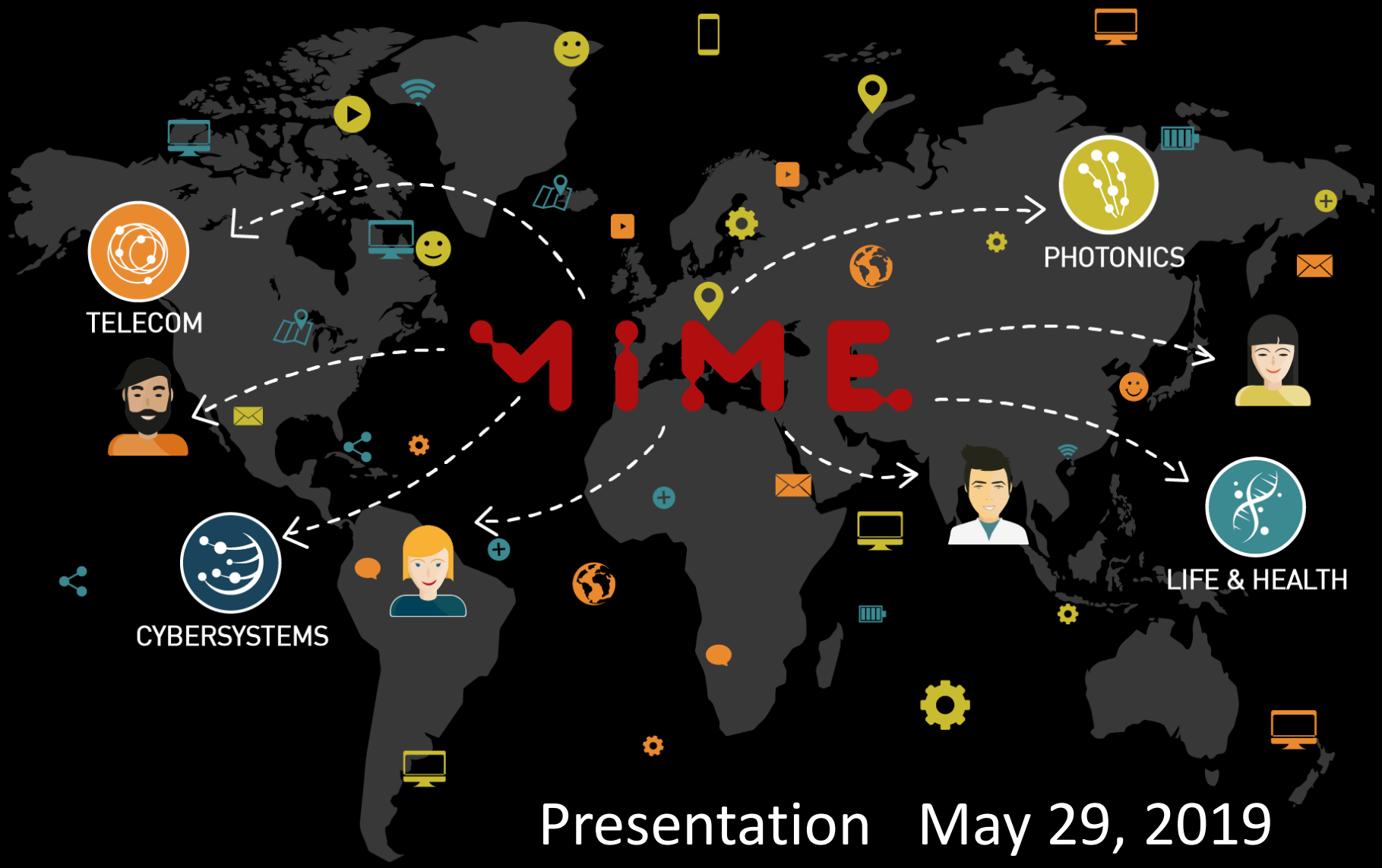
Master ICT for Internet and multimedia engineering



Presentation May 29, 2019

Ingegneria delle Telecomunicazioni

ICT for Internet and multimedia

Master's degree ICT Internet Multimedia Engineering

Overview

What is ICT?

- Acronym of
  Information and Communication Technologies =
  Systems (both hardware and software) for transmitting, sharing, and processing information

Why Internet and multimedia?

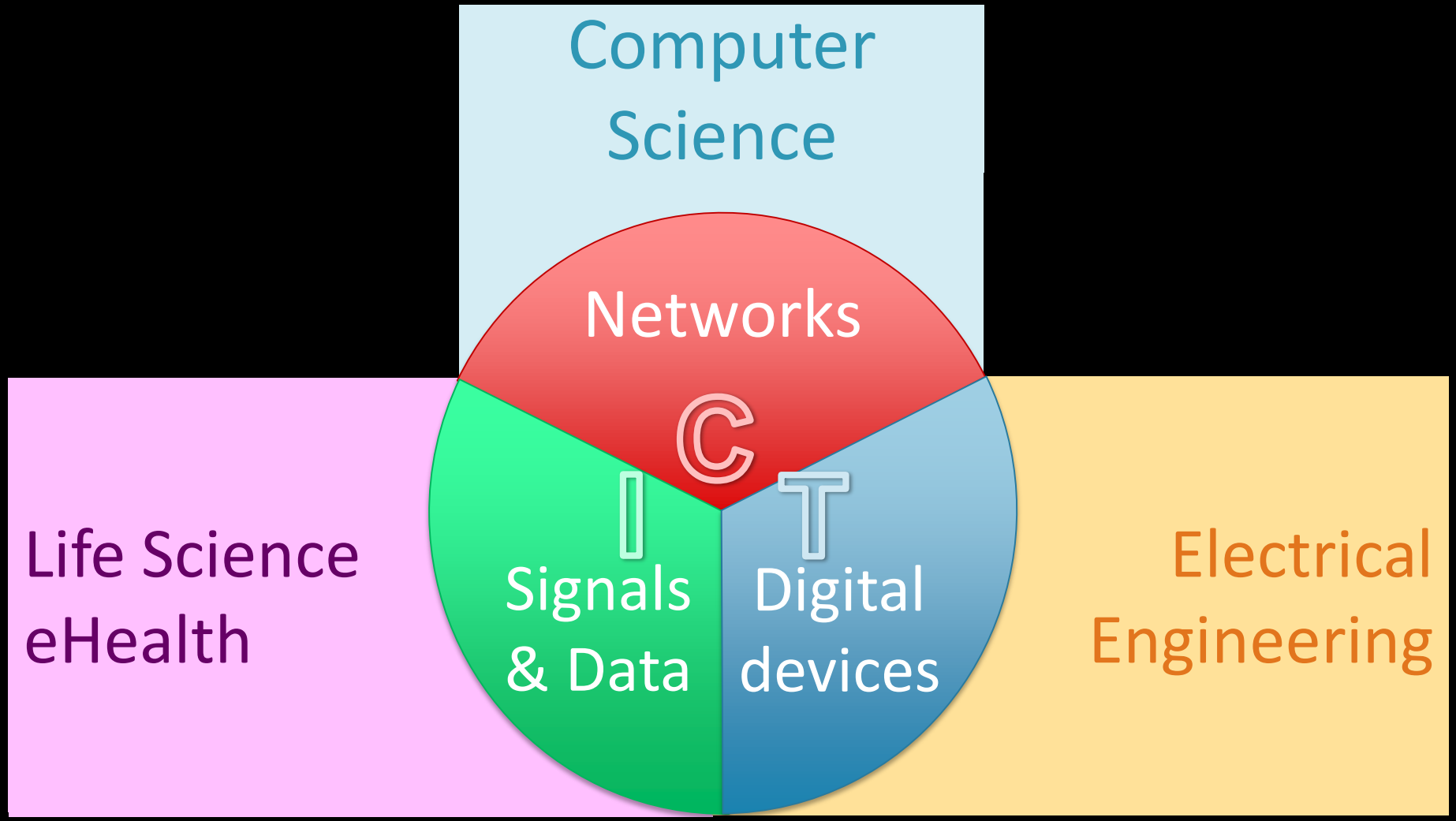
Internet
is the biggest and most used telecommunication system in the entire planet

Nowadays $\simeq$ 50% world population is connected → still wide margins for growth

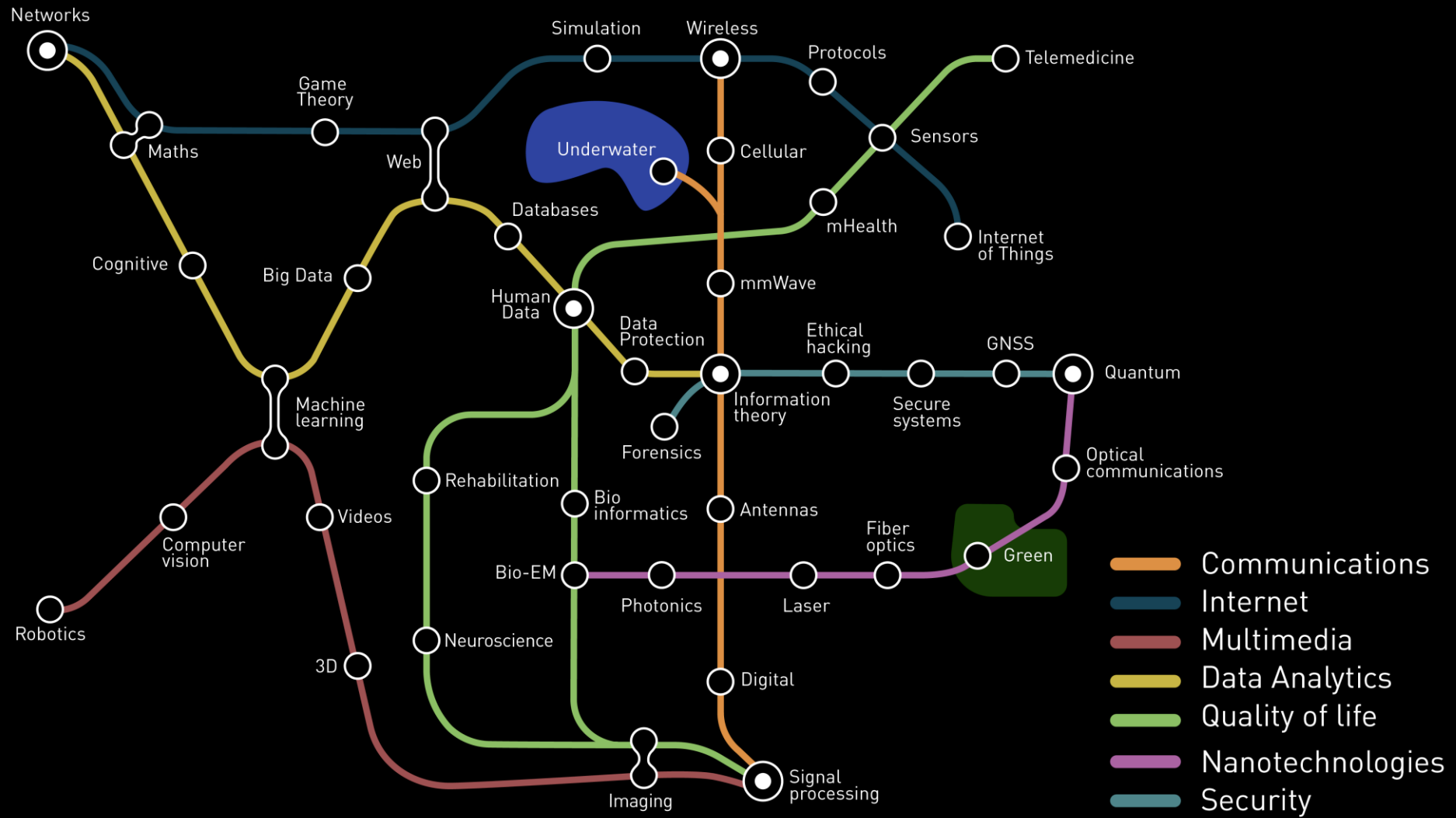
Why Internet and multimedia?

- **Multimedia** = multiple information sources
- Also multiple ways to communicate (Text, Video, Audio, Augmented reality...)
- The majority of Internet traffic is multimedia!

