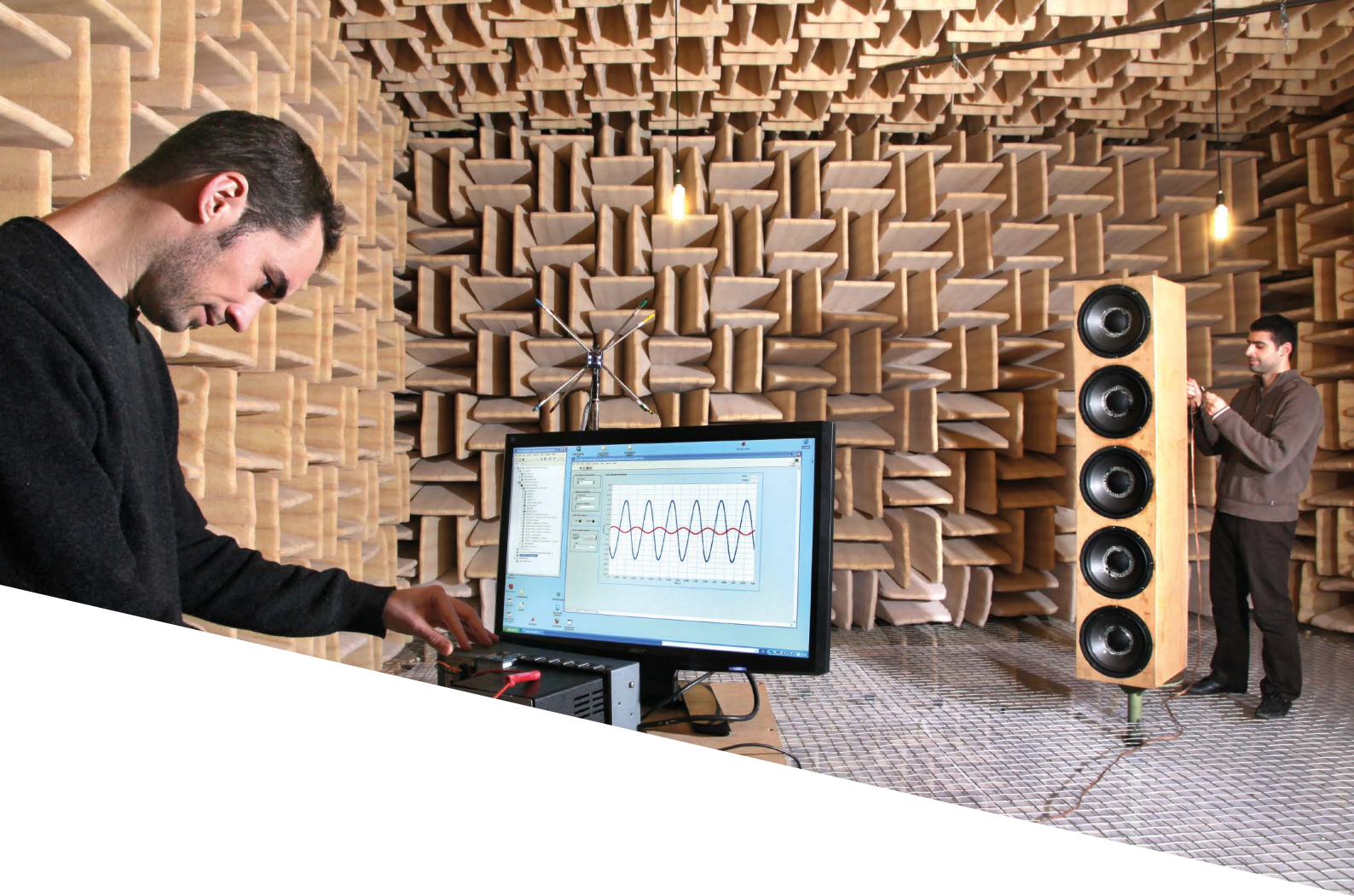


ELECTRICAL AND ELECTRONIC ENGINEERING

MASTER





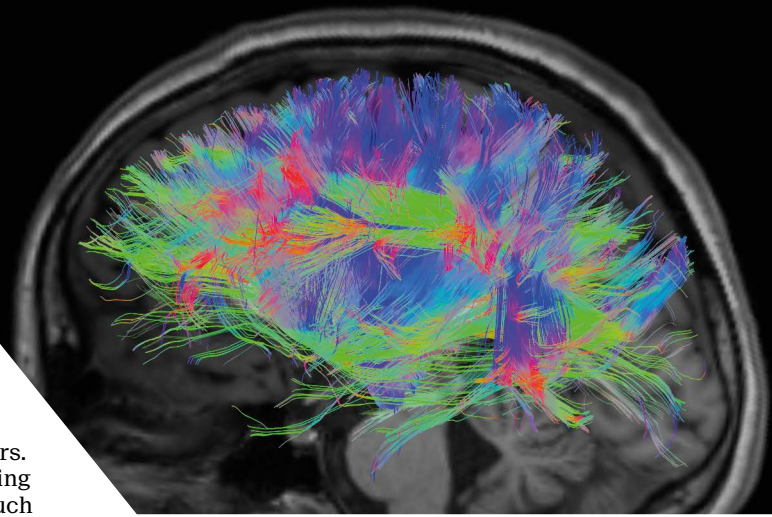
In addition to its two renowned specializations in Micro and Nanoelectronics and in Information technologies, the Section of Electrical Engineering offers to its students a new high-level teaching program on Smart Grids Science and Technologies. The electricity sector is experiencing deep changes and evolutions, and the new challenges of Smart Grids requires high-profile engineers capable of understanding and solving multi-disciplinary problems that integrate energy conversion systems together with power and telecommunication networks. You are invited to join us in one of these three 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

*Mina Bjelogrić:
"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:



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.



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 environment to understand it better."

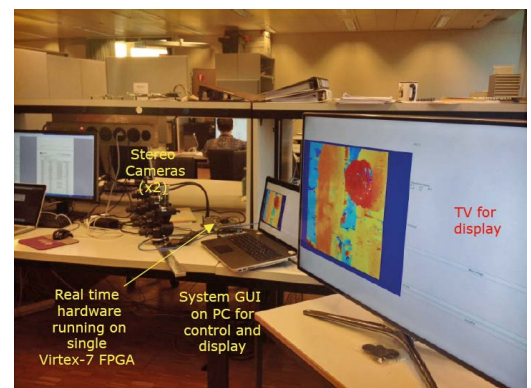


The Real-Time and High Performance System-on-Chip Development for High Resolution Stereo Camera Depth Map Estimation

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.

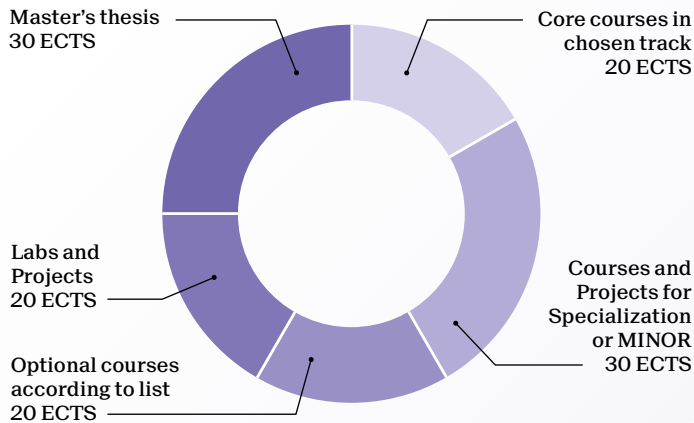
