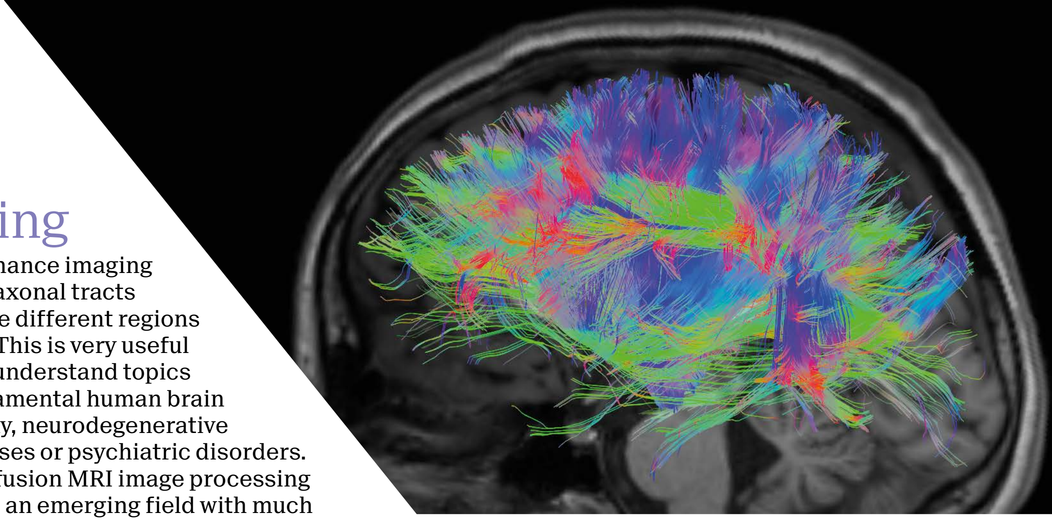
MASTER

ELECTRICAL AND ELECTRONIC ENGINEERING

EPFL

Our society is facing important challenges, including the energy transition and the big data wave. This master's program prepares future engineers to address those challenges by covering the whole spectrum of Electrical Engineering Sciences and Technologies. The broad and flexible array of courses, labs and projects rank amongst the highest internationally. In addition to its three renowned domains (Micro/Nanoelectronics, Information Technologies and Energy/Smart Grids), the section of Electrical and Electronic Engineering offers two new high-level specializations in Data Science and Systems and in Internet of Things (IoT).

Come and join us in one of these inspiring programs.



Human Brain Imaging

Diffusion MRI is a special magnetic resonance imaging technique that allows to reconstruct the axonal tracts that connect the different regions of the brain. This is very useful in order to understand topics like fundamental human brain anatomy, neurodegenerative diseases or psychiatric disorders. Diffusion MRI image processing is an emerging field with much to explore and great potential for the further evolution of medical imaging. It offers a wide range of signal and image processing problems such as improving the modeling of diffusion at the local level, reducing the needed scan time to acquire an image, developing global optimization algorithms to derive the axonal tracts from the raw data, graph analysis on one of the most complex networks known to man, or transferring those developments to clinical practice by studying the connectivity of real pathological brains as compared to normal controls. EE student projects in this field of research consist for instance in developing a global optimization algorithm to infer the most probable set of neuronal bundles from diffusion MR images of a brain. This kind of project involves image processing, mathematics, statistics, and computer science - it allows EE students and graduates to contribute to the understanding of the fascinating human brain.

Mina Bjelogrlic: "Everything that you saw and was a bit theoretical during your Bachelor's, you will be able to use it during this Master's: you have the tools, let's do something with it."

Watch the video:

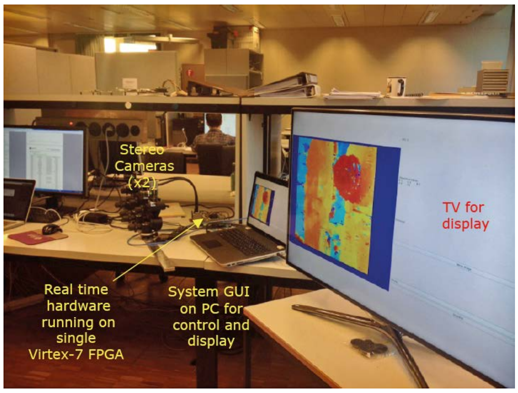
Charles Gigandet: "I work as an electrical engineer for Logitech in Taiwan, to develop and qualify the electronic components integrated in our products. The electronical industry produces many of its products in Asia and I wanted to discover this environnement to understand it better."