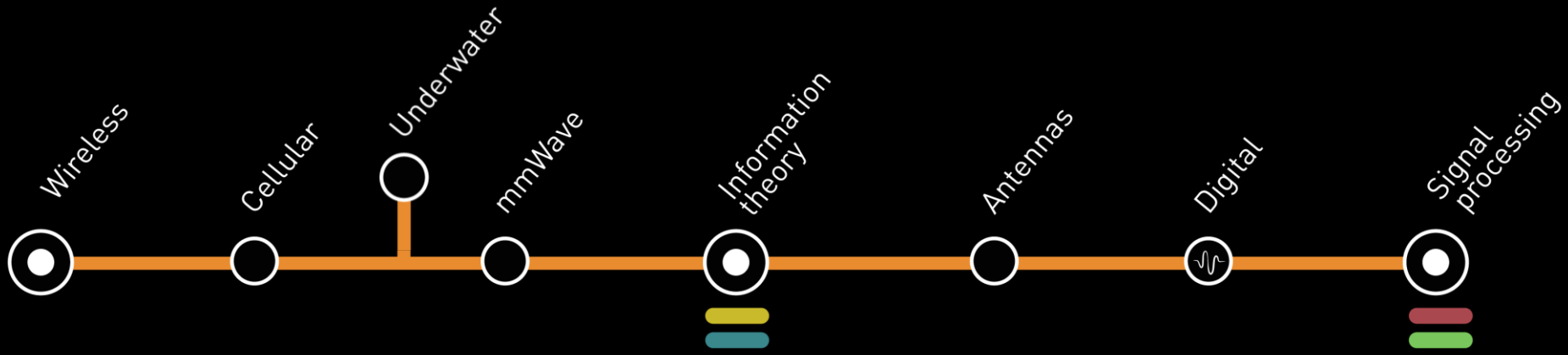
ICT: cornerstone of the Digital Era



MIME transit map



Communications route



Classical and revolutionary transmission techniques

Communications route

5G networks

broadband, low latency connectivity

access through stations: Cellular, mmWave

Massive MIMO

really many transmitting units

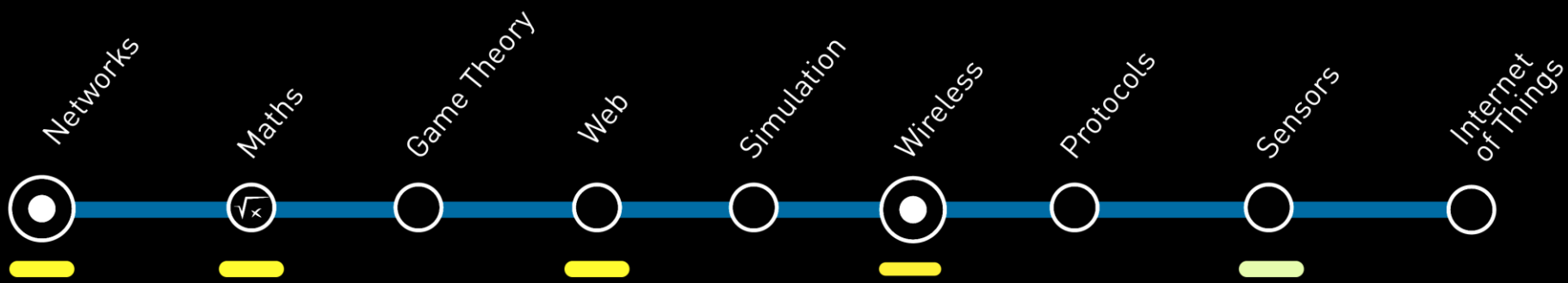
access through stations: Antennas, Inf.Theory

Acoustic communications

marine monitoring and networking

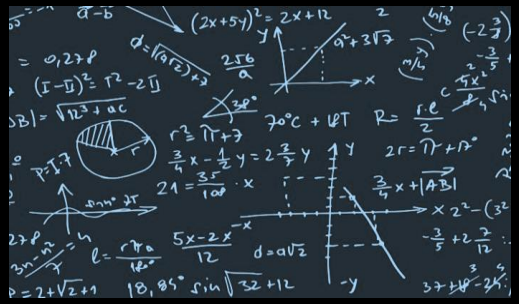
access through station: Underwater

Internet route



Software applications through the entire protocol stack

Internet route



Mathematical models

understanding and designing the Internet

access through station: Maths

Cognitive and Software-defined

intelligence brought in the interconnection

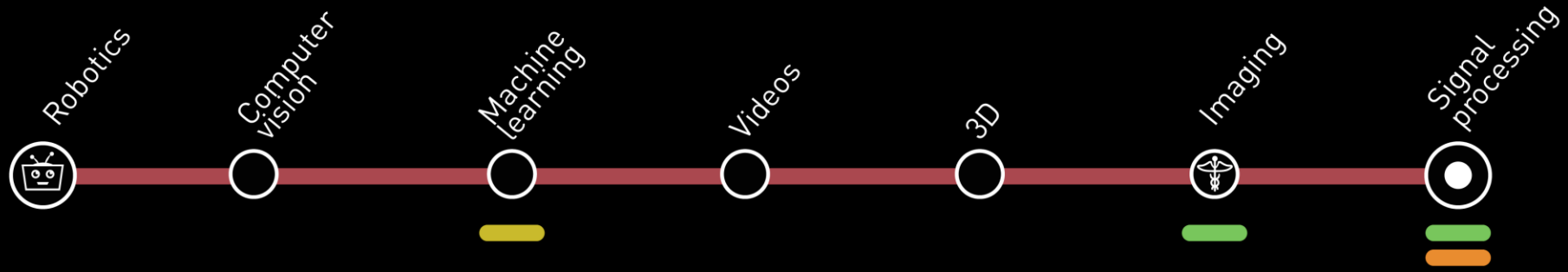
access through stations: Networks, Game Theory

Smart cities

ubiquitous networking for public services

access through station: Internet of Things

Multimedia route



Multidimensional contents for data-hungry systems

Multimedia route

Immersive reality

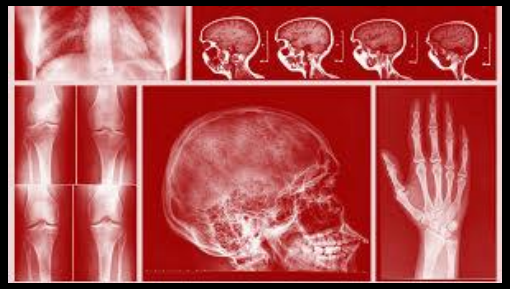
Delivering a full multimedia experience

access through station: 3D

Digitalized perception

Eyes, ears, brains of robots or autonomous cars

access through station: Computer vision



Medical signal processing

Advanced diagnosis and treatment

access through station: Imaging

Data analytics route

Systematic ways to extract knowledge from data

Data analytics route

Distributed data management

Querying the cloud from everywhere

access through station: Web

Biometrics

The human body as the sensing field

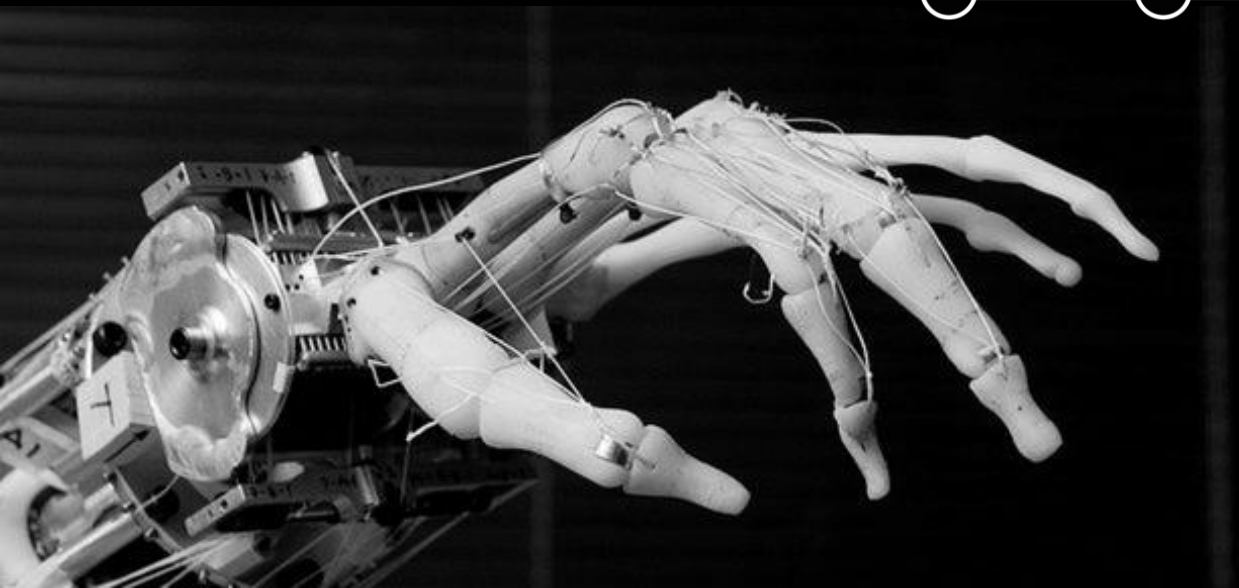
access through station: Human data

Deep learning

Unsupervised artificial intelligence

access through station: Machine learning

Quality of life route



IT expertise for medical care and mHealth scenarios

Quality of life route

Digital health

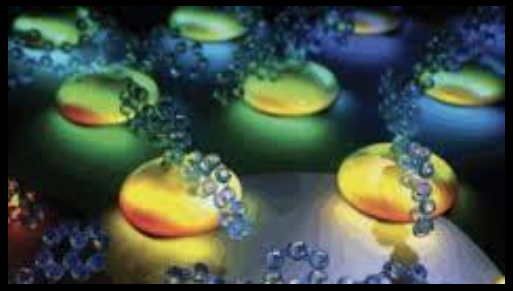
Real-time communication for medical apps

access through station: Telemedicine

Brain computer interfaces

Neural training against degeneration

access through: Neuroscience, Rehabilitation

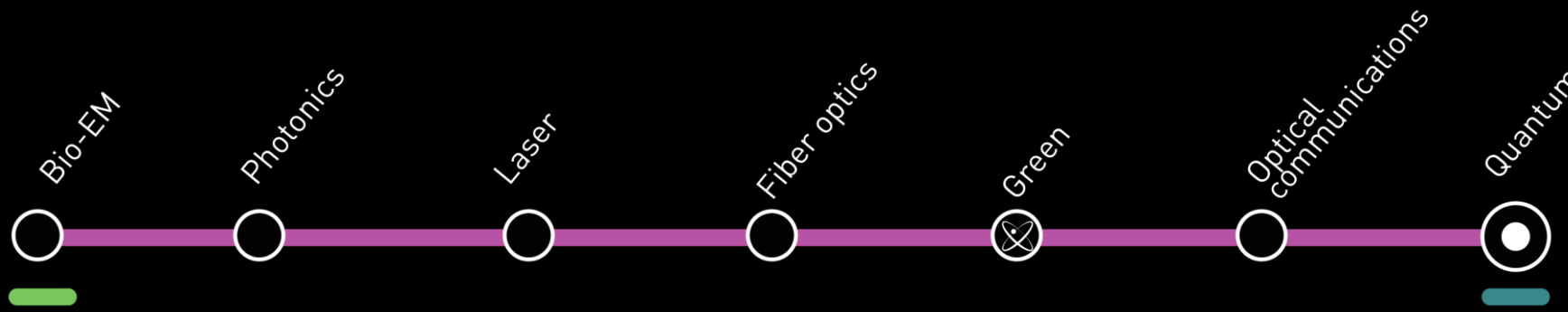


Molecular photonics

Non-invasive monitoring and diagnostics

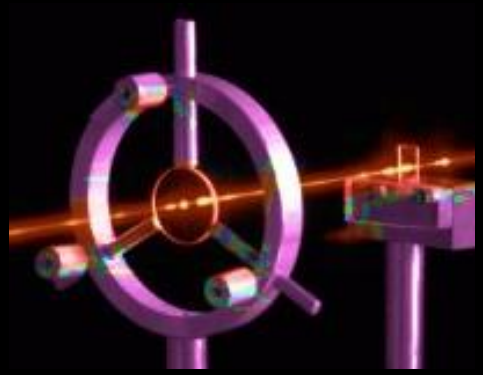
access through station: Bio-EM

Nanotechnologies route



Reach nanoscale to communicate at the speed of light

Nanotechnologies route



Photonic sensing

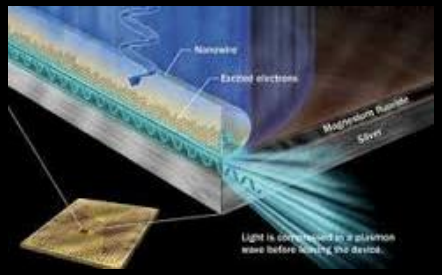
Monitoring through dielectric coupling

access through station: Fiber optics

Renewable energies

Smart exploitation of natural energy sources

access through station: Green

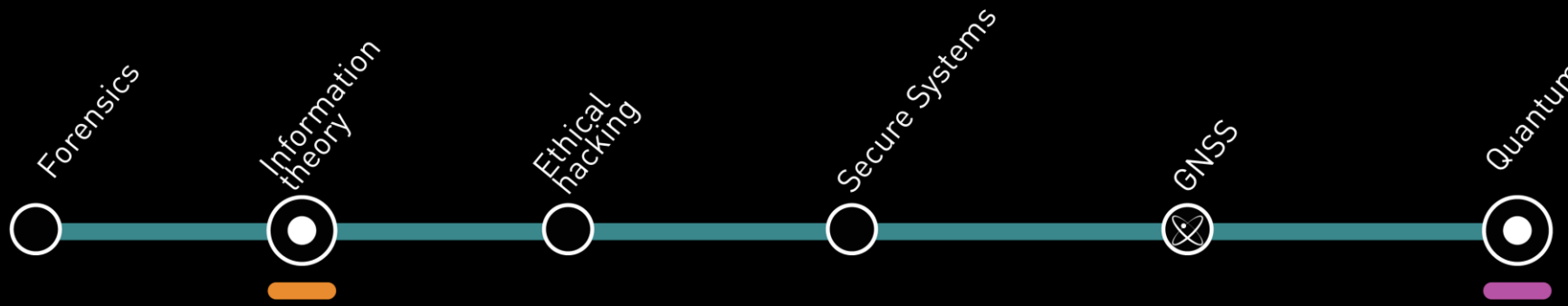


Plasmonics

Electron/photon coupling to go beyond λ

access through station: Photonics

Security route



Ensure privacy and data protection for cybersecure systems

Security route

Secure satellite positioning

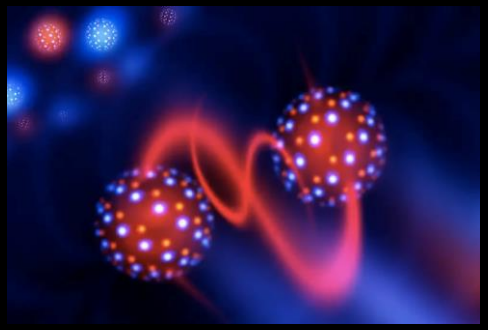
Preventing localization and navigation forging

access through station: GNSS

Digital crime fighting

Detecting false media and documents

access through station: Forensics



Quantum cryptography

Ultimate security through quantum physics

access through station: Quantum

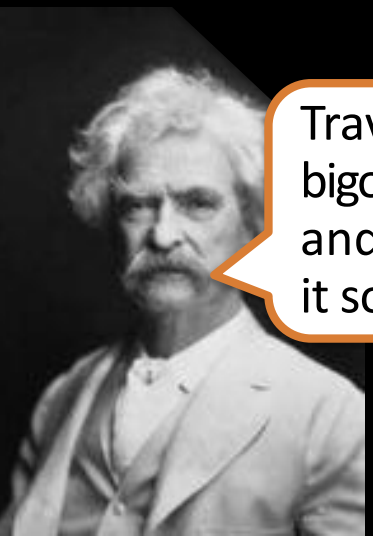
To sum up

- **Innovative scientific topics** at the edge of new research horizons
- **Matching all tastes** from highly mathematical to applied and hands-on
- **Interconnecting disciplines** with a planned path (we don’t just do “a bunch of cool stuff”)

