

Università
della
Svizzera
italiana

Faculty
of
Informatics

**Plan of studies
3-5-8**

2017/18

**2017/
18**



Plan of studies

3-5-8

2017/18

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Preface

Informatics is information plus automation. It covers techniques and methods to represent, organize, store, access, communicate, and process information. Informatics is a bit like mathematics. It is a universal language and a powerful formalism to describe and analyze, and it is fundamental for science and engineering. Informatics is a bit like engineering. It is the practical and clever application of principles for a myriad of good uses. It is invention, innovation, technology, and design. Informatics is a bit like art, too. It is a mix of imagination and skills, and also a sense of beauty. And it is absolutely fascinating!

Informatics is everywhere. It impacts and contributes to all aspects of human life in modern societies, and therefore it is a platform for exciting careers, not only in information technology but also in economics, health, aerospace, entertainment, and so many other sectors.

Informatics is our passion. The Faculty of Informatics is home to a diverse group of excellent researchers and dedicated teachers. We are engaged in several national and international research projects, and we offer a full curriculum that includes Bachelor, Master, and PhD programmes, all taught in English. The Faculty continues to grow while keeping an enthusiastic, exciting, and vibrant environment for students and researchers.

Prof. Antonio Carzaniga
Dean of the Faculty of Informatics

Faculty of Informatics

Established in October 2004, USI's Faculty of Informatics is dedicated to high quality teaching and research. The mission of the Faculty is to conduct research and produce results in the field of informatics and to equip students with creative problem-solving skills that enable them to address complex problems in business and society.

The Faculty features 8 main areas of research, namely: Software Engineering, Computer Systems, Computational Science, Geometric and Visual Computing, Information Systems, Intelligent Systems, Programming Languages, and Theory and Algorithms. Born as a traditionally flat structure, the Faculty also features some institutes, such as the Advanced Learning and Research Institute (ALaRI), the Institute of Computational Science (ICS), and the Software Institute (SI), and as partner institute the Dalle Molle Institute for Artificial Intelligence (IDSIA) and the Swiss National Supercomputing Centre (CSCS).

Teaching excellence is assured by an international faculty, low student/academic staff ratio and a modern, innovative curriculum. The tuition language in the Faculty is English. The undergraduate programme is project-based and comprises six semesters of highly integrated courses and team-oriented projects.

For graduate students, the Faculty offers several specialized Master's programmes (also in cooperation with the Faculty of Economics) and a research-oriented PhD programme. The PhD programme is highly selective and gives students the opportunity to participate in national and international research projects.

The Faculty has an active network of research partnerships with other Swiss and international centres. The national and international networks support research collaborations and student mobility.

Executive bodies

Dean

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Vice-Dean

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Vice-Dean

Prof. Fernando Pedone
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The Dean and Vice-Deans
 are available for meetings by appointment.

Dean's Office secretaries

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 Janine Caggiano,
 Jacinta Vigni
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Coordinator of Faculty activities/projects and external relations:

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Mobility Delegate

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Faculty IT office:

Ing. Giacomo Toffetti-Carughi

Bachelor's programme Director

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Master in Informatics

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The programme directors and delegates
 are available by appointment.

Faculty's governing bodies

The Faculty's governing bodies include: the Faculty Council, the Professors Council, and the Dean's Office.

Faculty Council

The highest body of the Faculty is the Faculty Council. It comprises:

- all tenured professors (full and associate), the assistant professors and adjunct professors of the Faculty;
- one teacher representative (with one- or two-year contract),
- one post-doctoral researcher representative, one PhD student representative and one student representative (Bachelor and Master).

Full professors

Cesare Alippi
 Walter Binder
 Antonio Carzaniga
 Fabio Crestani
 Patrick Eugster
 Illia Horenko
 Kai Hormann
 Mehdi Jazayeri
 Rolf Krause
 Marc Langheinrich
 Michele Lanza
 Evanthia Papadopoulou
 Michele Parrinello
 Cesare Pautasso
 Fernando Pedone
 Mauro Pezzè
 Laura Pozzi
 Olaf Schenk
 Jürgen Schmidhuber
 Natasha Sharygina
 Stefan Wolf

| | |
|--------------------------------|--|
| Associate professors | Michael Bronstein Matthias Hauswirth Igor Pivkin Silvia Santini |
| Assistant professors | Gabriele Bavota Piotr Didyk Vittorio Limongelli Nate Nystrom Robert Soulé |
| Adjunct professors | Luca Maria Gambardella Miroslaw Malek |
| Faculty Representatives | <ul style="list-style-type: none"> • Students Simon Reding (Luca Dolfi) • PhDs Kolja Junginger (Cyrill von Planta) • Post-docs Antti Hyvärinen (Ivan Elhart) • Teachers Chiara Francalanci |
| Professors Council | The Professors Council is made up of all tenured professors (full and associate) of the Faculty. |
| Dean | The current Dean is Prof. Antonio Carzaniga. For the specific duties of each body please refer to the Statute of the Faculty. |

