

Module: M2 — Optimization and inference techniques for

Computer Vision

Lecture 0: Presentation

October 4th, 2022





Contact information

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Lecturers:

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Main goals of the module

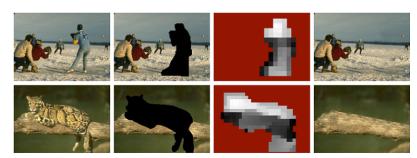
1. Theoretical aspects:

- Learn about the optimization algorithms and inference techniques that are behind many tasks in computer vision.
- Main concepts: energy formulation and minimization, numerical techniques for variational problems, gradient descent optimization algorithms and tools useful for deep learning strategies. convex optimization, and graphical models.
- Special emphasis on the formulation of the optimization problem and its resolution.
- The tools learnt along this module and project are generic and present in a majority of computer vision applications (as found in other modules, e.g. M3, M4, M6).
- Exercises to practice and deliver.
 - More exercises: previous exams in the 'Evaluation' section.

Main goals of the module

2. Practical aspects:

- The techniques will be applied in the context of image segmentation and inpainting.
- More detailed information on Thursday at 18:00h this week (room 52.S31 of UPF-Poblenou campus).



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	week	date	time	lecture	lecturer	university	room
E	1	Tue. Oct. 4th	16:00 -18:00	Introduction to optimization problems and energy minimization methods. Exemples and overview of variational formulations. Numerical techniques for variational problems (I).	Coloma Ballester	UPF	zoom room aula global UPF
	1	Thu. Oct. 6th	16:00 -18:00	Numerical techniques for variational problems (II): Gateaux derivative, Euler-Lagrange equation and gradient methods. Applications: denoising, image inpainting and Poisson editing. Review of numerical linear algebra (I).	Coloma Ballester	UPF	room 52.329, Roc Boronat building
l	1	Thu. Oct. 6th	18:00 - 19:00	Project Introduction	Karim Lekadir	UPF	room 52.329, Roc Boronat building
ľ	2	Tue. Oct. 11th	16:00 - 18:00	Review of numerical linear algebra (II): least squares methods, singular value decomposition and applications. The Backpropagation strategy for gradient computation.	Pablo Arias	UPF	zoom room aula global UPF
	2	Thu. Oct. 13th	16:00 - 18:00	Gradient descent optimization algorithms useful for deep learning strategies.	Pablo Arias	UPF	room 52.329, Roc Boronat building
L	2	Thu. Oct. 13th	18:00 - 19:00	Project follow-up	Karim Lekadir	UPF	room 52.329, Roc Boronat building
ľ	3	Tue. Oct. 18th	16:00 -18:00	Convex optimization (I). Convex sets and convex functions. Convex optimization. Segmentation with variational models. The Mumford and Shah Functional and the Level sets framework.	Pablo Arias / Karim Lekadir	UPF	zoom room - aula global UPF
	3	Thu. Oct. 20th	16:00 - 18:00	Convex optimization (II). Constrained optimization. Karush–Kuhn–Tucker optimality conditions.	Pablo Arias	UPF	room 52.329, Roc Boronat building
	3	Thu. Oct. 20th	18:00 - 19:00	HOMEWORK			
ľ	4	Tue. Oct. 25th	16:00 -18:00	Convex optimization (III): Duality principles and methods. Subgradient methods. Interior point methods. Non-convex problems and convex relaxation. Applications.	Coloma Ballester	UPF	zoom room - aula global UPF
	4	Thu. Oct. 27th	16:00 - 18:00	HOMEWORK			
	4	Thu. Oct. 27th	18:00 - 19:00	Project follow-up	Karim Lekadir	UPF	room 52.329, Roc Boronat building
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	5	Tue. Nov. 1st	16:00 - 18:00	HOLIDAY Bayesian networks and MRFs. Inference types. Main Inference algorithms. Examples: stereo, denoising.		UPF	room 52.329, Roc Boronat
	5	Thu. Nov. 3rd	16:00 - 18:00		Oriol Ramos	UPF	building
ı	5	Thu. Nov. 3rd	18:00 - 19:00	Project follow-up	Karim Lekadir	UPF	room 52.329, Roc Boronat building
ľ		Tue, Nov. 8th		Belief propagation: message passing, loopy belief propagation. Applications in the context of some deep learning strategies. Exercise: inference for			zoom room - aula global
	6	Tue. Nov. 8th	16:00 - 18:00	segmentation. Sampling methods: Particle-based methods, Markov Chain Monte Carlo, Gibbs Sampling.	Oriol Ramos	UPF	UPF room 52.329, Roc Boronat
	6	Thu. Nov. 10th	16:00 - 18:00		Oriol Ramos	UPF	building
ı	6	Thu. Nov. 10th	18:00 - 19:00	Project follow-up	Karim Lekadir	UPF	room 52.329, Roc Boronat building
ĺ	7	Thu. Nov. 17th	16:00 - 19:00	Project Presentations	Karim Lekadir	UPF	room 52.329, Roc Boronat building
ı	8	Tue. Nov. 22nd		HOMEWORK			
	8	Thu, Nov. 24th		HOMEWORK			
Γ				EXAM			room 52.117, Roc Boronat
ŀ	9	Thu. Dec. 1st	16:00 -19:00		Coloma Ballester	UPF	building