about the master
- 4. about the partners
 - UAB-CVC
 - UOC
 - UPC
 - UPF
 - UB
- 5. about the students



UAB

Created in 1968

University campus with 263ha with all necessary services for living



International Ranquings



Rank	Scientific fields and subjects
1-50	Geography (34), Veterinary Sciences (5)
51-75	Agricultural Sciences
76-100	Biotechnology, Ecology, Economics
101-150	Atmospherical Sciences, Instrumental Sciences and Technology, Mathematics, Materials Science, Nanoscience and Nanotechnology, Oceanography, Physics,
151-200	Biological Sciences, Chemistry, Energy Science and Engineering, Environment Science and Engineering, Hospitality and Tourism Management, Human Biological Sciences, Medical Technology, Nursing, Pharmacy, Political Science, Public Administration, Sociology
201-300	Biomedical Engineering, Clinical Medicine, Earth Sciences, Education, Food Science and Technology, Psychology, Telecomunications Engineering

Degrees

112 Bachelor's degrees
140 Official Master's degrees
129 Master's Degrees
293 Lifelong learning programmes

56 MOOC offered at Coursera
221,562 MOOC students
89% Bachelor's degree performance rate
93% Employment rate

Students

27,203 Undergraduate students (25,537 full-time)
2,987 Official Master's students
2,046 UAB master's degree students
3,789 Lifelong learning programmes students

Staff

57 Departments **Computer Science Department**

15 Centers — Engineering School

4,020 Teaching and Research Staff



Computer Vision Center, since 1995







ONGOING PHD THESIS

2,8 M

€/YEAR INCOME



- **40** active projects with a total budget of 2.342.200 €
- **18** new projects with a total budget of 1.188.372 €
- Transferred Licenses
- +150 companies among our customers and contacts

CVC SPIN-OFFS







Universitat Autònoma de Barcelona



Research Lines







Computer assisted diagnosis, intervention and planning; Augmented modelling; Well-being and ambient assisted living.







Mobility and transport

Advanced driving systems and autonomous driving; Virtual worlds for ADAS; Unmanned Aerial Vehicles.

Culture & Experience-based technologies

Cultural heritage (AR/VR) Reading Systems – Document analysis Surveillance

Industry 4.0 Quality control AR/VR technologies for industry 4.0 Robotic Vision





The world's first online university



"We wanted to break down the barriers of space and time"