ALaRI Advanced Learning and Research Institute

ALaRI, established in 1999, is the Advanced Learning and research Institute at the Faculty of Informatics at the Università della Svizzera italiana in Lugano, Switzerland. ALaRI's mission is promoting research and education in Cyber- Physical and embedded Systems. Aware of the real need for an interdisciplinary approach to education, ALaRI equips students with a unique body of knowledge ranging from electronics to informatics, from sensors and actuators to communication, from physical modeling to application design including interpersonal skills, indispensable in today's industry, such as team work, complex-project management, and market sensitivity. The research activities focus on topics of great scientific interest and industrial applicability, based on real-life design issues such as physical modeling, highlevel system design, Internet of Things, smart grids, wireless communication as well as system properties such as performance, dependability, intelligence, security and real time

Director of ALaRI

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ICS Institute of Computational Science

Advanced mathematical modeling and high performance methods in numerical simulations open new perspectives for science, research and economy. Exploiting the capabilities of modern supercomputers, increasingly complex problems can be tackled - covering a very broad spectrum of disciplines, from exact and natural sciences to economics and social sciences, including biomedical, environmental, materials, and engineering sciences. The ICS provides a unique research environment, where strong competences in modeling, simulation and information science come together in an open and application oriented atmosphere. Our aim is the efficient modeling and simulation of nonlinear processes on multiple scales in scientific and biomechanical applications. Current projects include biomechanics, contact

**Director of
ICS**

problems in elasticity with and without friction, nonconforming domain decomposition methods, nonlinear and non-smooth multigrid methods, parallel nonlinear solution methods, adaptive finite elements for complex geometries, and the coupling of molecular dynamics and finite element discretizations.

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**SI
Software
Institute**

The Software Institute (SI) is part of the Faculty of informatics of the Università della Svizzera italiana (USI), located in beautiful Lugano, in Southern Switzerland. At the SI, our strength is discovering, designing, and developing new ideas that ease the conception of modern software systems. Our research is rooted both in sound theoretical models as well as practical, real-life questions that impact modern society, a society where reliable, well engineered software systems have become quintessential. The SI is a center of excellence committed to the teaching, the research and the development of software. The SI is directed by Michele Lanza and features renowned software researchers among its members: Profs. Gabriele Bavota (Software Analytics & Empirical Software Engineering), Matthias Hauswirth (Software Performance), Mehdi Jazayeri (Software Education), Cesare Pautasso (Software Architecture & Web Engineering), and Mauro Pezzè (Software Quality & Testing).

**Director of
SI**

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Partner institutes**IDSIA
Istituto Dalle
Molle di Studi
sull'Intelligenza
Artificiale**

IDSIA was founded in Lugano in 1988 by Angelo Dalle Molle (1908-2002), an Italian philanthropist whose vision was a world where technological progress and human development could both contribute to the improvement of our quality of life. Dalle Molle was a precursor of electric mobility, and he established a Trustee in Switzerland to promote creative scientific research, free from the bureaucratic ties of university institutions. Nowadays the institutes founded by Angelo (IDSIA in Lugano, IDIAP in Martigny, and ISSCo in Geneva) are integrated in the local institutions. Since the foundation of USI and SUPSI in Canton Ticino, IDSIA has been designated to be a "bridge" between these two institutions. For this reason IDSIA activities span from fundamental to applied research, transferring its knowledge into applications in the real world.

**Director of
IDSIA**

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CSCS Swiss National Supercomputing Centre

Founded in 1991, CSCS develops and provides the key supercomputing capabilities required to solve challenging problems in science and/or society. The centre enables world-class research with a scientific user lab that is available to domestic and international researchers through a transparent, peer-reviewed allocation process. CSCS's resources are open to academia, and are available as well to users from industry and the business sector. The centre is operated by ETH Zurich and is located in Lugano. CSCS and the Università della Svizzera italiana coordinate the Swiss Platform for Advanced Scientific Computing (PASC); a joint effort of all Swiss universities to create a long-term research-driven cooperation network in computational science. The PASC overarching goal is to position Swiss computational sciences in the emerging exascale-era and aims to provide the Swiss scientific community with the tools to make the best use of the new generations of supercomputing machines to solve key problems for science and society. It addresses important scientific research issues in high-performance computing and computational science in different domain sciences through interdisciplinary collaborations between domain scientists, computational scientists, software developers, computing centres and hardware developers.

Director of CSCS

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Rector, Administration and Services

Administration and Services Lugano Campus

Rector

Prof. Boas Erez

USI administration comprises of different services and it is under the Rectorate responsibility, specifically under the responsibility of the Secretary General and the Administrative Director, and through the Rectorate, under the University Council.

