Master Programs @ IC

Prof. Serge Vaudenay

February 28, 2024
SG 1 – 19h15-19h45
School of Computer and Communication Sciences - IC

- Internationally highly ranked
- 54 + (6 joint) professors
- Internationally recognized
- Strong industrial liaison
- Core + interdisciplinary science: Collaboration with Life Sciences, Mathematics, Microengineering, Electrical Engineering, etc.
- Doctoral program (EDIC)
### IC Research at a glance

<table>
<thead>
<tr>
<th>ATCS</th>
<th>ICT</th>
<th>AIML</th>
<th>DMIR</th>
<th>SIP</th>
<th>CAIS</th>
<th>OSNET</th>
<th>PLFM</th>
<th>S&amp;P</th>
<th>DC</th>
<th>DE</th>
<th>NLP</th>
<th>VC</th>
<th>HCI</th>
</tr>
</thead>
</table>

- **theory, foundations, fundamental limits...**
- **learning from data, extracting knowledge, transforming data...**
- **building real systems, all layers...**
- **interfacing with humans...**
Why choose IC?

CS is everywhere:
- You can work as a Computer Scientist anywhere, from the largest multinationals to the smallest farm, in the public sector, or at NGOs, or you create your own startup!

CS changes fast:
- You won’t get bored.
- You can do many different jobs in the course of one career.

The world in general, and Switzerland in particular, does not have enough trained Computer Scientists and Engineers:
- Jobs are easy to find (< 2 months).
- Switzerland needs 10'000 Computer Scientists per year but trains only 3'000 or so, and fewer than 200 in the two ETHs. Average EPF starting salaries are around CHF 85K and CHF 130K after 3–4 years.
Our Master programs

School of Computer & Communication Sciences

- Computer Science  
  go.epfl.ch/master-IN

- Communication Systems  
  go.epfl.ch/master-SC

- Cyber Security  
  go.epfl.ch/master-cyber

- Data Science  
  go.epfl.ch/master-DS

Cross-School Programs presented separately

- Neuro_X (STI-SV-IC)

- Quantum Science and Engineering (IC-STI-SB)

Master Info Days – February 2024
Master in Computer Science with Specialization in Teaching in collaboration with HEP-VD

This is a joint program between EPFL and HEP-VD to train high school teachers in Computer Science in Switzerland.

The program consists of 120 + 9 ECTS credits:
- 1st year: corresponding to studies in IN, SC or DS
- 2nd year: composed of the Master’s project + specialization courses at HEP.
Our four Master programs

- Our 4 Master’s are **designed to be flexible** to allow students to tailor their courses to their ambitions.
- The main difference between the 4 Master’s lies in the choice of Group 1 (Core) courses.
- The choice of **Group 2 courses (Options)** is very similar across the 4 Master’s.
- For Cyber Security, the **depth requirement** must be fulfilled.

<table>
<thead>
<tr>
<th>Group 1 – Core courses (min. 32 credits)</th>
<th>IN</th>
<th>Cyber</th>
<th>SC</th>
<th>DS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced computer architecture</td>
<td>8</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced probability and applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced topics on privacy enhancing tech.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algorithms II</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Applied data analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cryptography and security</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Decentralized systems engineering</td>
<td>8</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distributed algorithms</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Foundations of Data Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foundations of software</td>
<td>8</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information security and privacy</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Information theory and coding</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Machine learning</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Mobile networks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modern digital comm.: a hands-on approach</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Modern natural language processing</td>
<td>8</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Optimization for Machine Learning</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Statistical signal and data processing through apps.</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Statistics for Data Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systems for data management and data science</td>
<td>8</td>
<td>8</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>TCP/IP networking</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>ETHZ courses counting as breadth requirement</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum 32 credits</td>
<td>~32</td>
<td>~32</td>
<td>~32</td>
<td>~32</td>
</tr>
</tbody>
</table>
Master of Science in
COMPUTER SCIENCE
go.epfl.ch/master-IN

- This Master's program offers a choice of courses that covers all aspects of the discipline, ranging from foundations of computer sciences, software and computer systems to big data and construction of software.

- Students may choose a 30 ECTS specialization or a minor included in the 120 ECTS.

- The program includes a compulsory internship of eight weeks during the summer, or six months during the semester. The internship can also be combined with the master's project.