The target of this project is to develop real-time and high resolution depth map estimation system using Virtex-7 FPGA. While FPGA computes the depth map in real-time, the depth map results and the original images will be displayed in PC using QT based Graphical User Interface (GUI). Moreover, some depth 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



	Credits
Labs and Projects	20
Lab in Acoustics	4
Lab in EDA based design	4
Lab in Electrical Energy Systems	4
Lab in Microelectronics	4
Lab in Microwaves	4
Lab in Signal and Image Processing	4
Lab on Apps Development for Tablets and Smartphones	4
Project in Electrical Energy Systems	10
Project in Information Technologies	10
Project in Micro and Nanoelectronics	10
Project in human and social sciences	6

Possible Minors:

- Biomedical Technologies
- Computational Science & Engineering
- Energy
- Management, Technology and Entrepreneurship
- Science, Technology and Area Studies
- Space Technologies

or 30 ECTS internship (4-6 months)

Possible specializations:

- A Digital Design and Computer Engineering
- B Analog, Mixed-Signal and RF Design
- C Data, Signal & Image Science
- D Communication Technologies
- E Optoelectronics and Optics
- F Advanced Control and Communication for Power Systems Operation
- G Renewables and Energy Conversion Systems

Industrial internship

The program includes a minimum 8-week long compulsory internship.