Administrative Director

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Secretary General

Albino Zraggen

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Sport

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 web www.cpstartup.ch

E-learning (eLab)

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Development and Fund Raising

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Copy Center Onys

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USI online services and resources

- **Student platform**
www.usilu.net
- **Faculty Course registration platform**
<http://teaching.inf.usi.ch>
- **eCourses platform (Moodle)**
www.icorsi.ch
- **Exam registration and consultation:**
www.esami.lu.usi.ch
- **Email access**
www.mail.usi.ch
- **FTP access**
ftp.lu.usi.ch
- **Corporate design**
www.usi.ch/en/images-and-logotype

Student associations

Several student associations have been created within the University. The main objectives are to improve relations between students and the institution and to enrich the range of educational and recreational offer during school. The associations are concerned mainly with the collection of didactic material, organisation of parties and meetings, cultural and sporting events, and networking among University students and the business world.
www.desk.usi.ch/en/list-acknowledged-student-associations

More information:
www.usi.ch/en/administration-and-services

Academic calendar

The academic year goes from September until June. Courses are held from September until December and from February until June. The semester includes 3 exam sessions (January, June and September).

| | | |
|------------------------------------|-----------------------|-------------------------------|
| Autumn Semester 2017-18 | Formal registration | 4 - 22 September 2017 |
| | Classes begin | 18 September 2017 |
| | Classes end | 22 December 2017 |
| Winter Exams 2017-18 | Registration | 20 November - 4 December 2017 |
| | Exams session | 15 January - 2 February 2018 |
| | Master defenses | 29 January - 2 February 2018 |
| Spring Semester 2018 | Classes begin | 19 February 2018 |
| | Classes end | 1 June 2018 |
| Summer Exams | Registration | 23 April - 7 May 2018 |
| | Exams session | 11 - 28 June 2018 |
| | Master defenses | 25 - 28 June 2018 |
| Autumn Exams (recovery) | Registration | 23 July - 6 August 2018 |
| | Exams session | 3-14 September 2018 |
| No classes: | All Saint's Day | 1 November 2017 |
| | Immaculate Conception | 8 December 2017 |
| | St. Joseph Day | 19 March 2018 |
| | Easter holidays | 30 March - 6 April 2018 |
| | Labour Day | 1 May 2018 |
| | Ascension Day | 10 May 2018 |
| | Pentecost Monday | 21 May 2018 |
| | Corpus Christi | 31 May 2018 |

Bachelor in informatics

BSc

| | |
|--------------------------|--|
| Introduction | The Bachelor of Science in Informatics introduces students to the theory and practice of informatics. It emphasizes theoretical foundations, technology, systems thinking, and soft skills like communication and teamwork. The curriculum is structured around four areas of learning essential for a truly interdisciplinary education: |
| Theory | The principles and foundations were established in the 20th century. These foundations help the students understand the potential and limits of computing. The theoretical subjects represent a solid basis to conduct sound scientific analysis and design. |
| Technology | Informatics is in permanent and fast-paced evolution, characterized by rapid changes in technology. Students are exposed to the most recent technological advances and learn to cope with technological change and evolution, as well as the impact of technology on society. |
| Systems thinking. | Informatics systems today form the foundations of many societal, governmental, and business systems and services. Students learn to view a computer-based system as a component of a larger environment rather than an isolated system. Communication and Teamwork. Information technology projects are intrinsically interdisciplinary. Informatics professionals work in teams to identify complex problems and develop appropriate solutions. Students learn to communicate, to work with others in teams, and to present the results of their work. The program is based on the European Credit Transfer System (ECTS), which is recognized by all universities in Europe. The three-year Bachelor degree (BSc) is followed by a two-year graduate study programme, leading to a Master degree (MSc). The Faculty offers six Master programmes (see p. 81). |
| Mobility | A student can take part in a mobility or student exchange programme and undertake a semester in another university for a maximum of 30 ECTS in one semester. The student must discuss the choice of host institution and the study plan with the Bachelor |

director and obtain approval. The mobility period generally lasts one semester; it may be extended, subject to approval of the Bachelor director, to a maximum of two consecutive semesters. For all information about mobility please consults the International Relations and Study-abroad Office at <http://www.usi.ch/en/relint>.

Study plan

The Bachelor programme consists of an innovative, project-based, team-oriented curriculum of six semesters (three years) and corresponds to 180 ECTS credits proportionally distributed (30 ECTS for each semester). In the first four semesters, students work on group projects. In the fifth semester students are required to do an internship in industry. In the sixth semester, they work on an individual final project in which they use all the acquired knowledge to solve an interesting problem. The Bachelor students have opportunities for summer internships both at companies and at the university.