<table>
<thead>
<tr>
<th>Core courses (min. 32 credits)</th>
<th>cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced computer architecture</td>
<td>8</td>
</tr>
<tr>
<td>Algorithms II</td>
<td>8</td>
</tr>
<tr>
<td>Cryptography and security</td>
<td>8</td>
</tr>
<tr>
<td>Decentralized systems engineering</td>
<td>8</td>
</tr>
<tr>
<td>Distributed algorithms</td>
<td>8</td>
</tr>
<tr>
<td>Foundations of software</td>
<td>8</td>
</tr>
<tr>
<td>Information security and privacy</td>
<td>8</td>
</tr>
<tr>
<td>Machine learning</td>
<td>8</td>
</tr>
<tr>
<td>Modern natural language processing</td>
<td>8</td>
</tr>
<tr>
<td>Systems for data management and data science</td>
<td>8</td>
</tr>
<tr>
<td>TCP/IP networking</td>
<td>8</td>
</tr>
</tbody>
</table>
This Master's program provides students with a unique education that places emphasis on the interdependence of mathematics, computer science and electrical engineering. It covers fields like wireless communications, networking and mobility, internet computing, information security and signal processing.

- Students may choose a **30 ECTS specialization** or a **minor** included in the 120 ECTS.

- The program includes a **compulsory internship** of eight weeks during the summer, or six months during the semester. The internship can also be combined with the master's project.

### Core courses (min. 32 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced probability and applications</td>
<td>8</td>
</tr>
<tr>
<td>Algorithms II</td>
<td>8</td>
</tr>
<tr>
<td>Cryptography and security</td>
<td>8</td>
</tr>
<tr>
<td>Distributed algorithms</td>
<td>8</td>
</tr>
<tr>
<td>Information security and privacy</td>
<td>8</td>
</tr>
<tr>
<td>Information theory and coding</td>
<td>8</td>
</tr>
<tr>
<td>Mobile networks</td>
<td>8</td>
</tr>
<tr>
<td>Modern digital communications</td>
<td>8</td>
</tr>
<tr>
<td>Machine learning</td>
<td>8</td>
</tr>
<tr>
<td>Statistical signal and data processing</td>
<td>8</td>
</tr>
<tr>
<td>TCP/IP networking</td>
<td>8</td>
</tr>
</tbody>
</table>
The Master's program in data science equips students with all relevant knowledge and skills while combining theoretical foundations with practical experience. It covers a comprehensive education, from the foundations to implementation, from algorithms to database architecture, and from information theory to machine learning.

- Students may choose a **30 ECTS minor** included in the 120 ECTS.
- The program includes a **compulsory internship** of eight weeks during the summer, or six months during the semester. The internship can also be combined with the master's project.
In collaboration with ETHZ, this joint-degree program offers a broad set of courses such as cryptography, formal methods, systems, network and wireless security. It aims to provide both foundational and applied knowledge in this quickly expanding domain by leveraging expertise from both universities.

- Students are required to spend one semester at ETHZ.
- To satisfy the “depth requirement” at least 30 ECTS must be tagged “depth” (security courses), which may be part of Group 1 or 2 & may be taken at EPFL / ETHZ.
- The program includes a compulsory internship of eight weeks during the summer, or six months during the semester. The internship can also be combined with the master's project.
- The research project and the Master’s project must be in the field of cyber security.
Specializations and Minors

Specializations (IN & SC only)

- Computer Engineering
- Computer Science Theory
- Cyber Security
- Data Analytics
- Foundations of Software
- Internet Information Systems
- Networking and Mobility
- Signals, Images & Interfaces
- Software Systems
- Wireless Communications

Some examples of Minors taken by IC students

- Computational Biology
- Computational Science & Eng.
- Cyber Security (DS only)
- Engineering for Sustainability
- Financial Engineering
- Imaging
- Management, Technology and Entrepreneurship
- Mathematics
- Neuro-X
- Quantum Science & Eng.
- Spatial Technologies

[Links to Specializations and Minors]

- go.epfl.ch/IC-master-specializations
- go.epfl.ch/IC-master-minors
Industry Internships

gogo.epfl.ch/IC-internships

- Mandatory for all EPFL MS students since 2010.
- Gain valuable work experience, develop and refines your skills.
- Explore a career path.
- Can be done in Switzerland or abroad. IC has a database of more than 3000 industry contacts.

- Internship models
  - Short, 8 weeks minimum during the summer.
  - Long, 6 months during a semester.
  - Integrated with your Master’s Project (26 weeks), at the end of the Master’s cycle.
Internships: Host testimonials

"Since we started hosting several interns as part of the EPFL internship program, we have been pleased with these students' hard work and contributions. I always enjoy interacting with these bright young students. We look for unique views these interns can bring. I hope they see IBM Research as a very exciting place to work."

Giovanni Pacifici, IBM T.J. Watson

“EPFL has been doing an excellent job at providing us the best internship candidates for our needs. Everything from selecting the candidates to managing administrative issues has been handled smoothly and efficiently, allowing us to focus on the students and the work to be done.”

