Communication Technologies and Multimedia

Laurea Magistrale

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(On Behalf of all the CTM-LM Faculty)

University of Brescia (Italy) – 2025-05-06

A Course for the Digital Economy

- The "Digital Economy" is growing ...

- **Digital Economy is based also on efficient and secure Multimedia Communications Systems**
- CTM-LM teaches the fundamentals of Secure Communications (fixed, mobile & the Internet), and Multimedia Signal Processing (Image/Video, Audio, Medical Data,…)

- It is an international degree:
  - Entirely taught in English
  - Double degree (GATECH, EMIMEP, ..)
  - Both Italian and foreign students

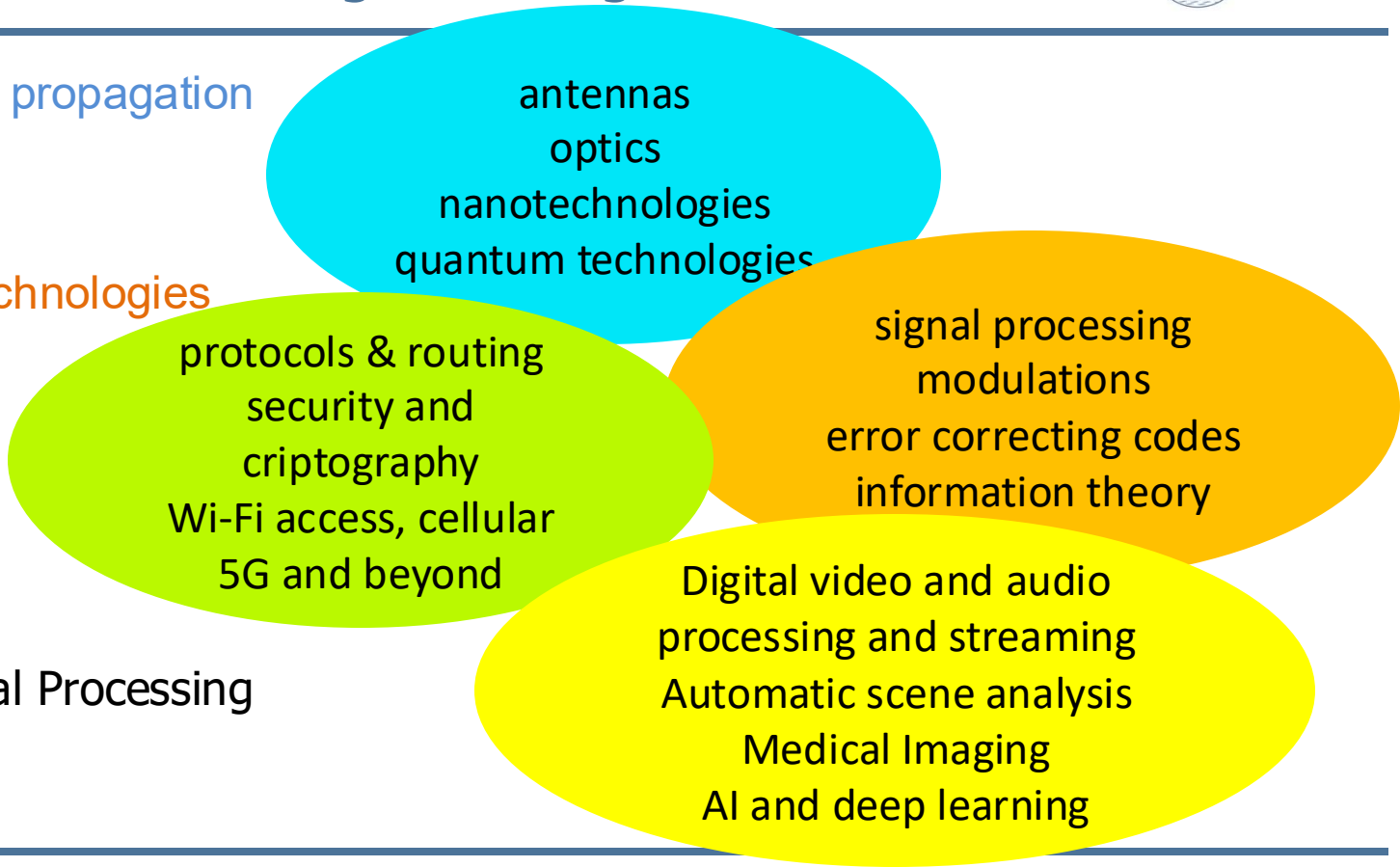
Communications Tech. & Multimedia

- Think about the last years technological evolution ...
- We are using
  - Telecommunications: transferring data (all of it !) around the world
    - Transmission techniques (optics, antennas, modulations, coding)
    - Networks and Protocols
  - Multimedia: video and audio to make conferences

- You can call it "The Internet" ... but ...

The four legs of the global network

- Electromagnetic propagation
- Transmission technologies
- Networking
- Multimedia Signal Processing



Admission Prerequisites

- Basic requirements, all in fundamental science
- No specific requirement related to Communications and Multimedia
  - The flexibility of the degree lets you choose what is best for you