Study programme Bachelor curriculum 2017-2018

| | Course | Instructor | ETCS |
|-----------------------------------|---|--------------------------------|-----------------------|
| First semester 30 ETCS | Calculus | Kai Hormann | 6 |
| | Computer Architecture | Marc Langheinrich | 6 |
| | Privatissimum | Faculty | 3 |
| | Programming Fundamentals 1 | Nate Nystrom | 6 |
| | Technical English | Jim Kaufmann | 3 |
| | Software Atelier 1: Fundamentals of Informatics | Gabriele Bavota | 6 |
| Second semester 30 ETCS | Algorithms & Data Structures | Antonio Carzaniga | 6 |
| | Discrete Structures | Stefan Wolf | 6 |
| | Linear Algebra | Igor Pivkin | 6 |
| | Programming Fundamentals 2 | Matthias Hauswirth | 6 |
| | Software Atelier 2: Human-Computer Interaction | Monica Landoni | 6 |
| Third semester 30 ETCS | Automata & Formal Languages | Laura Pozzi | 3 |
| | Computer Networking | Antonio Carzaniga | 6 |
| | Probability & Statistics | Davide Eynard | 6 |
| | Programming Fundamentals 3 | Walter Binder | 6 |
| | Software Atelier 3: The Web | Cesare Pautasso | 9 |
| Fourth semester 30 ETCS | Data Management | Patrick Eugster | 6 |
| | Introduction to Computational Science | Rolf Krause | 3 |
| | Operating Systems | Fernando Pedone | 6 |
| | Systems Programming | Antonio Carzaniga | 6 |
| | Software Atelier 4: Software Engineering Project | A. Mocci, L. Ponzanelli | 9 |
| | Fifth semester 30 ETCS | Algorithms & Data Structures 2 | Evanthia Papadopoulou |
| Artificial Intelligence | | Luca Maria Gambardella | 3 |
| Computer Graphics | | Kai Hormann | 6 |
| Experimentation & Evaluation | | M. Hauswirth, M. Langheinrich | 3 |
| Information Retrieval | | Fabio Crestani | 6 |
| Numerical Computing | | Olaf Schenk | 6 |
| Software Atelier 5: Field Project | | M. Lanza, M. Prevostini | 9 |
| Sixth semester 30 ETCS | Languages & Compilers | Nate Nystrom | 6 |
| | Optimization Methods | Rolf Krause | 6 |
| | Theory of Computation | Natasha Sharygina | 6 |
| | Bachelor Project | Mauro Pezzè | 18 |

Bachelor of Science

First year

Lecture
6 ECTS

Calculus

Instructor Kai Hormann

Description This course teaches the essentials from real analysis, which are relevant to informatics. It consists of five chapters. After revisiting basic facts about natural numbers, integers, and rational numbers, the first milestone is to understand the concept of real numbers and their properties. We then study sequences and series of real numbers and learn about the idea of convergence. The third chapter introduces real functions in one variable and focuses on the property of continuity and its consequences. Differentiation and integration are covered in the last two chapters. After finishing this course, students possess the mathematical skills required for solving basic problems in a formal and structured way and they will have developed a good understanding of differential and integral calculus. Whenever possible, applications of theoretical concepts are highlighted and part of the homework assignments deal with the implementation of numerical algorithms to practically experience the mathematical concepts.

-
- References**
- Kenneth A. Ross. Elementary Analysis: The Theory of Calculus. Undergraduate Texts in Mathematics. Springer, 1980
 - Additional material will be provided through the course homepage.

Lecture
6 ECTS

Computer Architecture

Instructor Marc Langheinrich

Description The class teaches the basic principles of how a computer functions, from the very basic building blocks (transistors and logical gates) to the more complex components (CPU, memory, buses, I/O interfaces). Students learn how one can describe the basic operations in a computer using digital logic, and how these operations can be realized in both hardware and software. Students gradually combine these basic operations into a "microarchitecture" -- a softwarecontrolled datapath that connects digital memory with an arithmetic-logical unit -- on which one can then build more and more complex "layers" that will finally allow the writing of complex programs in human-readable programming languages. This knowledge not only forms the basis for understanding how something as complex as a modern computer actually works, but is also a pre-requisite for learning about many advanced topics in informatics, such as Hardware/Software Co-Design, System Programming, Compilers, and Operating Systems.

References

- "Structured Computer Organisation", Andrew S. Tanenbaum, Todd Austin. 6th Edition (International), Pearson Education, 2012, ISBN-10: 0273769243, ISBN-13: 978-0273769248

Seminar
3 ECTS

Privatissimum

Instructors Vittorio Limongelli, Evanthia Papadopoulou, Igor Pivkin, Laura Pozzi, Olaf Schenk

Description A weekly meeting to discuss university life, science, technology, and society. The course is intended to help the students learn about, and adjust to the heavy and conflicting demands of being a new university student.