Stein Lundby, Qualcomm Inc.
Life after EPFL

**COMPUTER SCIENCE**
What I liked the most was everyone’s commitment, the experience of being there with all these motivated people.

*Acacio Da Silva Martins*
Senior Software Engineer, AdNovum

**DATA SCIENCE**
I feel like I have a tailored, personalized master’s degree with exactly the courses I wanted. It’s the dream scenario.

*Emma Lejal Glaude*
Data, Analytics and AI Engineer, Swisscom

**CYBER SECURITY**
The teaching team is really great, it’s so motivating to be working alongside the very best and life on campus is excellent. There is some much to do!

*Mathilde Aliénor Raynal*
PhD student, EPFL Doctoral program in computer and communication sciences

**COMMUNICATION SYSTEMS**
It’s been almost 10 years since my master’s and our group are still very good friends, even if we are spread out all around the world!

*Arthur Germain*
CEO, OneDoc
For IC BS students: Choice of Master’s program in IC (IN, Cyber, SC or DS)

- Upon successful completion of your Bachelor, you are directly admitted to a Master’s program in IC. External students have to pass through a highly selective application process.
- You can continue your studies in one of the four consecutive Master IC programs: IN, Cyber, SC or DS. The choice is made via the FRAC.
- For holders of a Bachelor SC, the Master Neuro-X is consecutive. Registration is done via the FRAC.
- For the Quantum Science and Engineering Master's degree, an application is required.
- Deadline for change of Master's degree in IC (e.g. SC -> DS, Cyber -> IN): end of 1st semester of Master's studies. In this case, please contact the Section.
- It is possible to take a gap year between the Bachelor's and Master's degrees, and re-enrol in one of our consecutive Master's degrees, if other studies have not been undertaken.
For BS students from other sections: Admission bachelor courses

- If you are thinking of changing your field of study, prepare by taking these BS courses during your bachelor.

- Admission is competitive. We want to see that you do well in our courses and that you are motivated.

### For Computer Science
- Software Construction, 8 cr, 2nd year, fall
- Algorithms I, 8 cr, 2nd year, spring
- Computer systems, 8 cr, 2nd year, spring

### For Cyber Security
- Software Construction, 8 cr, 2nd year, fall
- Computer Systems, 8 cr, 2nd year, spring
- Computer Security and Privacy, 6 cr, 3rd year, fall
- Algebra, 4 cr, 3rd year, fall (except for MA, PH, & CH)

### For Communications Systems
- Computer Systems, 8 cr, 2nd year, spring
- Modèles Stochastiques pour les Communications, 6 cr, 3rd year, fall
- Signal Processing, 8 cr, 2nd year, fall (except EL, MT, SV)

### For Data Science
- Algorithms I, 8 cr, 2nd year, spring
- Data-Intensive Systems, 6 cr, 3rd year, spring
- Prob Stats, 6 cr, 2nd year, fall (only external EPFL candidates)
BS students from other sections: What happens if I do not take the admission courses during my bachelor?

- Should you be admitted, your admission to the Master’s program will be conditional on acquiring the additional credits.
- Priority must be given to acquiring these credits during your first-year of study.
- The credits will not count towards your Master’s degree.
- You may take Master’s courses in parallel with your admission conditions, but it will be your responsibility to deal with schedule overlaps, etc.
- Admission conditions are non-negotiable and cannot be modified.
- It’s best to take these courses during your Bachelor to show your motivation to apply.
BS students from other sections: How to apply?

[go.epfl.ch/master-application]

- 1st admission cycle
  - deadline December 15

- 2nd admission cycle
  - deadline March 31

Criteria for admission

- Necessary requirement min. GPA 4.5
- Taken some BS admission courses with good results
- Quality of application, relevance of BS program compared to the MS cursus of interest, motivation, ...
For students in other sections:
Minors offered by IC

For students in other sections:
Minors offered by IC

go.epfl.ch/IC-master-minors

- We also offer several minors. This can be a very good option if you are hesitant to change section (field of study).
- Condition: min 30 credits from a list of pre-defined courses in:
  - Computer Science
  - Communication Systems
  - Data Science
  - Cyber Security
  - Computational Biology
Your contacts in the section

Prof. A.-M. Kermarrec  
Associate Dean for Education

Prof. Karl Aberer  
Director IN-Cyber

Prof. Serge Vaudenay  
Director SC-DS

Eileen Hazboun  
Deputy, all programs

Antonella Veltro  
Master IN
antonella.veltro@epfl.ch

Carole Dauphin  
Master SC-DS
carole.dauphin@epfl.ch

Jasmine Locatelli  
Master Cyber
jasmine.locatelli@epfl.ch

Patricia Genet  
Internships / PDM IC
patricia.genet@epfl.ch
Merci