The Real-Time and High Performance System-on-Chip Development for High Resolution Stereo Camera Depth Map Estimation

Depth estimation is an algorithmic step in a variety of image processing applications such as autonomous navigation, robot and driving systems, 3D geographic information systems, object detection and tracking, medical imaging, computer games and advanced graphic applications, 3D television, multiview coding for stereoscopic video compression, and disparity-based rendering.

The target of this project is to develop real-time and high resolution depth map estimation system using Virtex-7 FPGA. While FPGA computes the depth map in real-time, the depth map results and the original images will be displayed in PC using QT based Graphical User Interface (GUI). Moreover, some depth map estimation based simple applications, such as measuring the exact distance of the objects (with meters and centimeters) and computing the speed of the object, will be developed in PC.

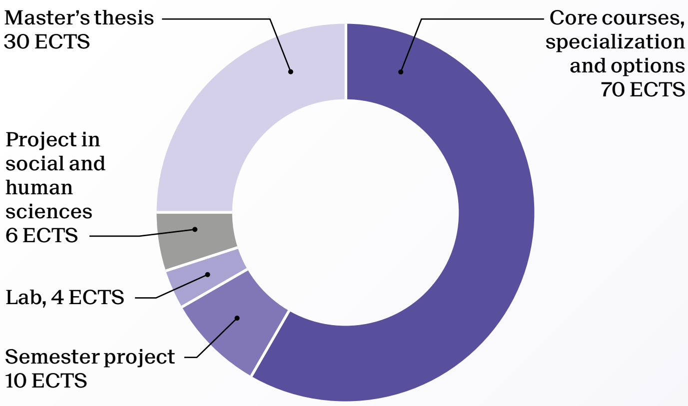
The engineer working on the project will improve his knowledge about embedded systems, Xilinx tools, Modelsim, QT, Ethernet Protocol, using high-end Xilinx Virtex 7 FPGA, hardware implementation using Verilog, image processing, and MATLAB.



Master of Science in

ELECTRICAL AND ELECTRONIC ENGINEERING

2-year program - 120 ECTS



	Specialization							Credits
Core courses (min. 12 credits)	A	B	C	D	E	F	G	
Convex optimization				D	E			5
Fundamentals of analog and mixed signal VLSI design	A	B	C	D			G	4
Fundamentals of inference and learning	A	B		D	E	F		4
Semiconductor devices I	A	B					G	4
Smart grids technologies								5
Wireless receivers: algorithms and architectures	A		C	D		F	G	4

Lab	A	B	C	D	E	F	G	4
Lab in acoustics								4
Lab in EDA based design				D				4
Lab in electrical energy systems								4
Lab in microwaves	A						G	4
Lab in nanoelectronics	A	B						4
Lab in signal and image processing				D				4
Lab on app development for tablets and smartphones				D	E			4
Lab on cell-free synthetic biology			C					4
Large-scale data science for real-world data				D				4

Students may choose a 30 ECTS specialization in:

A Microelectronic circuits and systems
B Electronic technologies and device-circuit interactions
C Bioelectronics
D Internet of Things (IoT)
E Data science and systems
F Signal, image, video and communication
G Wireless and photonic circuits and systems

Or / and a 30 ECTS minor included in the 120 ECTS. Recommended minors with this Master:

- Biomedical technologies
- Computational science and engineering
- Energy
- Management, technology and entrepreneurship
- Space technologies

Industrial internship

The program includes a compulsory industrial internship with a minimal duration of 8 weeks (30 ECTS if extended to 4-6 months).