Lecture & Lab
6 ECTS

Programming Fundamentals 1

Instructor Nate Nystrom

Description This is a first course in programming -- applying computation to problem solving. The course is aimed at students with little or no prior programming experience. We'll be using a programming language called Racket, in which we will practice functional programming. But, this is not a course about Racket; it's a course about software construction: designing programs and then translating designs into implementations. Designing software means making wise choices about data structures, algorithms, and program organization. Implementing means more than just writing code: it means making wise decisions about systems and interfaces. By the end of the course, students should be familiar with various programming constructs universal to all languages, they should be able to analyze problems and then create programs to solve them.

References

- "How to Design Programs", Second Edition, Matthias Felleisen, Robert Bruce Findler, Matthew Flatt, Shriram Krishnamurthi. 2014. <http://www.ccs.neu.edu/home/matthias/HtDP2e/>

Atelier
6 ECTS

Software Atelier 1: Fundamentals of Informatics

Instructor Gabriele Bavota

Description The first of the ateliers, which are a crucial part of our Bachelor curriculum is roughly divided into three main pieces. On the one hand the students will obtain first-hand experience with a variety of tools of the trade, such as LaTeX, HTML, Versioning (SVN), and the shell. Second, the students will get an overview of the history of computer science since its very beginning up to the present day. The third part of the atelier is dedicated to the semester project that the students will do as part of the Programming Fundamentals course.

Lecture
3 ECTS

Technical English

Instructor Jim Kauffman

Description This course focuses on improving the four language skills: listening, reading, writing and speaking. In addition, emphasis is given to understanding and using different grammatical structures, as well as expanding and applying vocabulary. Course content includes a variety of technical areas, for example technology, planning, projects, design and careers. Information is provided on how to obtain international language qualifications through either the Cambridge English Language Assessment exams (for example, the First Certificate Exam) or the International English Language Testing System (IELTS). If participants are interested in pursuing these qualifications, some preparation and practice for the exams will be included in the course.

References

- For the Intensive Course: New Language Leader Upper Intermediate, published by Pearson, ISBN 978-1-4479-6154-3
- For the Technical English Course: Technical English 4, published by Pearson, ISBN 978-1-4082-2955-2

Lecture
6 ECTS

Algorithms & Data Structures

Instructor Antonio Carzaniga

Description Algorithms and data structures are fundamental to computer science. They are the essence of computer programs. The performance of any software system depends on the efficiency of its algorithms and data structures, and more generally, the study of algorithms provides insights into the nature of problems. This course provides students with the basic knowledge and skills necessary to design and reason about algorithms, and to understand the purpose as well as the strengths and weaknesses of some of the most fundamental algorithms and data structures. The course covers basic notions of: complexity, asymptotic worst-case and average complexity, big-O notation, complexity classes; general algorithmic strategies, brute force, greedy, divide-and-conquer, and dynamic programming; common algorithms, searching and sorting, elementary graph algorithms, string matching; basic data structures, stacks, queues, linked lists, rooted trees; more advanced data structures, B-trees, heaps, hash tables.

References

- Textbook: "Introduction to Algorithms" (Third Edition), by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Cliff Stein, published by MIT Press and McGraw-Hill.

 Lecture
 6 ECTS

Discrete Structures

Instructor Stefan Wolf

Description This course deals with the mathematics of countable structures. Hereby, central themes are modeling, abstraction, simplification, and generalization. The main topics of the course are propositional logic and proofs; sets, relations, and functions; combinatorics (urn models, inclusion-exclusion), graph theory (trees, planar graphs, Euler tours and Hamilton cycles) and some basic number theory (modular calculus, groups, Euler's theorem, RSA).

 Lecture
 6 ECTS

Linear Algebra

Instructor Olga Ilie

Description This course gives an introduction to the field of linear algebra. Concepts and techniques from linear algebra are of fundamental importance in many scientific disciplines and provide the "language" for understanding the behavior of linear mappings and linear spaces. Topics covered are linear systems and Gauss method, vector spaces, linear maps and matrices, determinants, eigenvectors and eigenvalues.

Lecture & Lab
6 ECTS

Programming Fundamentals 2

Instructor Matthias Hauswirth

Description This course teaches how to develop software using an object-oriented approach. It teaches how to structure a problem using the concept of classes, and how to use fields and methods to model state and behavior. The course uses Java as its programming language. It introduces the fundamental concepts of types, dynamic memory allocation, and references. It covers the ideas of collections and iteration to deal with multiple objects, the ideas of inheritance and polymorphism to deal with variability in software, and the idea of exception handling to deal with unexpected situations. It covers principles of design such as coupling and cohesion, encapsulation, and immutability, and it introduces common design patterns. The practical aspects of the course include testing and debugging techniques that help improve the quality of the resulting software.