Master's degree ICT Internet Multimedia Engineering

International priority

International by design



Travel is fatal to prejudice, bigotry, and narrow-mindedness, and many of our people need it sorely on these accounts

Mark Twain

MiME

completely in English

with many international opportunities

Fully taught in English

- No English test required beforehand
- But you must understand (basic) English

Incoming students

- **ICT for Internet and Multimedia** is one of 20 UniPD's International Masters
- So far: 293 applicants (top of UniPD) from 41 countries
- applications are still ongoing

Incoming students

- Admitted so far

es	al	in	tn	pk	ir	ba	ru	vn	sd
									
1	3	6	7	1	10	1	1	2	1

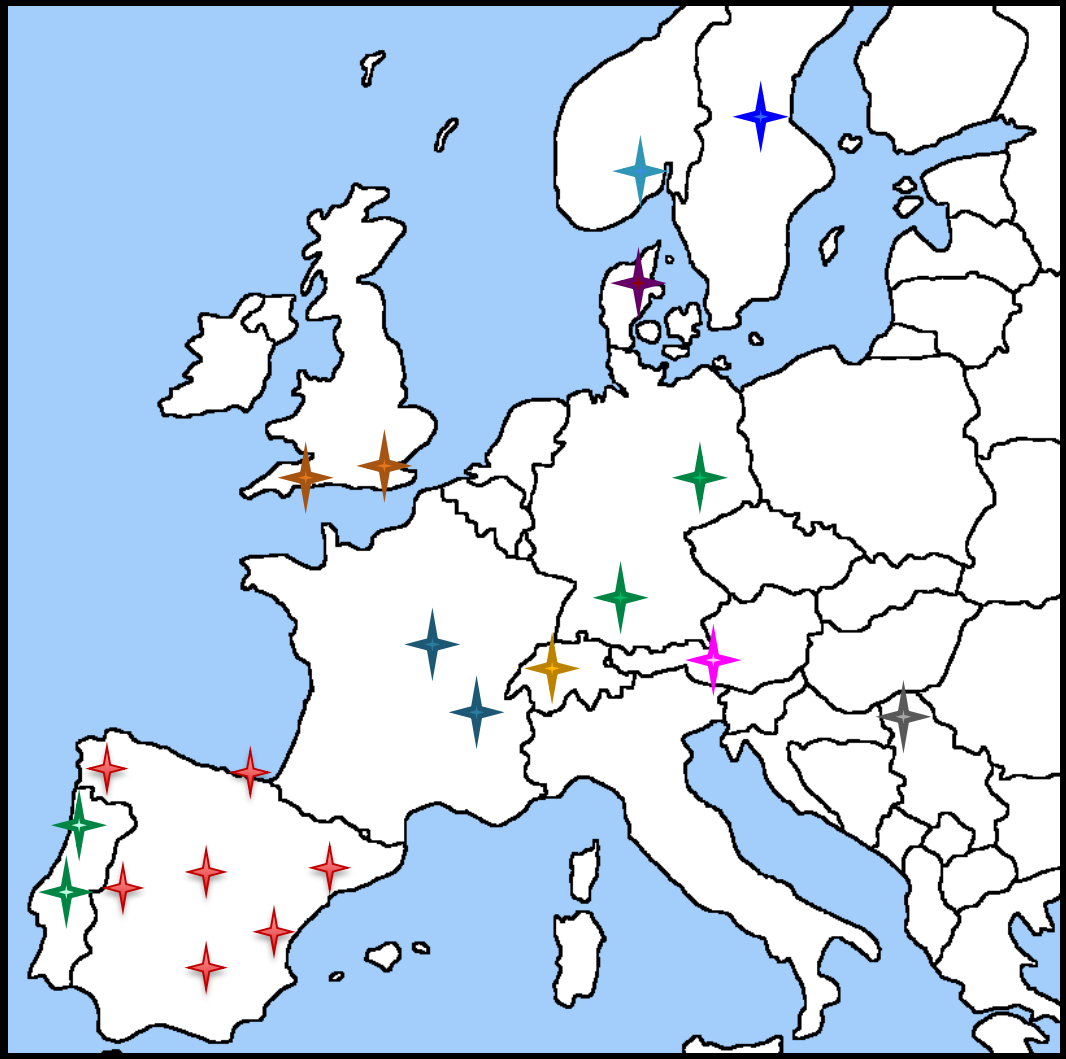
gh	ly	tr	ve	az	ug	br	rs	cn	ng	pe
										
1	1	2	1	1	1	2	1	1	1	1

Erasmus+

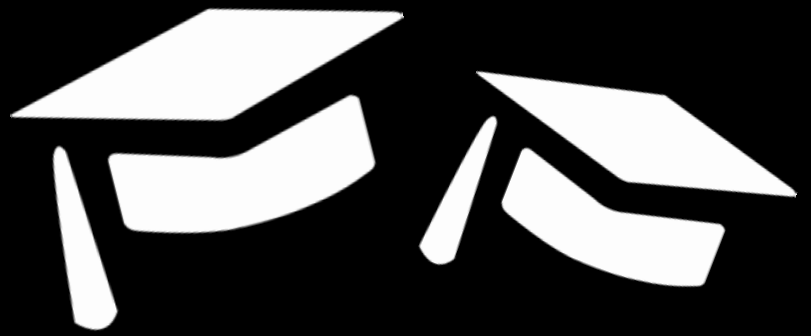
destinations

	2
	2
	1
	2
	1
	2
	1
	1
	1 (KA107)
	1 (SEMP)
	8 (incl. Canary)

and counting...



Double degrees



International agreements of Double Degree with top-ranked universities worldwide:

- National Taiwan University (2 positions)
- Universidad Politecnica de Madrid (2 positions)
- U. Jean Monnet Lyon-St.Etienne (in preparation)

Compared to similar programs (e.g TIME) you still get 2 degrees but in ~2 years, not 3

DD: how does it work?

- Apply halfway through 1st year → must earn 60 ECTS in Padova by September
- If selected, spend the 2nd year abroad
- Final thesis done and discussed abroad before a joint committee, also valid for Italian degree
- When abroad, scholarship at least 2×Erasmus for a period = min(graduation, 24 months)

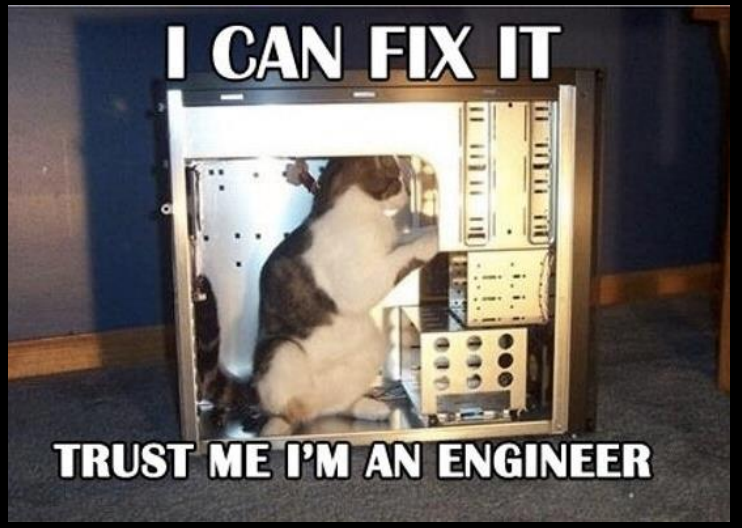
Master's degree ICT Internet Multimedia Engineering

Study plan

MIME Master's degree ICT Internet Multimedia Engineering

Frequently Asked Questions

- is it an engineering degree?
- is it a *Laurea Magistrale*?
- why do you call it a Master?



Admission

Holders of Italian degree ≥ 84/110

with at least 50 ECTS credits in:

- maths (MAT/02, MAT/03, MAT/05, MAT/06)
- physics (FIS/01)
- computer science (INF/01, ING-INF/05)
- telecommunications (ING-INF/02, ING-INF/03)

Direct access for all of Padova's graduates in the Bachelor class L-8 (every "Laurea degree" of DEI)
Also the same holds for Math, Physics, CS @unipd
and very likely for many other Italian graduates
- foreign candidates have their own evaluation track

Foundations

Recommended background in

- Signals and systems
- Probability and statistics
- Telecommunications

If in doubt about it → contact the teaching committee

Solutions available without courses before enrolling (e.g., Brixen)

No English certificate required, but

you need to prove/declare that you understand it

So if you have a certification, even better

- there is an English test within the program, anyways

Enrolment steps

1: Pre-enrolment
from June 17 on uniweb

2: Career evaluation
from June 17 on uniweb.unipd.it/valutazionetitoli
(actually another website!) – all students must do it!

You must perform BOTH - you can do 2 just after 1.
After receiving confirmation of that your career is ok:

3: Enrollment – also on uniweb until October 25

Study plan: what's new in 2019/20

Exams of different sizes
Mandatory exams
"Serial" courses

All courses = 6 credits
Highest freedom of choice
"Open" courses

Common characteristics

Flexible

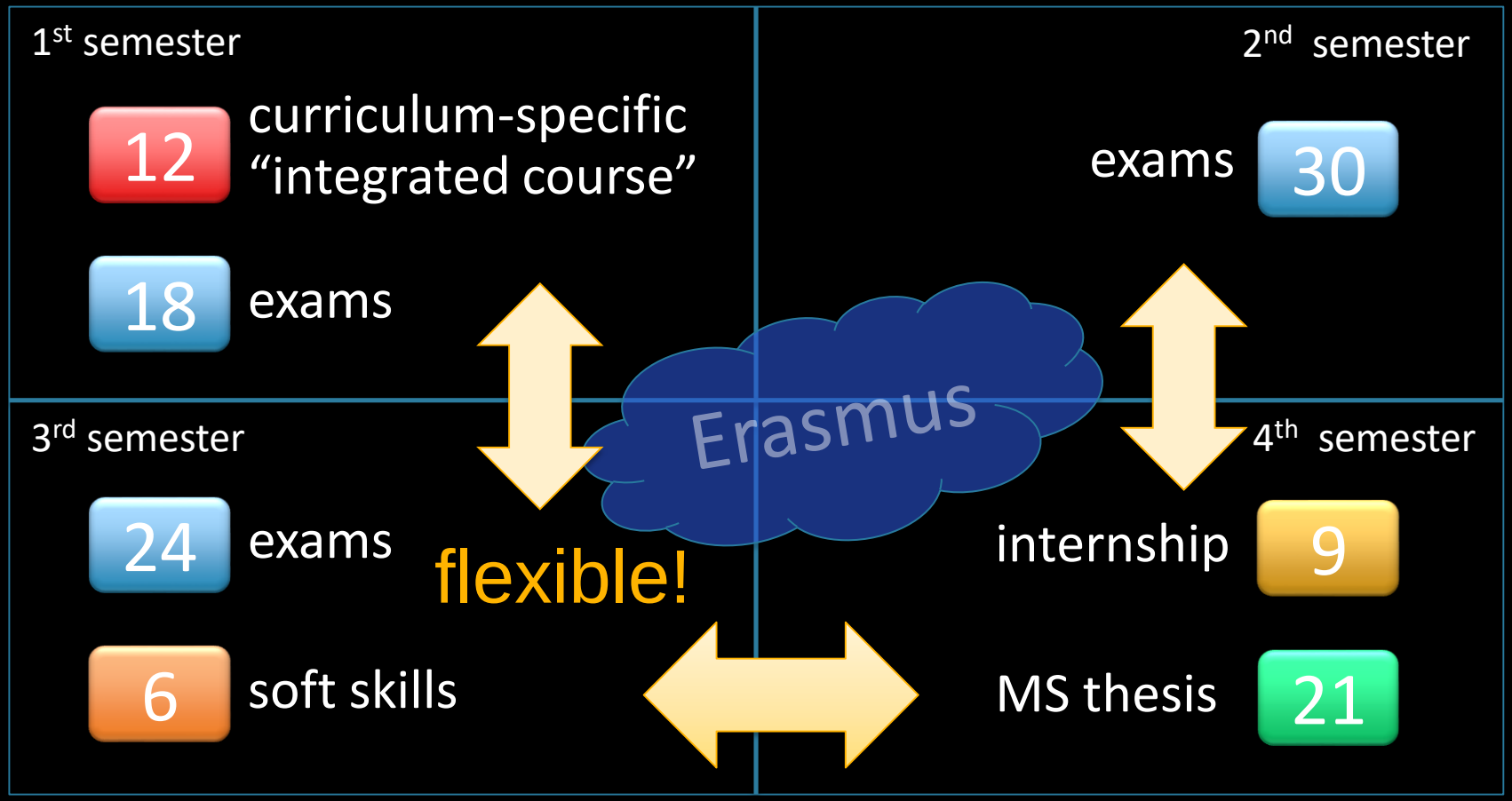
- Without mandatory exams
- All the exams are of 6 ECTS credits: just choose the preferred disciplines that fit you the most
- 12 ETCS credits (2 exams) are “fully elective” → you can take previously discarded subjects or even exams from another curriculum or degree