SSD o insieme di SSD	Numero di crediti minimo da acquisire
MAT/01, MAT/02, MAT/03, MAT/04, MAT/05, MAT/06, MAT/07, MAT/08, MAT/09, FIS/01, FIS/02, FIS/03, FIS/04, FIS/05, FIS/06, FIS/07, CHIM/07, ING-IND/10	24

Year 1 Classes

Primo anno (attivo nell'a.a. 2025-26)	CFU	Attività	Per	SSD
1 DIGITAL COMMUNICATIONS				
- Information theory (6)	6	B	S1	ING-INF/03
- Digital modulation and channel coding (6)	6	B	S1	ING-INF/03
2 A scelta tra:				
NETWORK SECURITY	6	B	S2	ING-INF/03
PHOTONICS	6	B	S2	ING-INF/02
3 A scelta tra:				
DATA-DRIVEN SYSTEM MODELLING	6	C	S1	ING-INF/04
QUANTUM TECHNOLOGIES	6	C	S2	FIS/03
4 ARTIFICIAL INTELLIGENCE FOR IMAGE ANALYSIS AND MEDIA GENERATION				
- Vision & Recognition (6)	6	B	S2	ING-INF/03
- Generative AI for Media (3)	3	B	S2	ING-INF/03
- Processing and Communications Laboratory (3)	3	B	S1	ING-INF/03
5 A scelta tra:				
DATA GOVERNANCE AND ANALYTICS IN HEALTH INFORMATION	6	C	S1	ING-INF/05
AMMINISTRAZIONE DI SISTEMA	6	C	S1	ING-INF/05
DATA SCIENCE FOR RELIABLE DECISION-MAKING	6	C	S2	ING-INF/04
SISTEMI INFORMATIVI EVOLUTI	6	C	S1	ING-INF/05
6 ELECTRONICS SYSTEMS FOR TELECOMMUNICATIONS				
- Digital Systems for Telecommunications (3)	3	C	S1	ING-INF/01
- Measurements and Instrumentation for telecommunications (3)	3	C	S1	ING-INF/07
7 ANTENNAS AND WIRELESS SYSTEMS LABORATORY				
- Antennas (6)	6	B	S2	ING-INF/02
- Wireless systems laboratory (3)	3	B	S2	ING-INF/02
8 A SCELTA DELLO STUDENTE	9	D		