References

- Mandatory textbook: Barnes and Kölling, Objects First with Java (5th edition)

Atelier
6 ECTS

Software Atelier 2: Human-Computer Interaction

Instructor Monica Landoni

Description This Atelier combines some important ingredients to help students get a better understanding of their future profession as ICT experts. It starts from an introduction to ethics that investigates the many ways and venues ICT can be used maliciously, focuses on responsibilities and proposes ethical solutions. The course moves on to introduce the concept of user centred design to produce usable, useful and used tools. The different stages from ideation to paper prototyping are covered in theory and practice. In the second part of the course students can focus on and take a critical approach in assessing what makes an interface usable, used and useful. In fact, by putting theory to good use in practice, the last part of the course will see students engage in group work to deliver a project where they combine their newly acquired programming skills (from Fundamentals in Programming 2) with their ability to design ethical, usable, useful and enjoyable interfaces.

References

- The UX Book: Process and Guidelines for Ensuring a Quality User Experience; Rex Hartson and Pardha Pyla; Morgan Kaufmann, 2012, ISBN: 0123852412.
- Don't make me think! : a common sense approach to Web usability; Steve Krug; Berkeley, Calif : New Riders Pub.2006.
- The Design of Everyday Things; Donald A. Norman; New York: Basic Books. 2013
- The Evidence-Based User Experience Research, Training, and Consulting web site by the Nielsen Norman group: www.nngroup.com

Bachelor of Science

Second year

Lecture
3 ECTS

Automata & Formal Languages

Instructor Laura Pozzi

Description The theory of automata and formal languages deals with the problem of modeling computation: what is a computer, and what are its fundamental capabilities? Thus, it constitutes the basis for further studies on the theory of computability and complexity. Additionally, Automata and Formal Languages is a very practical course, as it provides knowledge of the models used in many branches of computer science, from scanners and lexical analyzers in compilers, to programs for designing digital circuits, and even in other areas such as linguistics. At the end of this course you will be familiar with models of computations used today, you will understand how they are fundamental to further studies and you will be ready for a more advanced course on the theory of computation.

References

- Introduction to the Theory of Computation, Michael Sipser, ANY edition

Lecture
6 ECTS

Computer Networking

Instructor Antonio Carzaniga

Description The Internet provides global connectivity for applications and end-users. We want to understand, on the one hand, how common distributed applications such as the world-wide web use the network (the Internet), and on the other hand how the network is designed and how it provides its services to applications. This course serves the designers of distributed applications, as well as network designers as an introduction to advanced studies in computer networking. The course covers the architecture of networked applications and the network itself, their fundamental protocols, and the design principles behind them. This includes applications such as the Web, e-mail, and peer-to-peer systems; the two most important transport protocols of the Internet, namely UDP and TCP with its provisions for reliability and congestion control; and the network layer, with the structure of routers and the network as a whole, packet forwarding, and the basics of interdomain and intradomain routing.

References

- Textbook: "Computer Networking: A Top-Down Approach", by James F. Kurose and Keith W. Ross, published by Addison-Wesley.

Lecture
6 ECTS

Programming Fundamentals 3

Instructor Walter Binder

Description This course teaches concepts and methods of object-oriented programming as well as concurrent programming techniques. In the first part of the course, the object-oriented programming features of Java are presented in detail, covering inclusion polymorphism, dynamic binding, and parametric polymorphism. The course also teaches design by contract, UML, as well as selected design principles and patterns. The second part of the course gives an introduction to concurrent programming in Java. It covers multi-threading, safety and liveness hazards, and synchronization. The presented techniques enable the development of scalable Java software capable of exploiting modern multi-core hardware.

References

- Design Patterns: Elements of Reusable Object-Oriented Software (1994), by E. Gamma, R. Helm, R. Johnson, J. Vlissides. ISBN-13: 078-5342633610.
- Java Concurrency in Practice (2006), by B. Goetz, T. Peierls, J. Bloch, J. Bowbeer, D. Holmes, D. Lea. ISBN-13: 978-0321349606.

Lecture
6 ECTS

Probability & Statistics

Instructor Davide Eynard

Description The class provides an introduction to probability theory, descriptive statistics (data exploration and graphical inference; measures of central tendency, dispersion, and correlation; simple and multiple linear regression), and inferential statistics (sampling distributions, confidence intervals, significance testing). Theoretical concepts in the course will be illustrated with real-life examples and datasets, which students will analyse using the R software environment.

- References**
- Elements of information theory [Archivio elettronico] / Thomas M. Cover, Joy A. Thomas. - Hoboken, N.J. : Wiley-Interscience, 2006.
 - An introduction to probability theory and its applications / William Feller. - New York [etc.] : J. Wiley, 1968-1971.
 - Hogg, Tanis, Zimmerman: Probability and Statistical Inference, Ninth Edition (2015)
 - Diez, Barr, Cetinkaya-Rundel: OpenIntro Statistics, Third edition (2017) https://www.openintro.org/stat/textbook.php?stat_book=os
 - Darrell Huff: How to lie with statistics (1954)
 - Lecture notes will be made available on the e-learning platform.

