



COMPUTER ENGINEERING: MULTIMEDIA SECURITY, ROBOTICS AND COMPUTER VISION AND IMAGE PROCESSING

This course consists on a 3-weeks (60 hours) intensive academic training on three key topics nowadays in computer engineering: Multimedia Security, Computer Vision and Image Processing, and Robotics.

The students will be trained on different contents related to those topics. In particular: multimedia transmission, data security and legal issues, security in multimedia flows, copy detection; feature extraction and segmentation, motion analysis, object detection and classification, sensing and perception; robotic platforms, locomotion control of biped robots.

The methodology in this course will consist on training sessions (20 hours per week), combining both theoretical and practical lessons in the lab.

Practical exercises will be proposed to the students in order to complement their training and for evaluating their academic progress.

The students will have technical visits to the following facilities:

- Barcelona Super-computing Center
- Automotive plant
- Harbor logistics

Besides, the program is complemented with guided visits in the main cities of the area, and a hospitality program including welcome reception and farewell dinner.

Students	Duration	Period
12 to 20	3 weeks	Summer

CULTURE AND HOSPITALITY PROGRAM

The hospitality program includes:

- Welcome Reception at the College of Engineering.
- Tarragona city cultural visit
- Ebre Delta day outing
- Reus Modernist Route
- Winery visit
- Farewell meal





COURSE CONTENT

COURSE ON MULTIMEDIA SECURITY

Session 1: Background on Multimedia Transmission

- Compression Basics
- Audio and Video Compression
- Transport of Multimedia Systems
- Practice: Audio and Video, Compression and Quality

Session 2: Data Security and Legal Issues

- Attacks against Data and Computer Systems
- Symmetric Cryptography and Stream Ciphers
- Asymmetric Cryptography and Public Key
- Authentication of Data and Broadcast Encryption
- Practice: Encryption and Decryption

Session 3: Security in Multimedia Flows

- Secure VoIP and Video streams
- Security in DVB and IP-TV Systems
- Secure Internet TV Systems
- Secure Audio Streaming Services
- Secure Digital Music Stores
- Practice: Analysis of Security in Multimedia Services

Session 4: Copy Detection

- Legal Issues: Licenses and Copyright
- Watermarking
- Fingerprinting
- Copy Detection in Streaming Services
- Practice: Fingerprinting
- Practice: Analysis of Copy Detection Services

COURSE ON ROBOTICS

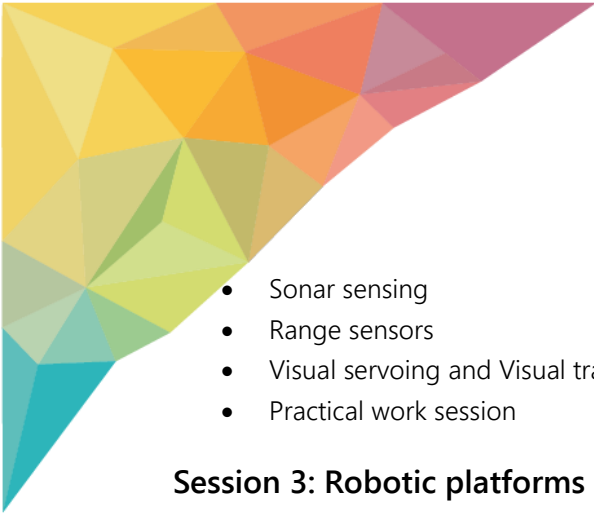
Session 1: Introduction to robotics

- Kinematics
- Dynamics
- Mechanisms and actuation
- Sensing and estimation
- Practical work session

Session 2: Sensing and perception

- Force and tactile sensors
- Inertial sensors, GPS and Odometry



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- Sonar sensing
 - Range sensors
 - Visual servoing and Visual tracking
 - Practical work session

Session 3: Robotic platforms

- Mobile and distributed robotics
- Field and service robotics
- Human-centered and life-like robotics
- Practical work session

Session 4: Locomotion control of biped robots

- Biped locomotion
- Motion control
- ZMP-based control methods
- Biologically inspired control methods
- Practical work session

COURSE ON COMPUTER VISION AND IMAGE PROCESSING

Session 1: Introduction to Image Processing and Computer Vision

- Basics of images
- Point operation and Enhancement
- Difference between image processing and computer vision
- Type of computer vision problems
- Computer vision models
- Mathematical concepts in computer vision
- Practical work session


Session 2: Feature Extraction and Segmentation

- Corner detection
- Feature Extraction
- Edge detection
- Basics of segmentation
- Practical work session

Session 3: Motion analysis

- Motion estimation
- Optical flow
- Practical work session

Session 4: Object detection and Classification

- Detection and classification models
 - Basics of machine learning
 - Practical work session
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CALENDAR

Week 1

	Mon	Tue	Wed	Thu	Fri	Sat
09.30-11.15	Welcome to URV	Multimedia Security	Technical visit: Barcelona Super-computing Center (TBC)	Multimedia Security	Multimedia Security	Ebre Delta day outing
	<i>Break</i>	<i>Break</i>		<i>Break</i>	<i>Break</i>	
11.45-13.30	Multimedia Security	Multimedia Security		Multimedia Security	Multimedia Security	
	<i>Lunch</i>	<i>Lunch</i>		<i>Lunch</i>		
14.30-16.30	Cultural visit Tarragona	Multimedia Security	Multimedia Security			

Week 2

	Mon	Tue	Wed	Thu	Fri	Sat
09.30-11.15	Robotics	Robotics	Technical visit: Automotive plant (TBC)	Robotics	Robotics	Winery visit at the Priorat County
	<i>Break</i>	<i>Break</i>		<i>Break</i>	<i>Break</i>	
11.45-13.30	Robotics	Robotics		Robotics	Robotics	
		<i>Lunch</i>		<i>Lunch</i>		
14.30-16.30	Cultural visit Reus	Robotics	Robotics			

Week 3

	Mon	Tue	Wed	Thu	Fri
09.30-11.15	Computer Vision and Image Processing	Computer Vision and Image Processing	Technical visit: Harbor logistics (TBC)	Computer Vision and Image Processing	Computer Vision and Image Processing
	<i>Break</i>	<i>Break</i>		<i>Break</i>	<i>Break</i>
11.45-13.30	Computer Vision and Image Processing	Computer Vision and Image Processing		Computer Vision and Image Processing	Diplomas
		<i>Lunch</i>		<i>Lunch</i>	
14.30-16.30		Computer Vision and Image Processing		Computer Vision and Image Processing	Farewell meal