Year 2 Classes

Secondo anno (attivo nell'a.a. 2026-27)	CFU	Attività	Per.	SSD
9 MULTIMEDIA COMMUNICATION SERVICES				
- Multimedia Information Coding and Description (6)	6	B	S1	ING-INF/03
- Streaming Technologies (3)	3	B	S1	ING-INF/03
10 A scelta tra:				
DIGITAL AUDIO PROCESSING	6	B	S2	ING-INF/03
ADVANCED METHODS FOR INFORMATION REPRESENTATION	6	B	S1	ING-INF/03
MICROWAVE ENGINEERING	6	B	S1	ING-INF/02
VEHICULAR NETWORKS AND COOPERATIVE DRIVING	6	B	S2	ING-INF/03
11 A scelta tra:				
DIGITAL AUDIO PROCESSING	6	B	S2	ING-INF/03
ADVANCED METHODS FOR INFORMATION REPRESENTATION	6	B	S1	ING-INF/03
MICROWAVE ENGINEERING	6	B	S1	ING-INF/02
VEHICULAR NETWORKS AND COOPERATIVE DRIVING	6	B	S2	ING-INF/03
12 A scelta tra:				
OPTICAL COMMUNICATION SYSTEMS		B	S2	ING-INF/02

Year 2 Classes

12 A scelta tra:				
OPTICAL COMMUNICATION SYSTEMS		*B*	*S2*	*ING-INF/02*
- *Optical Communication Components (6)*	*6*	*B*	*S2*	*ING-INF/02*

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Università degli Studi di Brescia

Corso di laurea magistrale in Communication Technologies and Multimedia

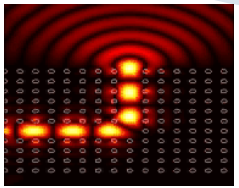
- *Optical Communication Networks (3)*	*3*	*F*	*S2*	*ING-INF/02*
REMOTE SENSING			*A*	
- *Image Data Analysis (6)*	*6*	*B*	*S1*	*ING-INF/03*
- *Remote Sensing Data Acquisition (3)*	*3*	*F*	*S1*	*ING-INF/02*
8 A SCELTA DELLO STUDENTE	*9*	*D*		
13 PROVA FINALE	*15*	*E*		

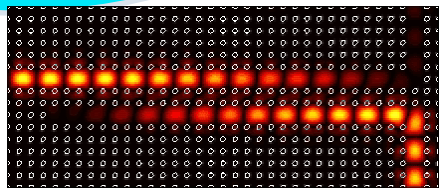
Details on: Propagation

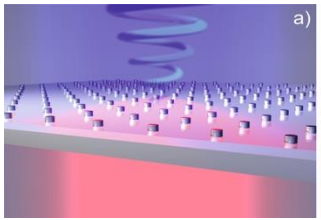
antennas
optics
nanotechnologies
quantum technologies

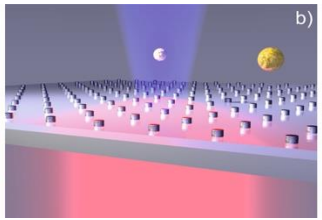
Electromagnetic propagation

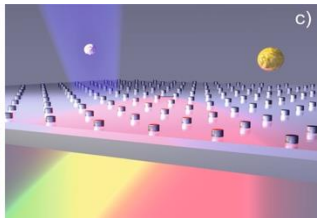
- Optical Communications
  - Non-linear Optics, Nano Structures, Flat Optics, ...
- Photonics
  - Surface propagation on graphene
- Antenna design
  - Free Space propagation
  - Urban propagation
  - Arrays