Atelier
9 ECTS

Software Atelier 3: The Web

Instructor Cesare Pautasso

Description The ultimate goal of the Informatics Atelier is to teach the student to become a computing professional. To this end, the atelier gives an introduction to the role of computing and computer scientists in the professional world as well as society in general and provides an environment for the students to learn about and use specific software tools, work with other students in group projects, and effectively present the results of their projects. The emphasis during the Web Atelier in the third semester is on client/server programming, emerging Web technologies and Web design. The Web Atelier will cover the following Web technologies: REST and HTTP, CSS3, HTML5, JSON and Web Components; students will also learn how to program in JavaScript on the client and on the server-side with Node.JS and the Express framework.

- References**
- Handouts during the theoretical part of the atelier will complement freely available online tutorials.

Lecture
6 ECTS

Data Management

Instructor Patrick Eugster

Description Databases are essential to applications in a wide variety of domains, including finance, health care, commerce, and telecommunications. In fact, most applications that people use on a day-to-day bases are backed by databases. This course provides a practical introduction to database technology. By the end of this course, students will understand the fundamental concepts about database management systems, become familiar with commercial tools for the design and development of database applications, and be exposed to recent trends in database-like storage systems. Topics covered include modeling enterprise data with ER diagrams, the relational model, SQL, XML, logical design with normalization, physical design, query execution, transaction processing, recovery, concurrency, online analytical processing, and NoSQL systems.

Lecture
6 ECTS

Introduction to Computational Science

Instructor Rolf Krause

Description Numerical computing is an interconnected combination of computer science and mathematics in which we develop and analyze algorithms for solving important problems in science, engineering, medicine, and business---for example, simulating an earthquake, choosing a stock portfolio, or detecting cancer tumors in medical images. The students will learn principles and practices of basic numerical computation. This is a key aspect of scientific computation. This class will cover several topics, including: one-dimensional nonlinear equations; understanding and dealing with sources of error; linear equations and linear least-squares; data fitting; and ordinary differential equations. As much as possible, numerical methods will be presented in the context of real-world applications.

References

- A First Course on Numerical Methods (Computational Science and Engineering), Uri M. Ascher, Chen Greif, SIAM Book, 14. July 2011.
- A Practical Introduction to Programming and Problem Solving Paperback, Stormy Attaway, Matlab, Third Edition, July 1, 2013

Lecture
6 ECTS

Operating Systems

Instructor Fernando Pedone

Description Operating systems are a fundamental part of any computer system and common to virtually every application. This course surveys conceptual design and implementation issues of such complex programs, starting with the most basic notions of operating systems (e.g., the difference between the kernel and user modes, system calls) and evolving to develop key approaches to operating systems design and implementation. The course delves into the four main pillars of operating systems: process management (i.e., concept of process, multithreaded programming, process scheduling, synchronization, and deadlocks), memory management (i.e., memory-management strategies, virtual memory), storage management (i.e., file systems interface and implementation, mass-storage structure, and I/O systems), and operating systems protection and security. In addition to a conceptual view of operating systems, the course exposes students to the implications of some techniques through a hands-on approach.

References

- Operating System Concepts 9th Edition, A. Silberschatz, P. B. Galvin, and G. Gagne, Wiley, 2012

Lecture
6 ECTS

Systems Programming

Instructor Antonio Carzaniga

Description A "system" integrates functionalities and devices at different levels. Examples are information systems consisting of databases and processing modules, a distributed storage system consisting of networked redundant storage devices, an operating system that manages heterogeneous computing resources, and a robotic system made of physical devices, embedded sensors and controllers, as well as complex processing modules. The most common system programming language is C. This course is a practice-oriented introduction to programming in C. The focus is on features of the language and libraries that are particularly useful in programming systems. This includes the memory model, input/output, the network programming interface and other system calls, the organization of a large system programs, including the relevant language features and the build process, symbols and their relations to compilation units and the linker, and an introduction to symbolic debugging.

References

- Textbook (optional): "The C Programming Language", Second Edition. By Brian W. Kernighan and Dennis M. Ritchie. Prentice Hall, Inc., 1988.
- Frequently Asked Questions on C programming. (<http://www.c-faq.com/>)
- C reference documentation from cppreference.com. (<http://en.cppreference.com/w/c>)
- C++ reference documentation from cppreference.com. (<http://en.cppreference.com/w/cpp>)

Atelier

9 ECTS

Software Atelier 4: Software Engineering Project

Instructor

Andrea Mocci, Luca Ponzanelli

Description

Programming skills are essential but not enough to develop large and complex software systems that require the coordination of a team of specialists. Software engineering is about the development of such modern software systems. The course is about software engineering in practice. Students will learn how to go beyond programming, how to coordinate a team of specialists, how to apply modern methodologies and techniques. Students will experience with state of the art tools to understand the role of automation for developing software systems and coordinate the work of a team.