Gabriel Ferraté, the UOC's founding president

Our story

Mary Beard is awarded an honorary doctorate for her Ċ The Interne academic and scientific ... achievements and her commitment to defendi Interdisciplinary Manuel Castelle Institute (IN3) research starts the 2001/2002 During the 2009/2010 centre was born women's rights. academic year with a academic year the UOC celebrates its 15th P New internatio lecture on "Internet • 49.671 studen office in Bogotá. The academic year is The international and freedom". 31 October 1995 Our first academic year Our first fou anniversary. It reaches affected by COVID-19. doctoral programme The UOC opens its first • 44,367 13 December 2005 the figure of 56,000 postgraduate courses an For the first time, all final Launch of Project Internet Catalonia Appointment of Imma Tubella as President. international office in Mexico City. starts with 206 students aunched: students and more than The new 2014-2020 sessment tests are held Knowledge Society is The UOC adheres to t and two programs · Business Studies online. Teacher Training 20,000 graduates. Strategic Plan focus Creation of UOC Alumni launched. The UOC United Nations 2030 which finished in on exc How to Create a which takes over from Agenda for Sustain hosts the first 2005: a large-scale a 11 STL student The UOC receive 6 October 2015 Creation of the Centre for - Educational Psychology Marketing Plan Programmes in Spanish the Graduates and research, enhancing Creation of UOC Corporate, which offers innovative over 77,500 the Technological International Accounting and Finance for Noninterdisciplinary Modern Languages. employability. are offered for the first Former Students Club esearch programme Innovation and Ouality Seminar on Higher Education strengthening the University's time thanks to a five-year formed in 2001. Award from the Centro for Innovation and that studied Creation of O2, the Accountants partnership with Grupo Planeta. Rankings and E-learning. learning solutions for over 85,700 Catalonia's UOC's open-access institutional repositor global profile and collaborative **Total Quality** companies. Management of Services transition to an **Business Development** 21,374 16,366 grad information society (CIDEM) of publications. governance 1994/1995 1996/1997 1998/1999 2000/2001 2002/2003 2008/2009 2010/2011 2006/2007 2012/2013 2018/2019 2004/2005 2014/2015 2016/2017 2001/2002 2003/2004 2005/2006 1995/1996 1997/1998 1999/2000 2007/2008 2009/2010 2011/2012 2013/2014 2015/2016 2017/2018 2019/2020 P 6 October 1994 The first two UOC Creation of the digital Creation of the The Catalan University 10 October 2008 The Virtual Campus and the UOC Library catalogue LIOC X takes over from The acquisition of two Creation of the Fundació First online university journal Artnodes, which explores the nternational Journa Ensenyament Obert and EducaciOnline Award of an honorary certified master's Quality Assurance buildings in the Can Creation of Hubbik, a per a la Universitat Oberta de Catalunya. entrance course for degrees are launched of Educational Agency (AQU Catalunya doctorate to Sir are made accessible to Jaumandreu complex in 3 April 2013 Poblenou moves the UOC's over.25s Occupational Health Technology in Higher Education (ETHE), ives a favourable Timothy Berners Lee mobile devices. platform for nurturing o offer advance-leve intersect Appointment as president of New centr art, science and Safety and Conditions ssessment to UOC for his contribution in entrepreneurship, raining beyond nerve centre to the 22@ 6 April 1995 in Madrid. Financial Instruments technology. initially titled the programmes through developing information The open access policy is open innovation and iniversity. district, Barcelona's digital Josep A. Planell The Catalan Parliamen and Markets evista de Universidad its Virtual programme - the first accreditation and co ved and all scientifi knowledge transfer 1,000 approved and all seren and teaching output is unanimously approves a law to officially recognize aunch of the eHealth Sociedad del echnologies, and in Creation of the UNESCO over 4.001 Conocimiento (Journa of official online Creation of the Center (eHC). The UOC becomes a WHO The first graduation E-learning Chair. particular for having made freely available to the the UOC. ceremony is held in of the University and programmes. invented the World Wide Doctoral School collaborating centre for community wledge Society Web in 1990 over 7,00 e-health. Manresa. Josep Laporte receives the UOC's first honorary P RUSC), which gradually climbs to the top of over 300 Creation of the eLearn doctorate for his the main teaching and contribution to the Center (eLC). 26 May 1995 technology indexes creation of the university Appointment of our first president, Gabriel Ferraté over 4,700 • 1,766,926,40 **Evolutions in technology** Studer * In 1990 Tim B ers-Lee invents the World Wide Web For the first Pages on For the first time, UOC students receive their exam results by SMS! Sony laund the first PlayStation never said so much – people get tweeting on Twitter. 863,105,65 on a new dimension with the streaming service hits the scene -Spotify! Gmail and get up and running. social media appear such Creation of Cadabra.co an online bookstore that will later becc Amazon! More than 50 million users are hit by ILoveYou – the first massnetwork TikTok an the video game Fo take the world by storm. appearance of iCloud. This is Wikipedia reaches more than one millior articles. changes the way we Skype, Safar Second Life, The BlackBe opening the door t

05-06

02-03

06-07

The idea behind founding the UOC back in 1995 was not to create a distance university, but to take advantage of the incipient World Wide Web to create the first-ever distanceless university

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16.17

17.19

18.10

19-20

12-13

11.17

13-14

24 October 2019



Leaders in quality e-learning

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The UOC has students in 141 countries Image: State of the students of the state of	gr	95,000 raduates	6,500 course instructors and tutors	15,500 virtual classrooms	Tin Wo Globa Top amor	nes Higher Educ orld University of 175 og young universities	<i>cation</i> Rankings
They come from many places and social backgrounds. They are between 25 and 40 years old, and more than 57% are women. They study, work and have family obligations. They have previous training and professional experience: almost 67% work in the private sector and 61% are studying to increase their knowledge. They have little time and balance their studies with their work.	st	87,500 tudents	800 programmes taught		Ibero-America 1st online university Spain 4th university created less than 50 years ago		
1,944 students have a certified disability of 33% or more	IN3 & faculties research group	Research centres Internet Interdis (IN3) The institute specializes i effects on human behavior	sciplinary Institute in the internet and technology's iour	Social sciences	205	Arts and humanities	Information and knowledge society
ing search in	Faculties' research group	eHealth Center (The centre conducts rese about a paradigm shift in	eHC) earch into digital health to bring n health and transform the system	Health sciences		Information and communication technologies	E-learning
The research groups are	eHealth Cente & faculties' research group	er ps er model to the next level	ation Center (eLinC) learning to bring our educational		Ç	ĿĘ	Ę
made up researchers from the research centres and research faculty from the faculties.		Doctoral School It organizes and coordina frame of reference for th offered by the University	ates doctoral courses and acts as a e various doctoral programmes				



AIWELL Artificial Intelligence for Human Well-being Lab



at the same time.