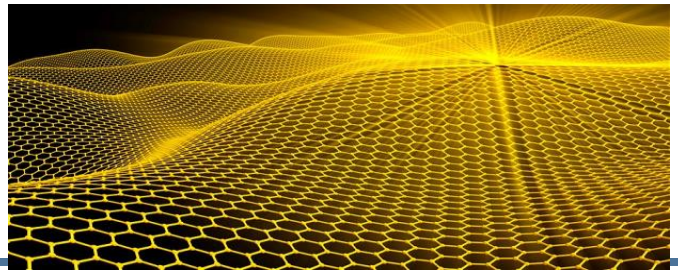






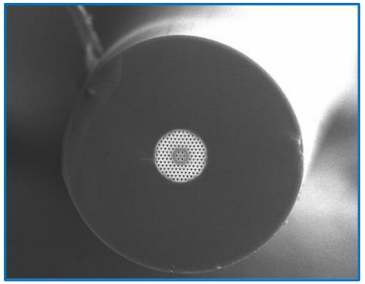


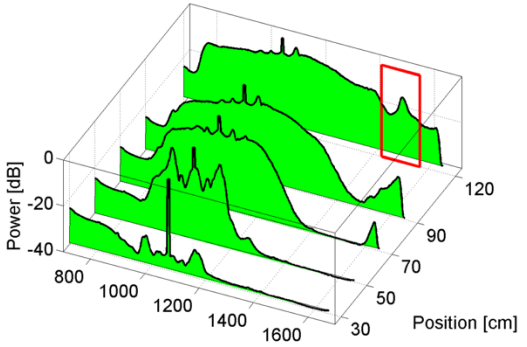


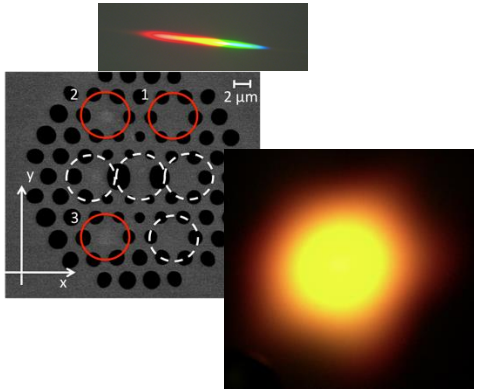


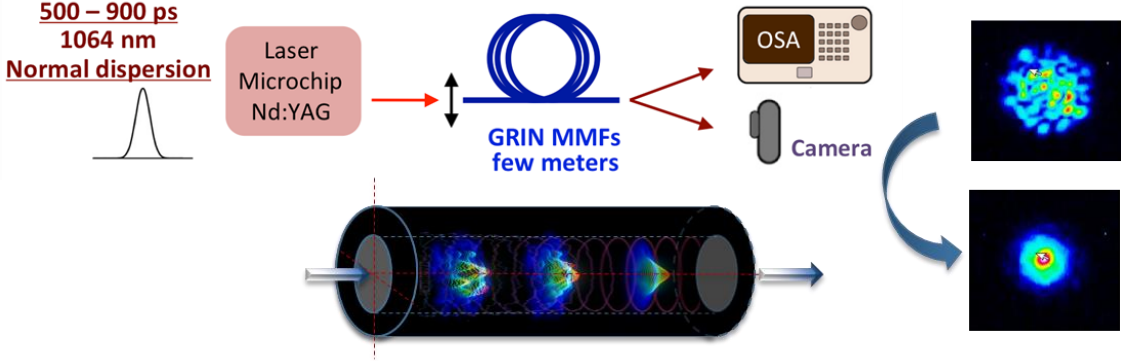
Harnessing light for any application

- controlling spectral components
- reshaping optical pulses
- generating and delivering laser beams (visible and infrared)