Common characteristics

Professional

- Internship of 9 ECTS credits
- Typically combined with the MS Thesis (21 ECTS credits) for an exam-free last semester
- 6 credits for “soft skills”
  - 3 for English B2 level
  - 3 for short courses on project management, public speaking in English or more

Typical study plan



Four areas of specialty = 4 curricula

Teaching committee

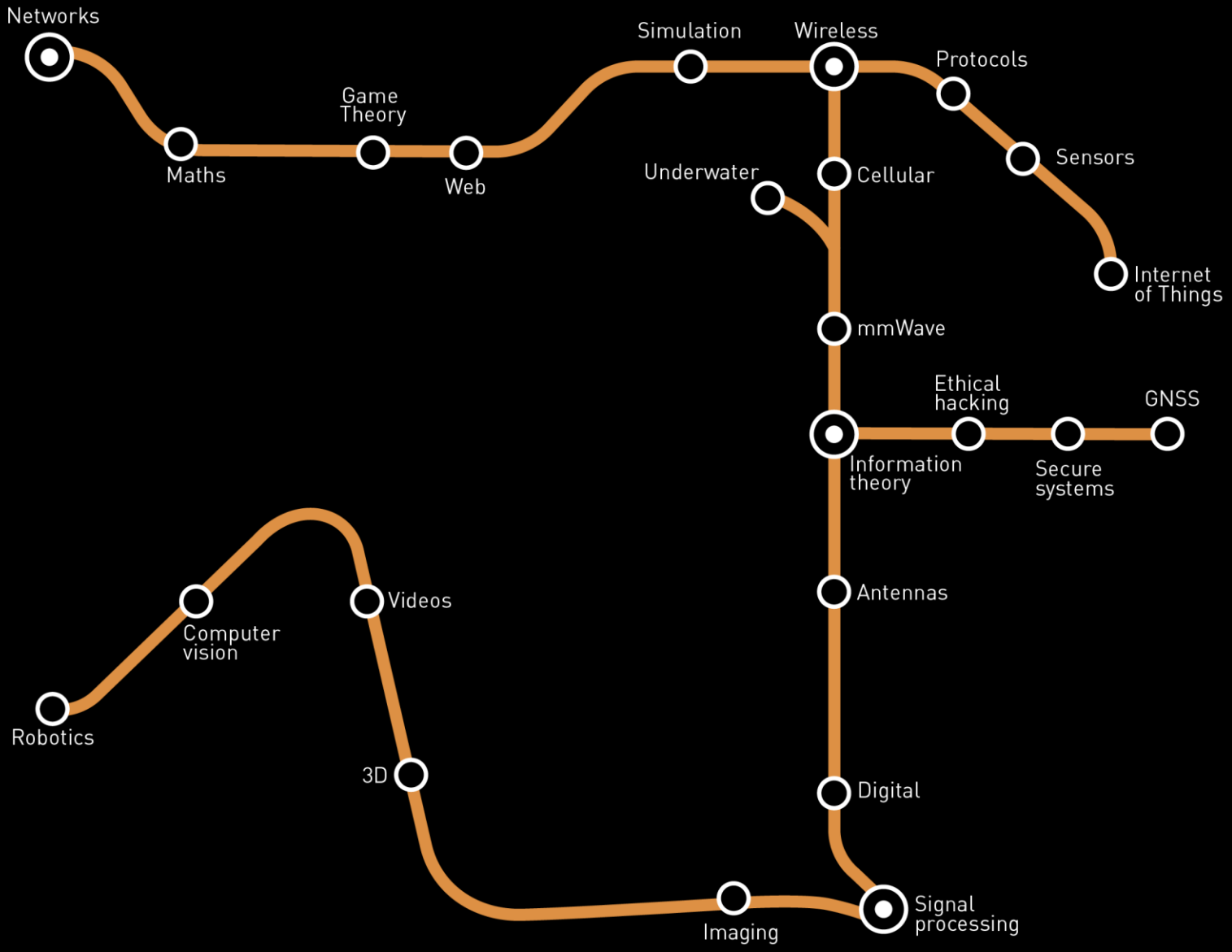
When in doubt about choices of curriculum or exams, ask the teaching committee!

Simone Milani simone.milani@unipd.it

Luca Palmieri luca.palmieri@unipd.it

You can also ask them how to handle Erasmus+ exchanges or **recognition of past extra activty**!

Telecommunications



Telecommunications

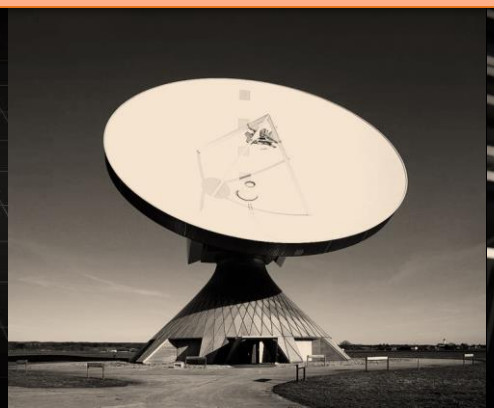
Rao

Motivation

Explore all layers from PHY to APP
ICT is the main enabler of Industry 4.0

Scenarios

Next generation wireless, antenna design, sensors network optimization, security, multimedia, R&D



Telecommunications

MANDATORY

Telecommunication principles
= Wireless communications
+ Programming for telecom

CHOOSE 2 FROM

Databases
High level programming
Innovation and entrepreneurship
Optimization
Optoelectronics for green
Programmable hardware devices

CHOOSE 8 FROM

3D augmented reality
5G systems
Antennas
Communication network design
Computer vision
Digital communications
Digital signal processing
Fiber optics
Game theory
Information security
Internet
IoT and smart cities
Machine learning
Multimedia coding
Network analysis and simulation
Network coding
Optical and quantum communications
Optical networks
Stochastic processes

Internships at …

ARRI
MÜNCHEN (DE)

Signal processing for digital cinema

Fiat Chrysler Automobiles
TURIN / USA

5G vehicular communications

Huawei
MILAN / CHINA

Cellular networks R&D

Wind Tre
VENICE

National telco operator

World Sensing
BARCELONA (ES)

Wireless sensors monitoring

RFI
MESTRE (VE)

Railway network

Telenor
OSLO (NO)

National telco operator

CAME SpA
DOSSON DI CASIER (TV)

Safe access

Gavia systems
ROVIGO

Public WiFi services

Bft Spa
SCHIO (VI)

Domotic and automation

Is it a good choice for me?

Strong mathematical background is needed

- especially in probability and signal theory

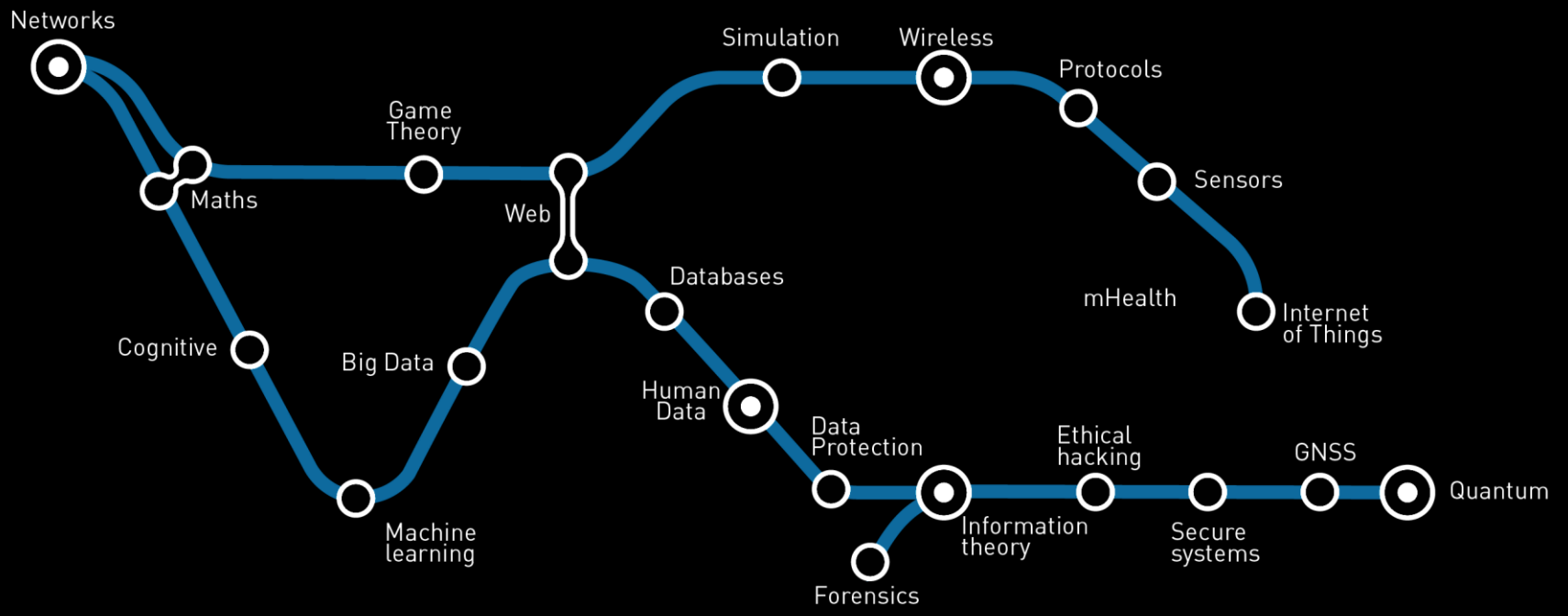
Many courses are project-oriented

- be careful not to pick too demanding tasks

Mostly focuses on telecommunications

- did you like your “fundamentals” course?

Cybersystems



Cybersystems

Motivation

System interconnection opens up new horizons , inspiring challenges... and amazing job opportunities!

Scenarios

The third platform: Social, Mobile, Analytics, Cloud
Automotive, Tactile Internet, WWW, Blockchain

Shannon

Cybersystems

MANDATORY

Network systems
= Network science
+ Internet
Databases

CHOOSE 2 FROM

Big data computing
Cryptography
Graph theory
High level programming
Optimization
Web applications

CHOOSE 7 FROM

3D augmented reality
Communication network design
Computer vision
Digital forensics
Digital signal processing
Game theory
Human data analytics
Information security
IoT and smart cities
Machine learning
Multimedia coding
Network analysis and simulation
Network coding
Stochastic processes
Wireless communications

Internships at …

Sanmarco Informatica	Teypra SRL	Sony Eutec	Mida Solutions	Uqido
GRISIGNANO DI ZOCCO (VI)	ROVIGO	STUTTGART (DE)	PADOVA	PADOVA
IT Solutions	IoT connected devices	Multimedia R&D	Voice & data app virtualization	IoT / Blockchain Software eng.