Our mission Rubén Carles Mohammad Mahd lassar Gereziher W Xavier Civit González Hayat Bustos Adhane Dehshibi Baró Advancing AI research and creating (PhD Student) (PhD Student) (PhD Student) (PhD Student) (PhD Student) (Postdoc) (Faculty) trustworthy AI technologies to promote and improve the human well-being. Carles Daniel David David Agata David Ventura Sanchez Moran Lapedriza Masip Merino (Faculty) (PhD Student) (PhD Student) (Faculty) (Faculty) (Faculty) Natural Language **Computer Vision Explainable Al** Fairness in Al Collage of some medical imaging applications in which deep learning has achieved state-of-the-art results. Processing From top-left to bottom-right Creating techniques to Creating computational Creating AI systems that Creating computational models to mammographic mass classification segmentation of lesions in the brain, leak detection in airway tree segmen diabetic retinopathy classification make sure the AI systems models to analyze and can provide explanations analyze and understand high level are not biased and work synthesize written and on their results that are information in digital images and prostate segmentation nodule classification understandable by well for any data group. spoken language. breast cancer metastas skin lesion classification videos. Special focus on: humans. bone suppression Person-centric Perception Scene Context Analysis Medical Image Analysis Visual analysis Jibo Station **Emotion Perception Behaviour Analysis** • Personality trait inference Text (spoken words) analysis Audio (voice) analysis Goal: reduce anxiety before surgery in Human Motion Prediction pediatric patients (3-10 years old) The glass is half empty • Hypothesis: through distraction, we The glass is half full ٠ can reduce stress and take vital signs




Campus d'Excel·lència Internacional

Universitat Politècnica de Catalunya Barcelona**Tech**

La UPC és una institució pública de recerca i d'educació superior en els àmbits de l'enginyeria, l'arquitectura, les ciències i la tecnologia, i és una de les universitats politècniques líders d'Europa.





Campus d'Excel·lència Internacional

Universitat Politècnica de Catalunya Barcelona**Tech**



La UPC és una universitat amb una extensa implantació en el territori, amb **9 campus** distribuïts en **7 ciutats** de **Catalunya**: Barcelona, Castelldefels, Manresa, Sant Adrià de Besòs, Sant Cugat del Vallès, Terrassa i Vilanova i la Geltrú.

 29.812
 3.523
 2.074
 65
 84

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18 centres docents 275 programes de formació permanent 19 patents el darrer any 317 M pressupost 2022 45 programes de doctorat

70.151 Alumni

72,7 M

ingressos per R+D+I (2021)



Campus d'Excel·lència Internacional

GPI – Image Processing Group Signal Theory and Communications Department



GPI – Image Processing Group

Signal theory and communications Department

- 10 faculty members
- 25 PhD and master students
- <u>https://imatge.upc.edu</u>
- Consolidated Research Group since 1999
- GPI is part of IDEAI



IDEAI - Intelligent Data Science and Artificial Intelligence

- UPC Research Center
- 60 researchers / 150 Phd and Master students
- <u>https://ideai.upc.edu</u>

GPI Experience:

- >30 years in image processing and computer vision
- Pioneered adoption of Deep Learning (DL) since 2015
 - Introduced DL in master and bachelor programs
- Long experience in European and national projects

GPI Current research lines:

- Medical imaging applications (neuroimaging, histopathology, dermoscopic,...)
- CV solutions for micro mobility vehicles
- CV for agri-food industry
- Image processing for plasma facing components protection
- Remote sensing applications (super-resolution, semantic segmentation,...)
- Human computer interfaces
- Audio-visual production, archives, search and retrieval



UPF An urban **public** university in the heart of Barcelona





Ciutadella campus:

Social Sciences and Humanities (+Inf. Tech.: <u>Centre for Brain</u> & Cognition - CBC)



Poblenou campus:

Health and Life Sciences

Mar campus:

Communication, Translation and Information Technologies

UPF in the rankings



1st. Spanish, 69th. European 156th. Worldwide (2022) **15th.** Worldwide Young University (<50Y)

1st. Spanish in <u>Engineering</u> studies **82nd. European** in <u>Engineering</u> studies **240th. Worldwide** in <u>Engineering</u> studies

5th. Worldwide in sector of gender & equality

(1) multirank **4th. European**

CONSTRUCTION CONST **1st.** Of two **Spanish** <u>ICT Department</u> granted with research excellence seal **Maria de Maeztu** by the Spanish Ministry

3rd. Spanish <u>university</u> in terms of absolute H2020 funding [source: Horizon dashboard] **21** cumulative ERC grants @DTIC up to date