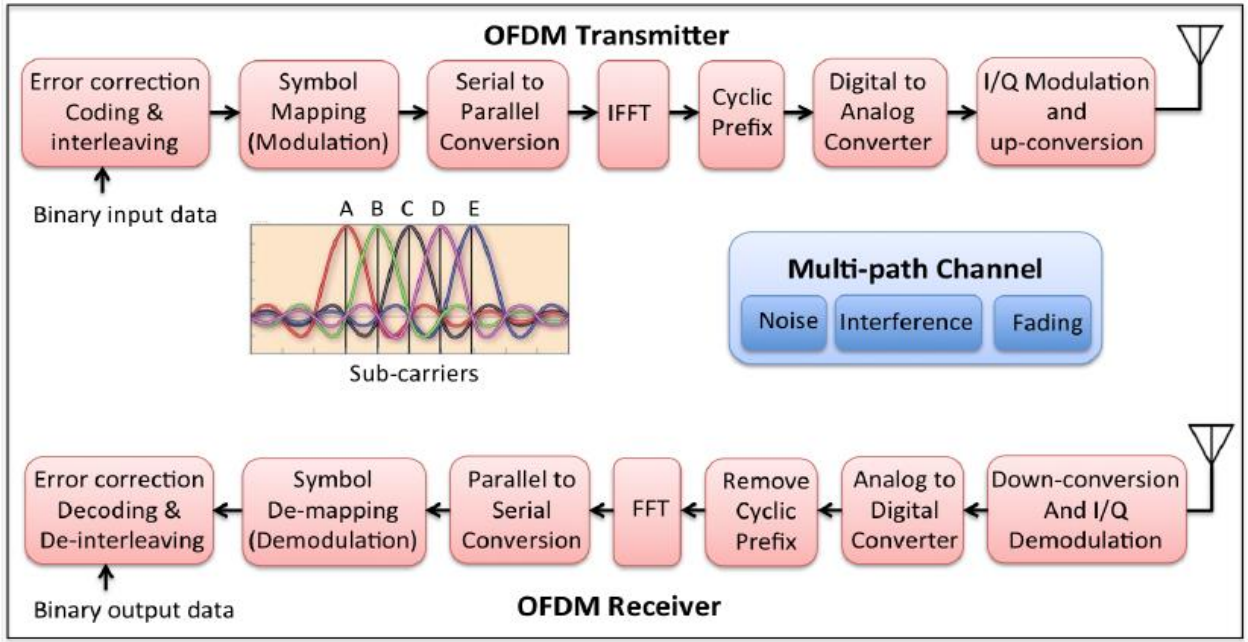


Transmission Tech.

signal processing
modulations
error correcting codes
information theory

Transmission technologies

- Information representation
- Information theory and information modeling
  - What is information?
- Modulation and Demodulation
  - Mapping information on signals
- Forward Error Correcting Codes
  - Adjusting "physics"

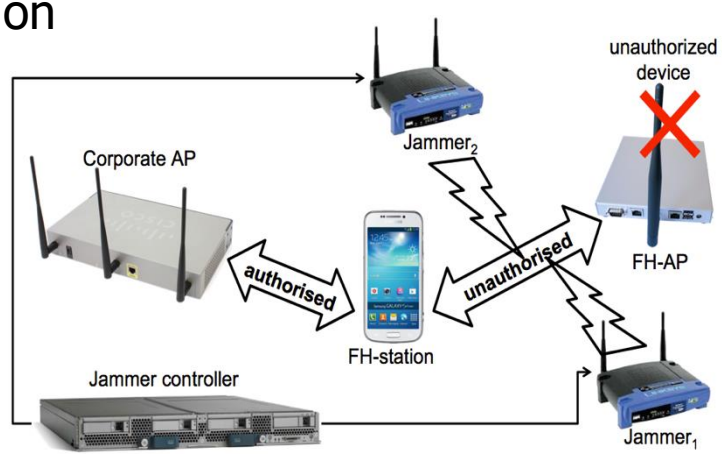


Networks

protocols & routing
security and criptography
Wi-Fi access, cellular
5G and beyond

Networking

- Protocol Design, Protocol Analysis
- Secure Networking
- Mobile and Vehicular Networks
- Wi-Fi Sensing
- Privacy Protection
- 5G
- SDN/NFV
- Slicing and virtualization