Aquifi	solidThinking	Nokia Bell Labs	Altran Italia	Athonet
PALO ALTO (US)	VICENZA / USA	DUBLIN (IR)	ROME	BOLZANO VICENTINO (VI)
3D vision	3D rendering	Low power networking	5G, video 3D, cybersecurity	Software defined networking

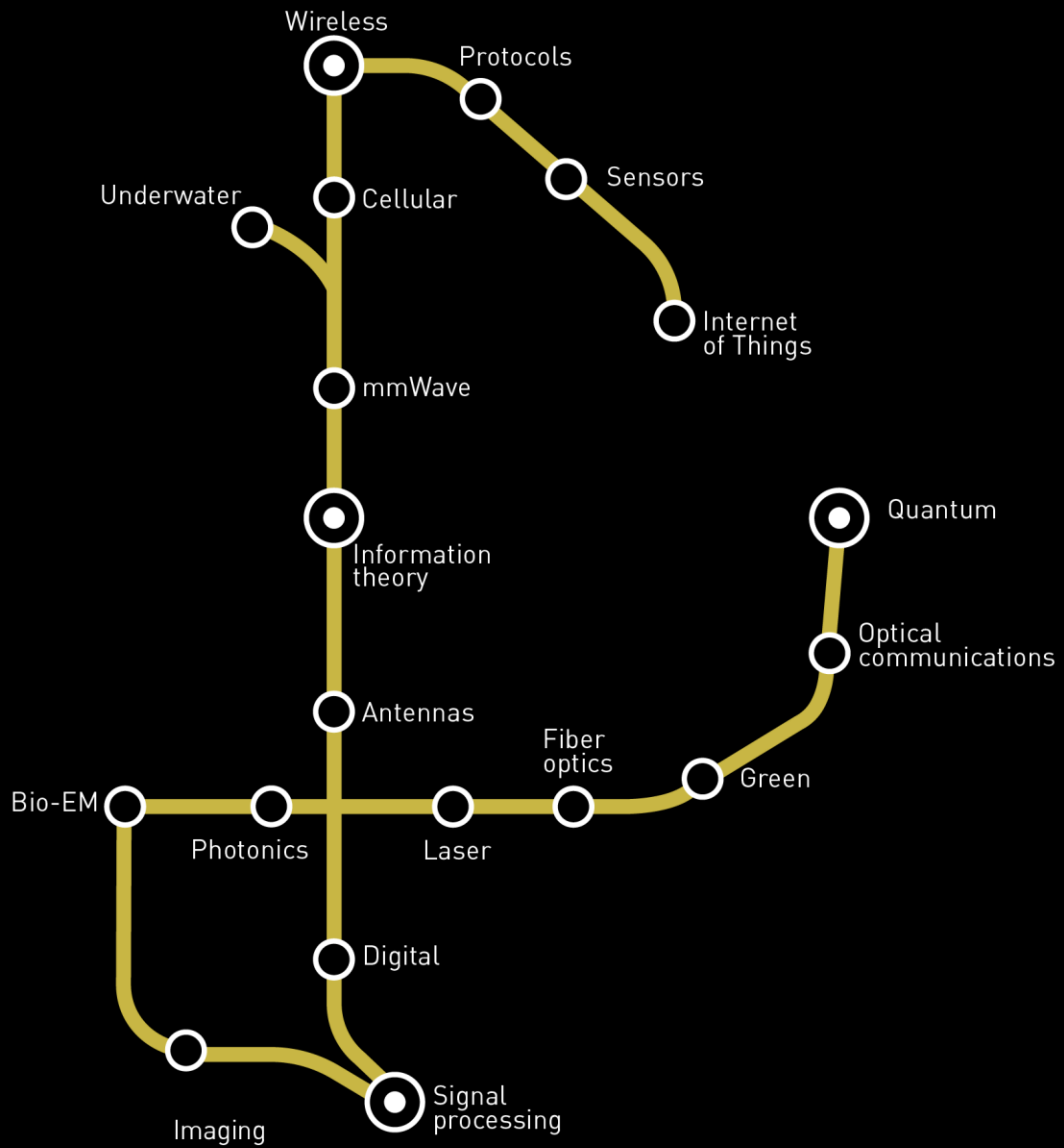
Is it a good choice for me?

A mixture of math, computer science, telecom

- you certainly need good programming skills

A system-wide perspective, with an eye on cross-disciplinary topics, and an open mindset

Photonics


Wireless
Protocols
Sensors
Underwater
Cellular
Internet
of Things
mmWave
Information
theory
Quantum
Optical
communications
Antennas
Fiber
optics
Green
Bio-EM
Photonics
Laser
Digital
Signal
processing
Imaging

Photonics

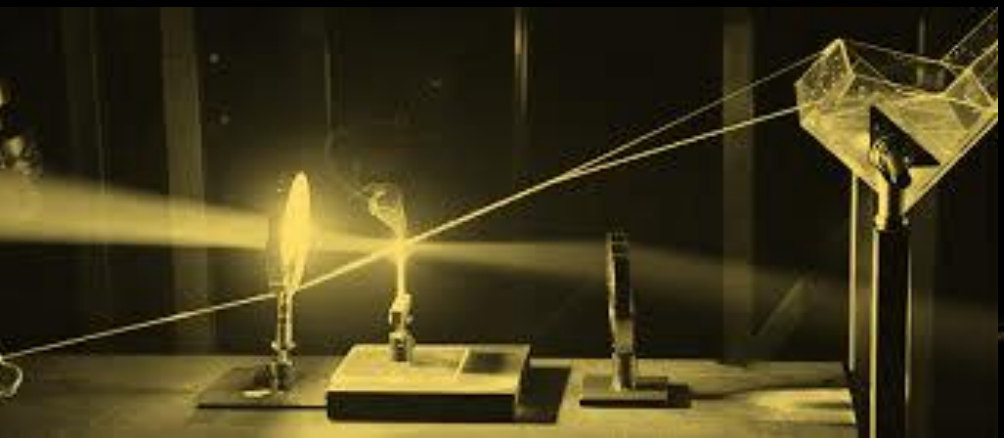
Hikari

Motivation

Photonics and light-based technologies are drivers of this century's industry

Scenarios

Hyperspectral analysis, earthquake monitoring, optical neurosynapic networks, quantum computers



Photonics

MANDATORY

Photonic technologies
= Fiber optics
+ Photonic devices
Molecular photonics

CHOOSE 2 FROM

Nanostructured materials
Optoelectronics for green
Photovoltaic science and technology
Quantum information and computing
Quantum optics and laser

CHOOSE 7 FROM

5G systems
Antennas
Biophotonics
Digital communications
Digital signal processing
Information theory
Internet
IoT and smart cities
Machine learning
Nanophotonics
Optical and quantum communications
Optical networks
Programmable hardware devices
Wireless communications

Internships at …

Leonardo	Qascom	DeltaOhm	CEIT	NTSG
CARSOLI (AQ)	BASSANO DEL GRAPPA (VI)	PADOVA	MONSELICE (PD) / SVIZZERA	ROMA
Thin films for space optics	Secure satellite communications	Photo radiometric sensors	Fiber optical networks	Fiber sensing and monitoring

Calearo Antenne	Infineon	Adant	SIT	Nidek Medical
ISOLA VICENTINA (VI)	PADOVA / AUSTRIA	PADOVA	PADOVA	ALBIGNASEGO (PD) / GIAPPONE
Antennas for 5G and automotive	Semiconductors and IoT	Reconfigurable antennas	Measurement for safety	Optometrical instrumentation

Is it a good choice for me?

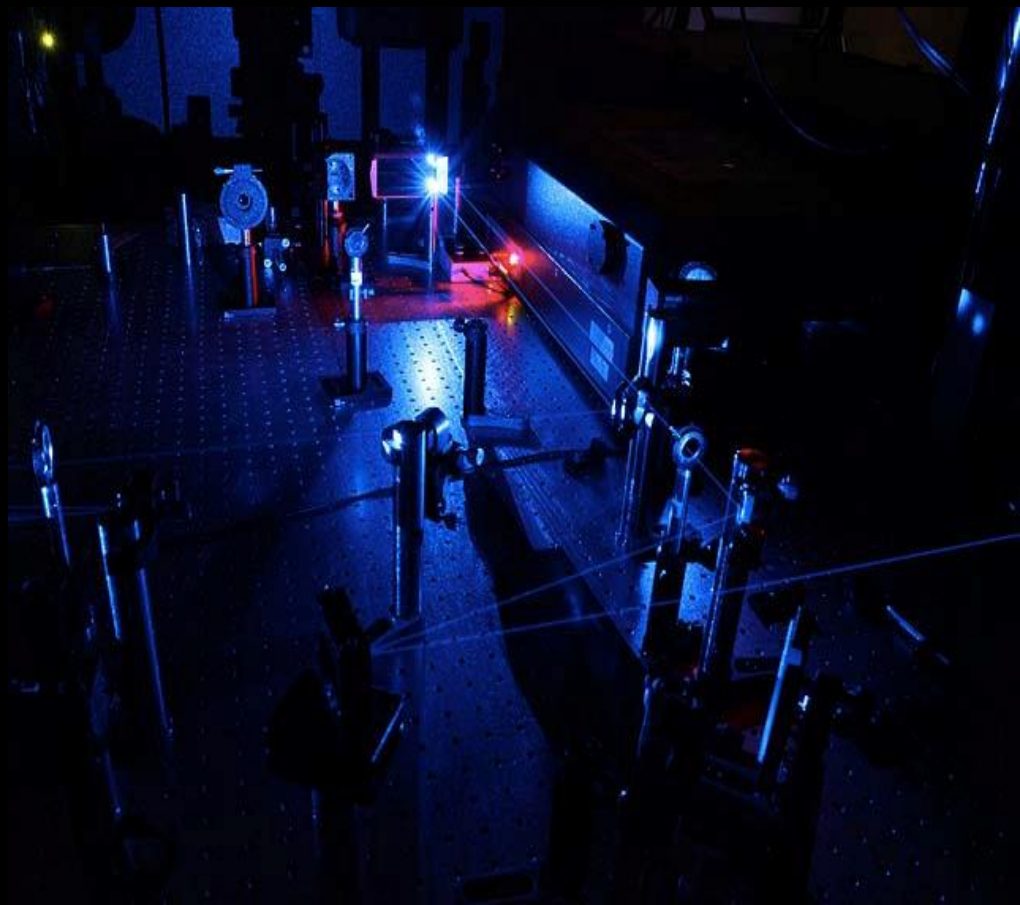
Your proficiency in physics will be put to the test

- electromagnetism, quantum, physics of matter

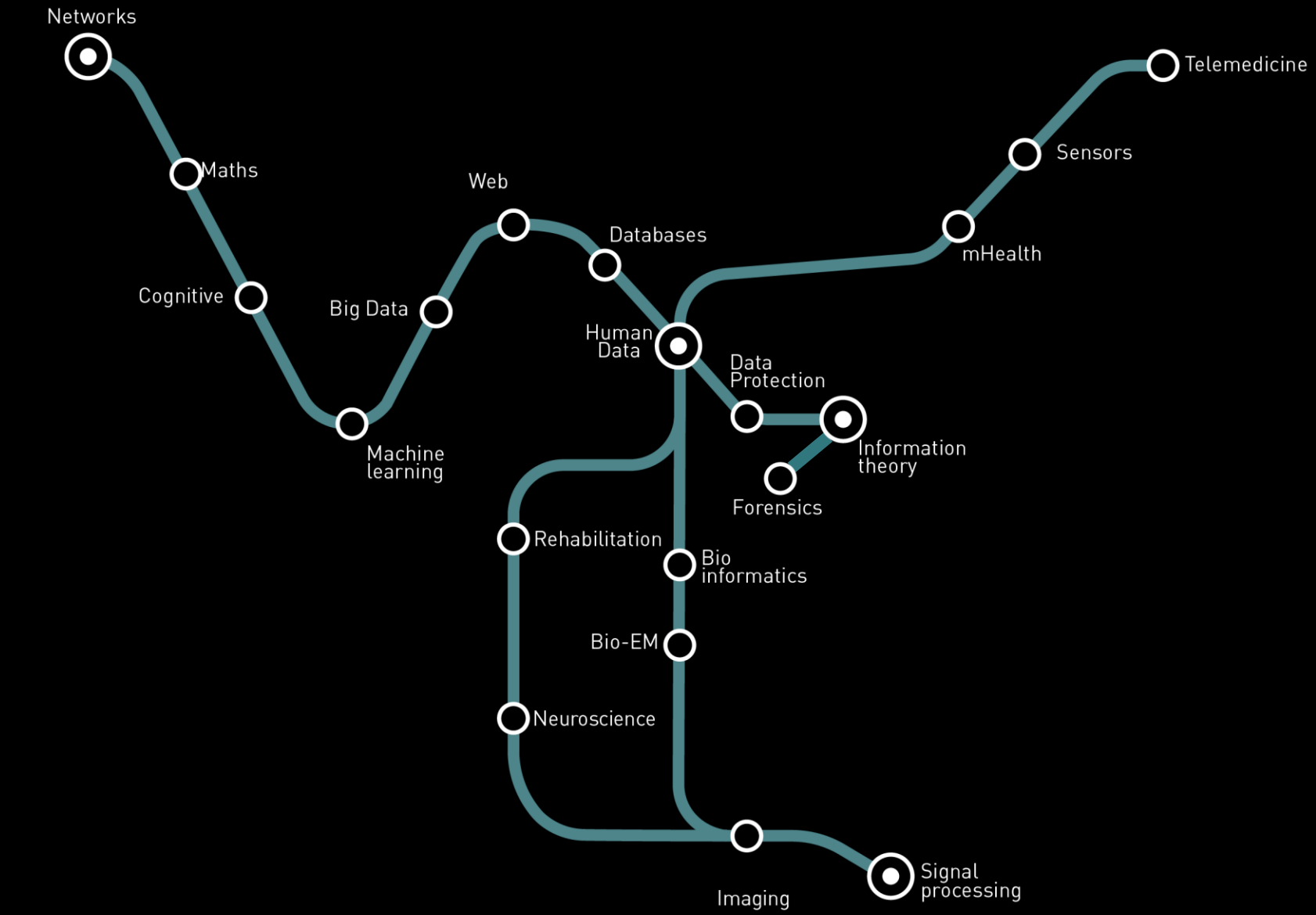
But you need a very engineering attitude

- laboratory activity is really important here

(yes, this is our real lab and not a stock picture)



Life & Health


Networks
Maths
Cognitive
Machine learning
Big Data
Web
Databases
Human Data
Data Protection
Information theory
Forensics
mHealth
Sensors
Telemedicine
Rehabilitation
Bio informatics
Bio-EM
Neuroscience
Imaging
Signal processing

Life & Health

Motivation

ICT improves well-being with pervasive monitoring, prevention/cure, rehabilitation

Vito

Scenarios

Neuroscience, augmented reality, genomics, stroke/accident prevention, healthy ageing, sport, wearable sensors, everyday life

Life & Health

MANDATORY

Digital health
= Digital signal processing
+ eHealth
Machine learning

CHOOSE 3 FROM

Clinical engineering
Computational genomics
Human computer interaction
Imaging for neuroscience
Life data epidemiology
Molecular photonics
Neurorehabilitation and BCI
Quantitative life science
Sports engineering and rehab

CHOOSE 6 FROM

3D augmented reality
Biophotonics
Computer vision
Digital forensics
Game theory
Human data analytics
Internet
IoT and smart cities
Multimedia coding
Network science
Neural networks and deep learning
Stochastic processes
Wireless communications

Internships at …

Malvestio
VILLANOVA DI CAMPOSAMPIERO (PD)

Sensors for hospital bed

Khymeia
NOVENTA PADOVANA (PD)

Virtual reality for neurorehab

Policlinico Sant'Orsola
BOLOGNA

Infectious diseases unit

BrainTrends
ROMA

Brain biosignal sensing

Phoenix RTO
PADOVA

Hyperspectral for agrifood

AMPED
TRIESTE

Forensics multimedia

Nidek Medical
ALBIGNASEGO (PD) / GIAPPONE

Ophtalmology ocular diagnosis

Inst. Behavioral Neurobiology
TUBINGEN (D)

Paralysis/stroke monitoring

WYSS Center
ZURICH (CH)

FMRI-BCI analysis, Neuroprosthetics

Inst. Tecnologico de Canarias
CANARY ISLANDS (E)

CAD for bone reconstraction

Is it a good choice for me?