School of Engineering Department of Information and Communication Technologies (DTIC)



46 Faculty members: 16 Full Professors
 + 20 Associate Professors
 + 10 ICREA Research Professors
 (<u>Catalan Institution for Research and Advanced Studies</u>)

23 Research Groups: 5 Research Areas



Research at Intelligent Multimodal Vision Analysis (IMVA) group

PIs: Coloma Ballester, Gloria Haro, Federico Sukno

Our overall goal is to investigate the automatic analysis and understanding of visual content and to address real-world problems and applications, often involving also modalities beyond vision, such as audio, natural language, ultrasound or magnetic resonance. We develop model-based and data-driven (deep learning) approaches, algorithms and innovative digital technologies, together with their theoretical analysis. The applications include: accessibility of people with visual, hearing or reading impairment to multimedia content and may contribute to the development of more accessible devices; the analysis of the human face both in terms of its morphology and its dynamics (e.g. expressions and emotions) with enormous potential for disciplines such as psychology, linguistics, neuroscience, health or developmental biology; the separation of the different audio sources that make up the audio mixture of a particular video; the understanding and the exploitation of the correlations and complementations among different modalities; etc



UB



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DEPARTAMENT DE MATEMÀTIQUES i INFORMÀTICA

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WIKIPEDIA The Free Encyclopedia	Q Create account Log in ····		
University of Barcelona		文 _人 53 lang	uages 🗸
Talk	Read	Edit View history	Tools 🗸
kipedia, the free encyclopedia	Coordinates: 🥥 41°23'12"N 2°09'50"E		
versity of Barcelona (Catalan: Universitat de Barcelona, UB; Spanish: Universidad de	University of Barcelona		
na) is a public research university located in the city of Barcelona, Catalonia, Spain. With students, it is one of the biggest universities in Spain. ^[4] It is one of the oldest universities in talonia and Spain, established in 1450.	Universitat de Barcelona UNIVERSITAT DE BARCELONA		
sidered one of the best universities in Spain. ^{[5][6]} Overall, the UB has been ranked 1st in Spain of the 2023-2024 rankings ^{[7][8][9]} and is located around the 50th place in Europe. ^[10]			
06 departments and more than 5,000 full-time researchers, technicians and research	luce (Freedom bathes everything with light)		hes ht)
ment of Catalonia. In 2010, the UB was awarded 175 national research grants and 17 European	Type Public		
nd participated in over 500 joint research projects with the business sector, generating an esearch income of 70 million euros. The work of these groups is overseen by the UB's	Established	stablished 3 November 1450; 572 years ago	
n centres and institutes which collaborate with leading research institutions and networks in nd abroad. The LIB is also home to three large research foundations: the Barcelona Science	Rector Administrative	Joan Guàrdia 5.715	

Is the oldest and the best in a lot of indexes

1401 - General Study of Medicine and Arts
1450 - General Study of Barcelona
Suppressed in 1717, with the the lost of Catalan independence.
1842 - Created again as University of Barcelona
1863 - Building of the current venue, courses started in 1871.

https://en.wikipedia.org/wiki/University_of_Barcelona



idation (PCB), which includes the Institute of Biomedical Research of Barcelona (IRBB); the



UNIVERSITATDE BARCELONA

Algebra and Geometry

Math & Computer Science Department IMUB Institut de Matemàtica

> Probability, Logic and Statistics

Analysis and Applied Mathematics









Human Pose Recovery and Behavior Analysis Group

Research lines Human Behavior Understanding



3D (& 4D) POSE, SHAPE, TEXTURE (IN 3D AND FROM 2D)



FACE ANALYSIS





BEHAVIOR ANALYSIS



UNDERSTANDING AND EXPLAINING HUMAN BEHAVIOR (Affective & Personality Computing) -INTERPRETABILITY & EXPLAINABILITY -FAIRNESS



BIAS ANALYSIS VISUALIZATION



INTERPRETING AND EXPLAINING LEARNING

Research lines:

- Spatio-temporal and multi-modal deep Learning
- Domain Adaptation
- Bias and fairness
- Explainability and interpretability

Research fields

- Computer Vision
- Machine Learning
- Social Signal Processing
- Affective Computing
- Personality Computing

Application domains:

- <u>eHealth and welfare</u>
- Security
- Connected city / home
- Leisure

Welcome session

- 1. aim of the master
- 2. about computer vision
- 3. about the master
- 4. about the partners
 - UAB-CVC
 - UOC
 - UPC
 - UPF
 - UB
- 5. about the students

Now, time for the students to introduce themselves

Welcome session

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Time to go to the garden (photo + drinks) ...