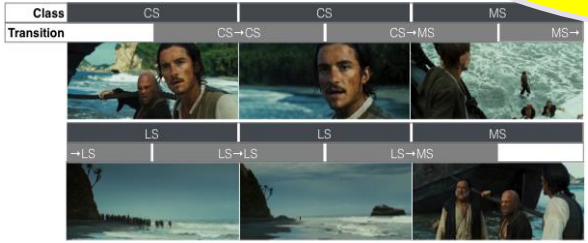


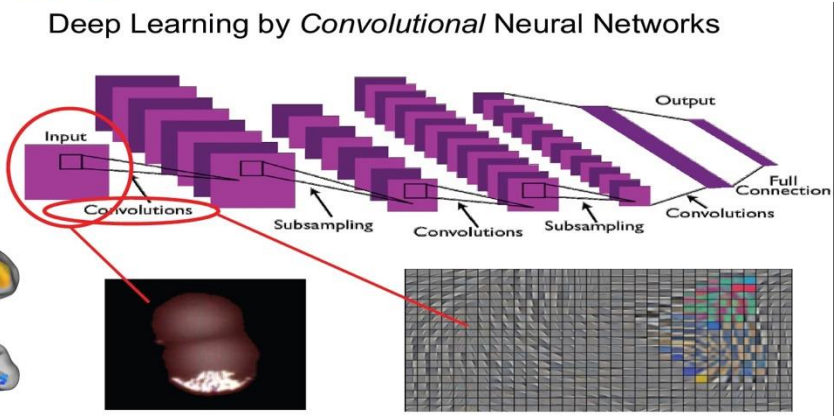
AI Multimedial Signal Processing

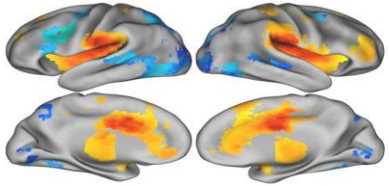
digital video and voice encoding
streaming and conferencing
scene analysis
image-audio processing
AI and deep learning

Video and voice manipulation

- Audio processing
  - Speech and music recognition
- Movie and image representation
- Medical Imaging
- AI-based Image Interpretation
- Cognitive video interpretation
  - Stimuli-based



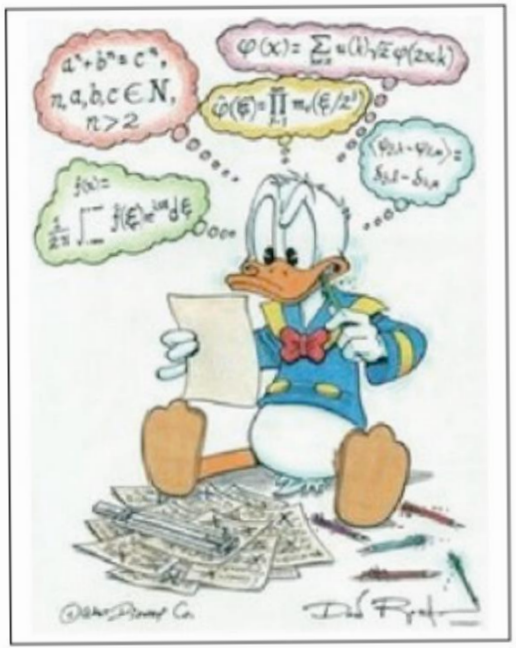




Communication Technologies and Multimedia: SINC Lab.

Multimedia Signal Processing and Communications (SINC Lab.)

- Signal Processing (Audio, Video, …)
- Imaging (Immagini, 3D, …)
- Networking
- Communications (Information Theory, Coding, Wireless, …)



Immagini

Digital Audio Processing

Ok … ma in Brescia … e dintorni ???

- Outline, Flero, Audio Processing;
- Vigilate, Rezzato, Audio-video/sorveglianza;
- Open-Technologies, Brescia, 3D, image-video processing;
- COPAN, Brescia, Biotechnologies;
- Tattile, Brescia, Image-Video processing;
- TSEC, Brescia, Safety;
- Antares Vision;
- Superpartes, Brescia;
- Yonder, Brescia, Data Mining;
- Intred Telecomunicazioni, Brescia Mobilità, Brescia;
- …
- Comelit, BG; ICTeam, BG;
- TELIT, Trieste, Telecomunicazioni tradizionali;
- …
- Google, USA; Telefonica, Peru'; …


"That's all folks!"


Thank you!