Requires interest in both ICT & medical subjects

- you must acquire solid skills in both areas; thus, also math, computer science, telecommunications
- a rigorous engineering program

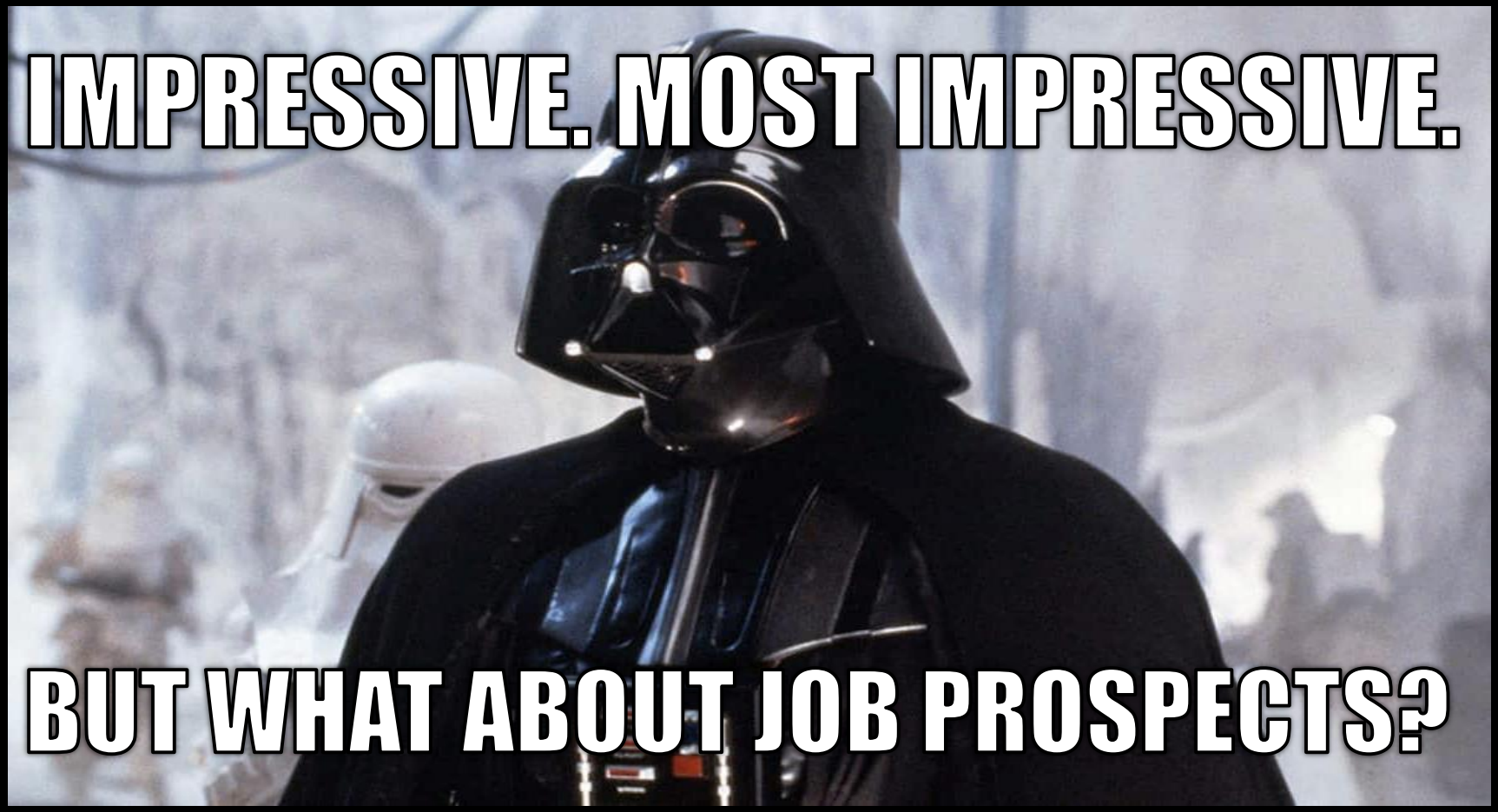
Note that you will not find:

- general courses in chemistry or physiology
- courses of biology, biomechanics, biomaterials

Goal	vs	Tool
Automazione		Telecommunications
Informatica		Cybersystems
Elettronica		Photonics
Biomedica		Life&Health

Master's degree ICT Internet Multimedia Engineering

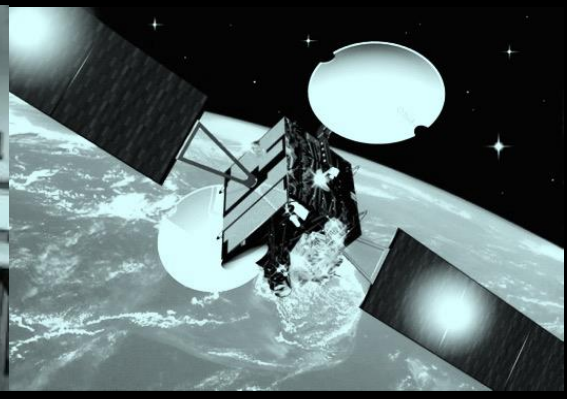
Job market


IMPRESSIVE. MOST IMPRESSIVE.
BUT WHAT ABOUT JOB PROSPECTS?

A **double track** for the job market

Enterprises working on ICT

from hardware to software, access/transport/application



Enterprises working using ICT

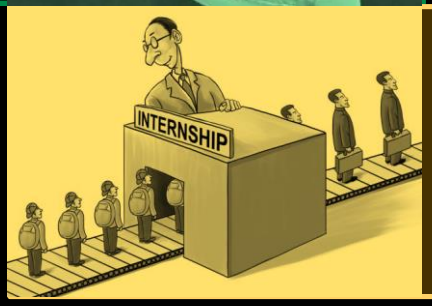
networking, data analytics, security, energy efficiency