School of Engineering

go.epfl.ch/master-electrical-electronic-engin
contact: philippe.gay-balmaz@epfl.ch

	Specialization							Credits
Options	A	B	C	D	E	F	G	
Adaptation and learning					E	F		4
Advanced A/MS VLSI: A-to-D Converter	A	B	C					3
Advanced analog integrated circuit design	A	B	C	D			G	3
Advanced computer architecture	A							8
Advanced lab in electrical energy systems								4
Advanced lab in electrical engineering								4
Advanced multiprocessor architecture	A			D				6
Advanced VLSI design	A			D				4
Advanced wireless receivers	A			D			G	3
Analog circuits for biochip	A		C	D				3
Applied biomedical signal processing				D		F		4
Applied data analysis				D	E			8
Applied machine learning				D	E			4
Audio						F		3
Automatic speech processing					E	F		3
Basics in bioinstrumentation			C					4
Bioelectronics and biomedical microelectronics	A	B	C	D				3
Biomicroscopy I, II	A		C	D			G	7
Bio-nanochip design			C	D				3
Causal inference				D	E	F		4
Cellular and molecular biology I			C					3
Classical and quantum photonic transducers								3
Computational neurosciences: neuronal dynamics			C					5
Computational photography						F		6
Computer graphics						F		6
Data visualization					E			6
Deep learning				D	E	F		4
Deep learning for autonomous vehicles								6
Deep learning for optical imaging					E	F		3
Design technologies for integrated systems	A	B	C	D		F		6
Discrete optimization				D	E			5
Distributed information systems				D		F		6
Distributed intelligent systems	A					F		5
Electromagnetic compatibility								2
Embedded systems design	A			D				6
Energy conversion and renewable energy								4
Energy storage systems								3
Fundamentals and processes for photovoltaic devices								3
Fundamentals of biomedical imaging			C					4
Fundamentals of biosensors and electronic biochips			C	D				3
Fundamentals of VLSI design	A	B	C	D				4
How to design for value for space applications								2
Hydropower plants: generating and pumping units								2
Image analysis and pattern recognition					E	F		4
Image and video processing				D		F		6
Imaging optics	A							3
Industrial automation								3
Industrial electronics I, II								8
Information theory and coding	A			D	E	F		8
Introduction to the design of space mechanisms								2
Lasers: theory and modern applications	A						G	4
Lessons learned from the space exploration								2
Machine learning	A				E			8
Mathematics of data: from theory to computation					E			6
Media security				D		F		6
Microwaves, the basics of wireless communications	A		C			F	G	4
Mobile networks	A			D				8
Model predictive control				D				4
Multivariable control								4
Nanoelectronics	A		C	D				2
Networked control systems				D				3
Network machine learning				D	E	F		4
Neural interfaces			C					6
New space economy								3
Optical detectors	A						G	3
Optics laboratories I	A						G	3
Optimal decision making				D				4
Photonic systems and technology	A					F	G	4
Physical models for micro- and nanosystems	A							2
Physics of photonic semiconductor devices	A						G	4
Power system restructuring and deregulation								3
Power systems dynamics								3
Project in electrical engineering	A		C	D	E	F	G	10
Projet en technologies spatiales								12
Quantum electrodynamics and quantum optics	A						G	6
Quantum optics and quantum information	A						G	6
Radio frequency circuits design techniques	A		C				G	4
Reinforcement learning								6
Scaling laws in micro- and nanosystems			C					2
Selected topics in advanced optics	A						G	3
Semiconductor devices II	A	B					G	4
Semiconductor physics and light-matter interaction								4
Seminar in physiology and instrumentation								2
Sensors in medical instrumentation			C					3
Smart sensors for IoT				D				3
Social media						F		2
Space mission design and operations								2
Space propulsion								3
Spacecraft design and system engineering								4
Statistical inference and machine learning	A	B		D	E	F		4
Statistics for data science								6
Systems and architectures for signal processing	A							2
Systems programming for systems-on-chip	A		C	D				6
TCP/IP networking								8
Test of VLSI systems	A							2
Transdisciplinary project								4
Wave propagation along transmission lines						F		2

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