A longer internship may be done instead of a specialization or in combination with the Master's thesis.

School of Engineering

master.epfl.ch/electricalengineering
contact: philippe.gay-balmaz@epfl.ch

	Track							Credits
Core courses (one track to be chosen)								
Micro and Nanoelectronics	1							20
Analog circuits design I, II								4
Hardware systems modeling I, II								4
HF and VHF circuits and techniques I								4
VLSI design Fundamentals and advanced								8
Information Technologies		2						20
Image analysis and pattern recognition								4
Mathematics of Data: From Theory to Computation								4
Microwaves								4
Photonic Systems and Technology								4
Wireless Receivers: Algorithms and Architectures								4
Smart Grids Science and Technology				3				20
Industrial electronics I								4
Mathematics of Data: From Theory to Computation								4
Multivariable Control and Coordination Systems								4
Power systems dynamics								4
Smart grids technologies								4
	Specialization							20/
Optional courses / Specialization	A	B	C	D	E	F	G	30
Advanced analog and RF integrated circuits design I		B						2
Advanced analog and RF integrated circuits design II		B						2
Advanced computer architecture	A							4
Advanced lab in Electrical Energy Systems						F	G	4
Advanced lab in Electrical Engineering	A	B	C	D				4
Advanced multiprocessor architecture	A							6
Advanced signal processing	A		C					3
Advanced Wireless Communications: Algorithms and Architectures				D				3
Analog Circuits for Biochip		B						3
A network tour of data science			C					3
Applied machine learning			C					4
Audio		B	C					3
Automatic speech processing			C					3
Bioelectronics and implantable biomedical microelectronics		B						3
Biological modeling of neural networks								4
Biomedical signal procesing								6
Biomicroscopy I					E			3
Biomicroscopy II					E			4
Bio-nano-chip design								3
Brain computer interaction								3
Compound semiconductor electronic devices					E	G		3
Data converter circuits and systems	A	B						3
Design technologies for integrated systems	A							6
Discrete optimization						F		4
Distributed information systems						F		4
Electrical filters		B						3
Electromagnetic compatibility							G	2
Embedded systems	A							4
Energy conversion and Renewable Energy							G	3
Energy storage systems							G	3
Flexible bioelectronics		B						3
Fundamentals and processes for photovoltaic devices							G	3
Fundamentals of biosensors and electronic biochips		B						3
HF and VHF circuits and techniques II		B						2
Hydropower plants : generating and pumping units							G	2
Image and video processing			C					6
Image communication				D				4
Image optics								3
Industrial automation							G	3
Industrial electronics II							G	4
Information theory and coding	A	B	C	D				7
Integrated circuits technology		B						2
Introduction to computer graphics			C					6
Lasers: theory and modern applications					E			3
Media security								6
Mobile networks				D				4
Model predictive control						F		3
Modeling of emerging electron devices		B						3
Nanoelectronics	A	B						2
Optical communication				D	E			3
Optical detectors					E			3
Optical waves propagation					E			3
Optics III					E			4
Optimal decision making						F		4
Physical models for micro and nanosystems		B						2
Physics of photonic semiconductors devices					E			4
Power system restructuring and deregulation						F		3
Propagation of acoustic waves					D			3
Propagation of electromagnetic waves					D			2
Quantum Electrodynamics and Quantum Optics						E		4
Quantum optics and quantum information						E		4
Real-time embedded systems								4
Réseaux hydrauliques et énergétiques							G	3
Selected topics in advanced optics					E			3
Semiconductor physics and fundamentals of electronic devices						E		4
Seminar in physiology and instrumentation								2
Sensors in medical instrumentation								3
Signal processing for functional brain imaging								3
Space mission design and operations								2
Speech processing								3
Systems and architectures for signal processing	A							2
TCP/IP Networking				D		F		5
Test of VLSI systems	A							2
Wave propagation along transmission lines				D		F		2