Job market

Local and global enterprises

Abroad for education or work

R&D at universities or research centers

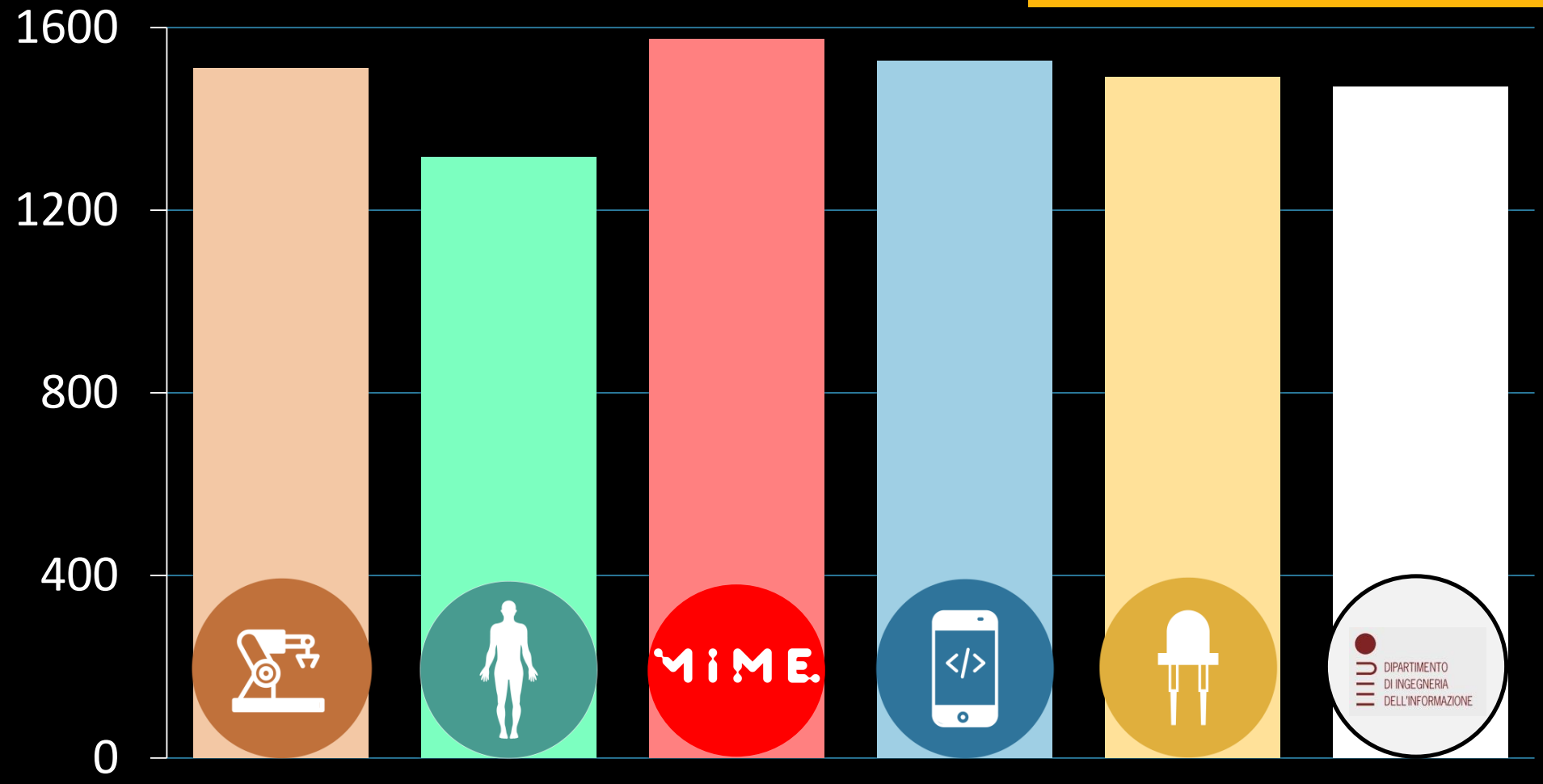


Internship options

Monthly salary after 1 year

Graduates of 2017

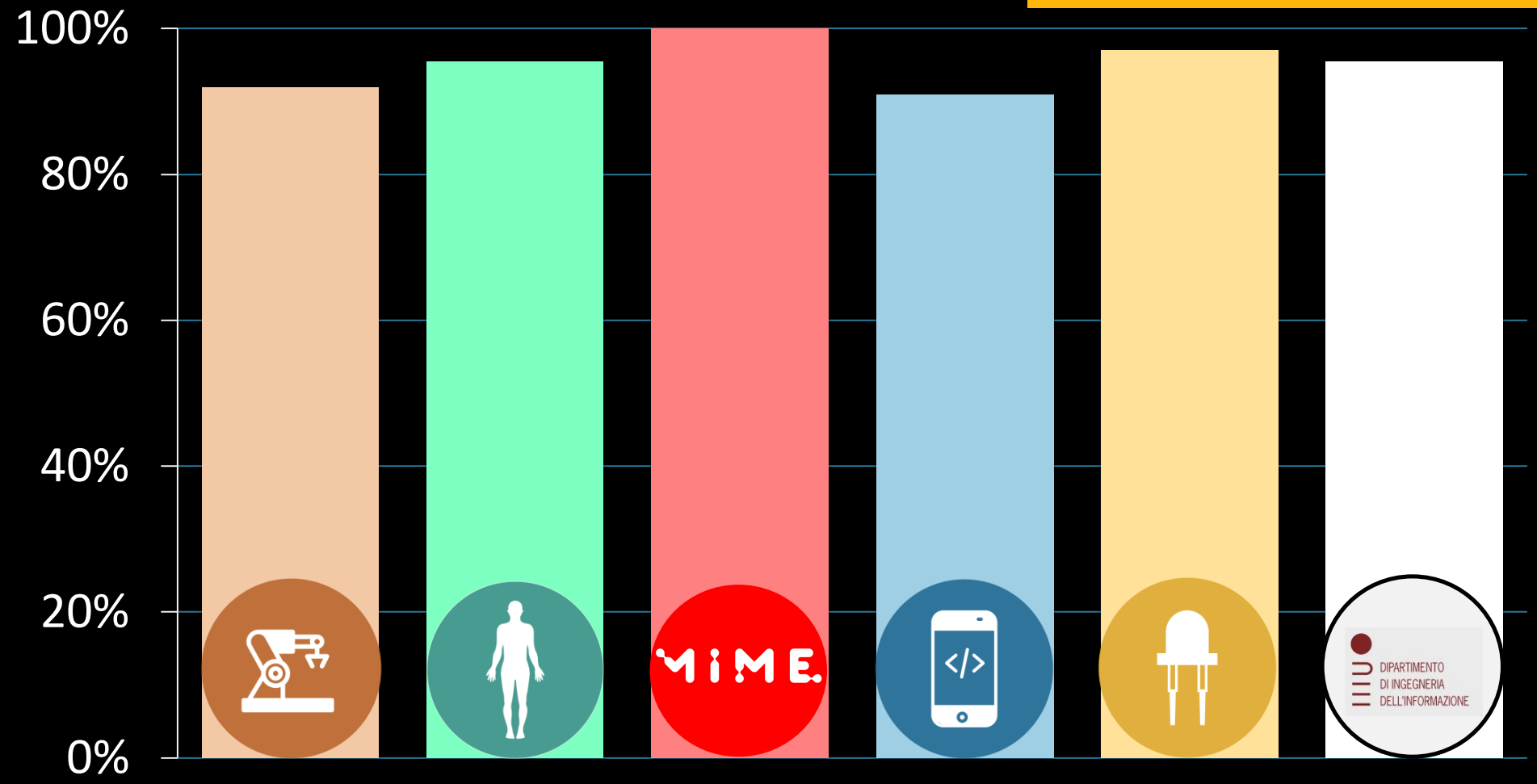
source: XX survey



Employment rate after 1 year

source: XX survey

Graduates of 2017

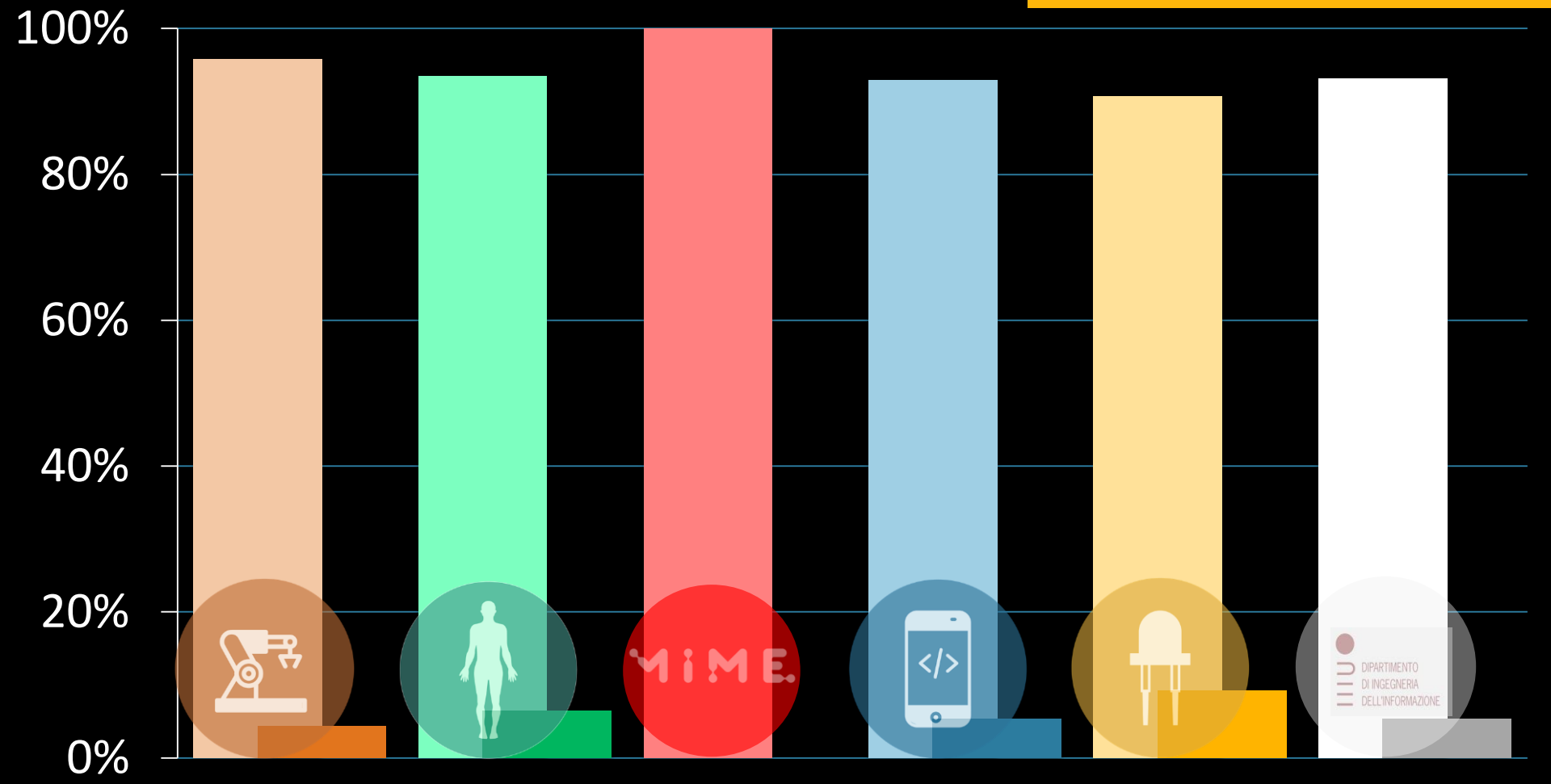


Satisfaction rate about the program

(yes = light, no = dark)

source: XX survey

Graduates of 2018

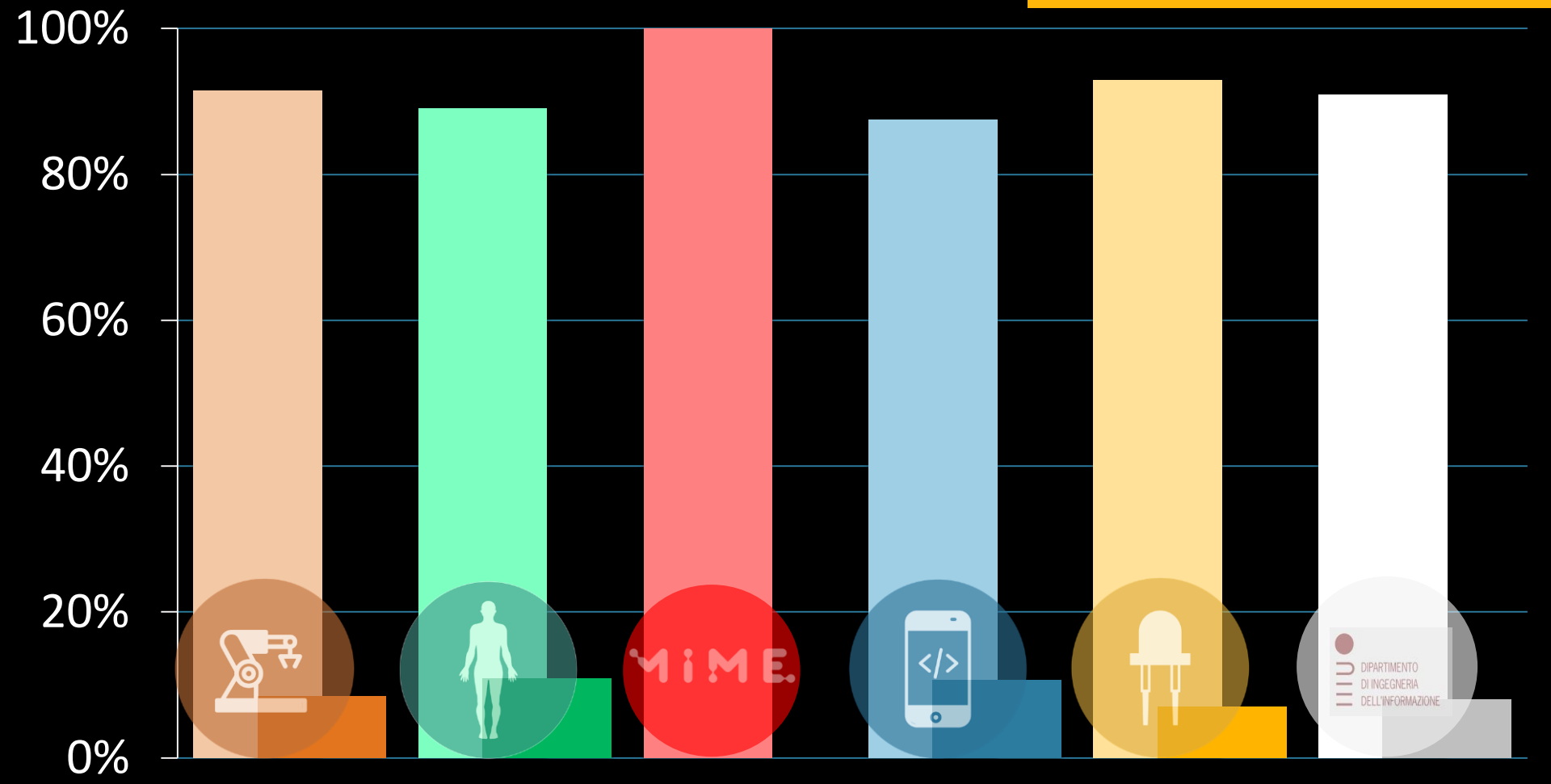


Satisfaction rate about the lecturers

(yes = light, no = dark)

source: XX survey

Graduates of 2018

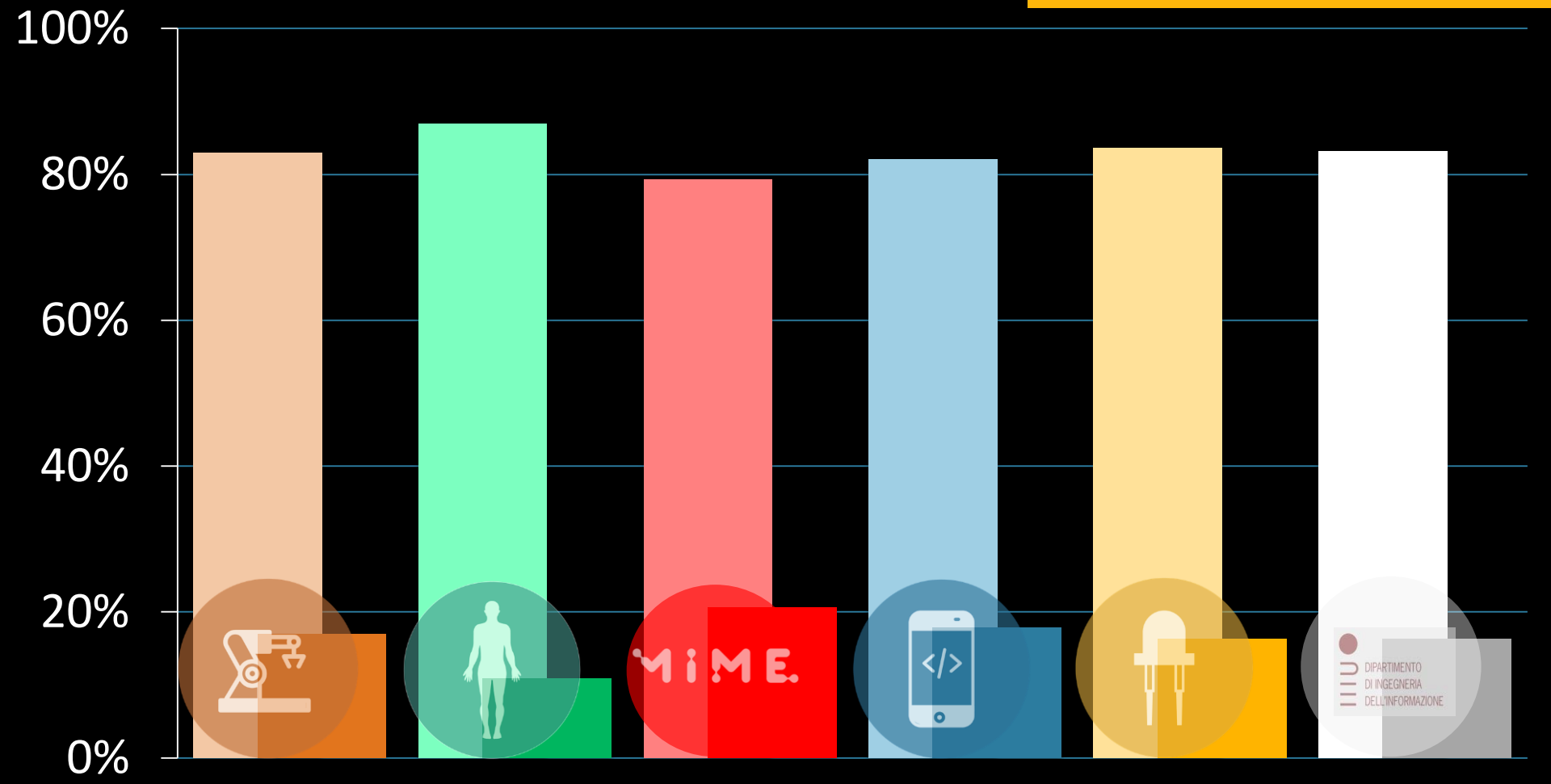


How is the teaching load?

(light or heavy = dark)

source: XX survey

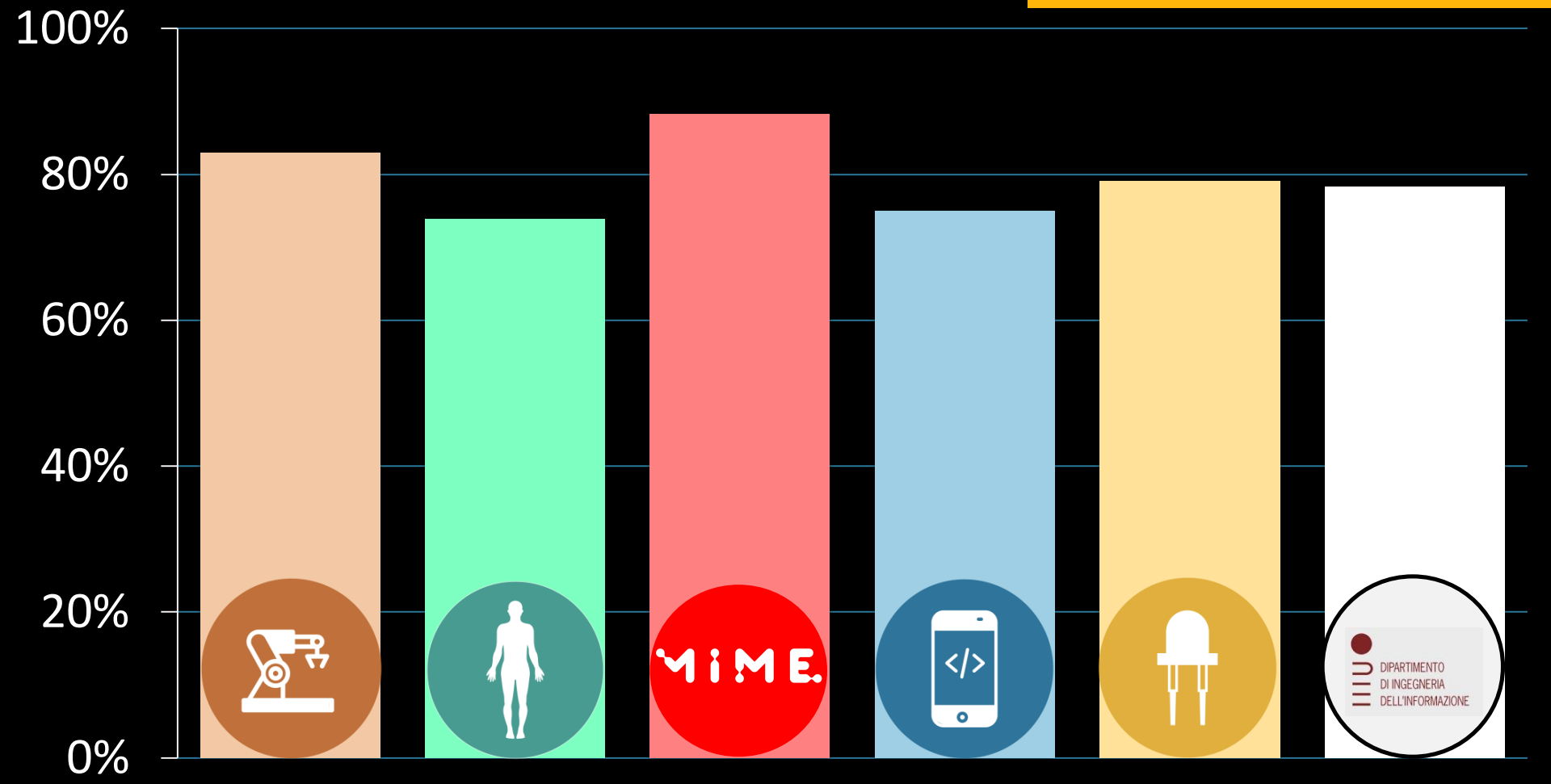
Graduates of 2018



Would you choose it again?

source: XX survey

Graduates of 2018



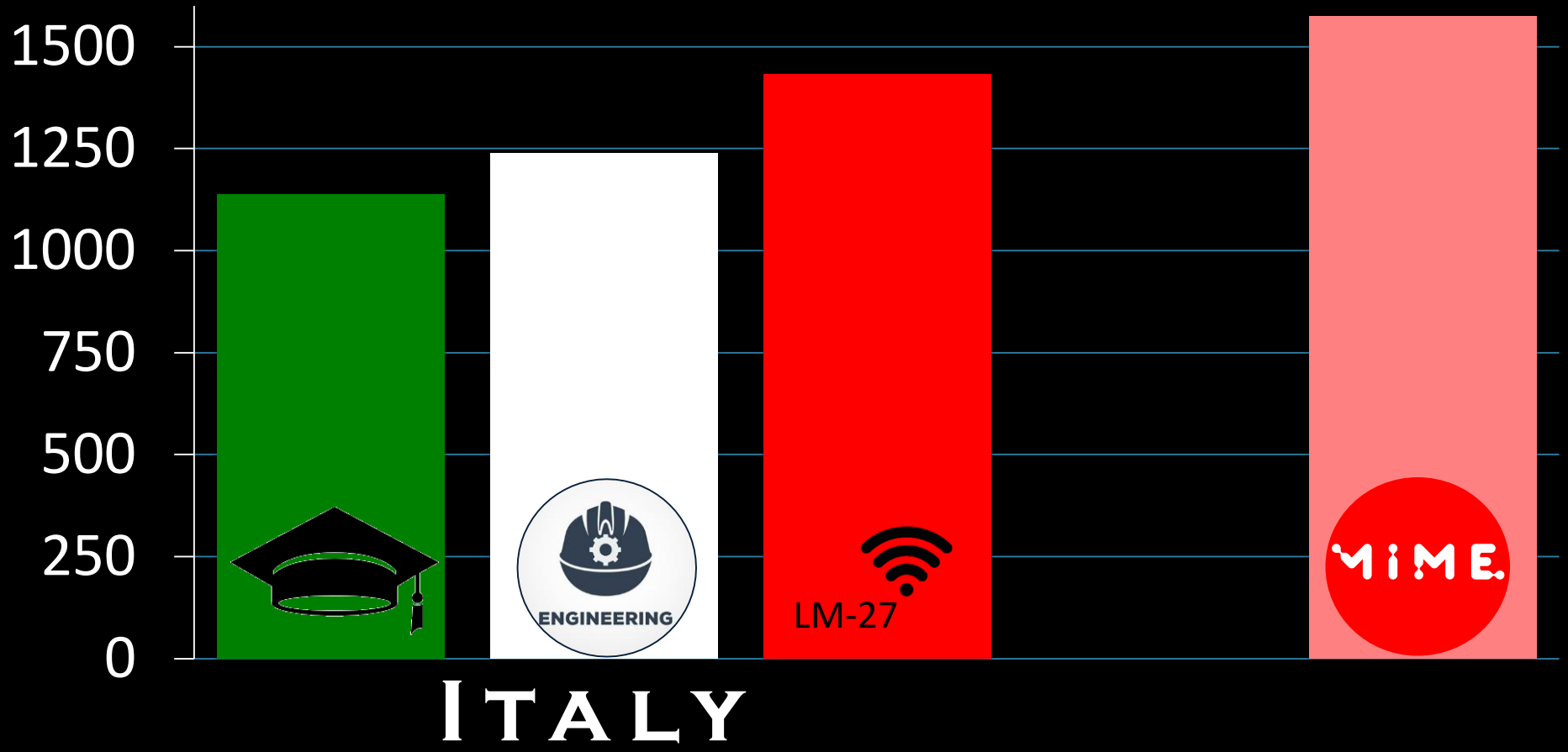
Monthly salary after 1 year

(comparison with Italy)

source: XX survey

AlmaLaurea

Graduates of 2017



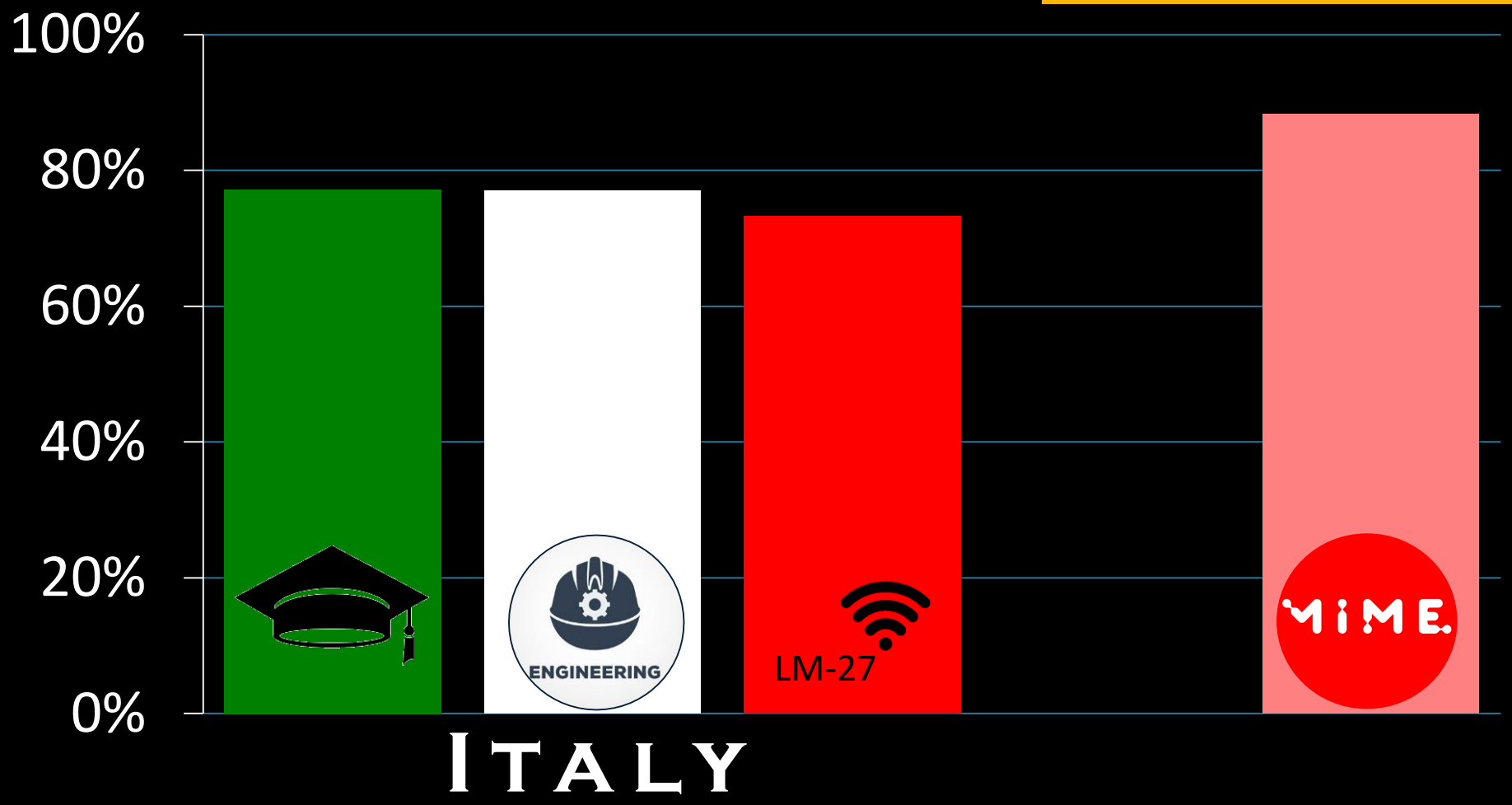
Would you choose it again?

(comparison with Italy)

source: XX survey

AlmaLaurea

Graduates of 2018



Other data

source: XX survey

- Average duration of studies: 2.6 years (also includes Double Degree students)
- Average graduation mark: 108.1
- Had an experience abroad: 35% (note: another ~25% are foreign nationals)
- Average time from graduation to 1st job: **2.0 months**

After the degree: PhD?

About 30% of graduates of our MSc pursue higher education toward a PhD

Our department offers a highly qualified PhD program in Information Engineering

Graduates of the last 10yrs from our MSc+PHD are now

- Professors/academic researchers: Purdue, Irvine, UC3M Madrid, Malaysia Pahang, New York Univ, Univ. Firenze, Michigan, Porto, San Diego, Kentucky, Dresden, Aalborg, Rochester, Norce Bergen Norway
- Industrial project engineers: Gameloft, Nokia, Ublox, Athonet, TIM, Qascom, SIAV, Aquifi, Ceam, Mount Sinai Hospitals NY, Wind-tre, McKinsey, Urbana Smart, ElettronicaBiomedicale, DLR, Calearo Antenne, ESA, Cisco, Microsoft

Infineon award

- A scholarship/award assigned to promising students to help them pursue the degree in "ICT for Internet and multimedia"
- Based on: (i) academic track record;
  (ii) interview with the Evaluation Committee
- 2 awarded prizes of 5000 euros each
- The call will be out soon: check the website www.unipd.it/borse-premi-studio-studenti

Questions

Contacts

Nicola Laurenti, Leonardo Badia, Michele Zorzi

mime@dei.unipd.it
mime.dei.unipd.it

Slides available at:

 /mime.unipd