Bachelor of Science

Third year

Lecture
3 ECTS

Algorithms & Data Structures 2

Instructor Evanthia Papadopoulou

Description This course covers a variety of topics on algorithms and data structures, building upon the material of the first year course “Algorithms and Data Structures”. Algorithms and data structures are fundamental to computer science and the essence of computer programs. The performance of any software system depends on the efficiency of its algorithms and data structures. This course extends the students' knowledge on fundamental algorithms by focusing on several important topics such as data structures for disjoint sets and union-find, interval trees, graphs and graph algorithms such as shortest paths, network flows and matchings, intractability and NP completeness.

-
- References**
- Introduction to Algorithms, 3rd edition, by T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, MIT Press, 2009.
 - Other useful books (not required): Algorithm Design, by J. Kleinberg, E. Tardos, Addison Wesley, 2005.

Lecture
3 ECTS

Artificial Intelligence

Instructor Luca Maria Gambardella

Description Reasoning, learning, searching for new information, extracting models from knowledge base systems and adapting to unpredictable situations are key factors in any modern computer system. The goal of this course is to investigate knowledge representation models and algorithms that are useful to reason about facts and situations and are suitable to support advanced search and optimisation strategies other than learning systems. In fact, learning from experience and from errors is a crucial aspect for any intelligent system that has to interact with an external environment. The course moves from simple to complex problems introducing concept such as heuristic search and approximation algorithms. These are important tools to allow the student to theoretically analyze and practically solve real life situations.

- References**
- Artificial Intelligence: a modern approach. S. Russel and Peter Norvig. Prentice Hall,
 - Course Material in English will be provided to the students
 - Additional readings:
Artificial Intelligence, third edition, P.H. Winston, Addison-Wesley
 - Genetic Algorithms in Search, Optimisation, and Machine Learning, Goldberg, Addison-Wesley, MA

Lecture
6 ECTS

Computer Graphics

Instructor Kai Hormann

Description This course gives a comprehensive introduction to the theoretical and practical aspects of computer graphics. The first half of this course is devoted to the implementation of a ray-tracer, a method for generating pictures of virtual scenes, which is used for special effects and computer-generated movies. A basic version of such a ray-tracer is developed already in the first week. While learning about the theory of local lighting models, colour, homogeneous coordinates, and texture mapping, we keep extending the code until it eventually handles moving objects, shadows, reflections, and refractions. The second half of this course treats the concept of rasterization, an alternative approach to image generation, which is used in games, for example. After implementing our own rasterizer, we learn how to use the OpenGL library and how to program the GPU to achieve special effects. For all programming tasks we provide a framework, so that the students can concentrate on implementing the core methods and algorithm.

- References**
- Fundamentals of Computer Graphics; Shirley; AK Peters, 2002
 - 3D Computer Graphics; Watt; Addison Wesley, 2000
 - Computer Graphics with OpenGL; Hearn, Baker; Pearson, 2003
 - OpenGL Reference Manual and Programming Guide
 - Additional material will be provided through the course homepage.

Lecture
3 ECTS

Experimentation & Evaluation

Instructor Matthias Hauswirth, Marc Langheinrich

Description Computer scientists build complex systems or choose among existing systems to satisfy perceived needs and requirements. The system is then deployed in an environment consisting of humans and other systems. How do we know the impact of the system on the environment and how well it meets the perceived requirements? A fundamental skill in informatics is the ability to design experiments for evaluating computer systems. In this course, the students will acquire a basic understanding of how to design such experiments and what pitfalls to avoid during design and experimentation. Basic concepts of experimental design, data measurement, qualitative and quantitative evaluation, and evaluation with and without users will be covered.

- References**
- No mandatory textbook will be used. Handouts will be provided. However, students are encouraged to complement their reading with one or more of the following sources:
 - E. J. Davidson: Evaluation Methodology Basics. Sage 2004, 280 pages.
 - A. Field, G. Hole: How to Design and Report Experiments. Sage 2003, 384 pages.
 - Claes Pohlin et al.: Experimentation in Software Engineering. Springer-Verlag 2012, ISBN-13: 978-3642290435.

Lecture
6 ECTS

Information Retrieval

Instructor Fabio Crestani

Description Today more and more information is becoming available in unstructured or poorly structured form. Examples of information of this type are textual documents, web pages, videos, images, sounds, blogs, etc. The goal of this course is to enable the student to understand the foundations of dealing with unstructured or poorly structured information. In particular, the aim is to assist the student to get an understanding of some of the techniques for the indexing, retrieval, filtering, clustering, and presentation of textual and multimedia information held in digital archives and/or on the web. From this perspective the course complements what the student learned from a previous course on Database technology, where only structured information is managed.

- References**
- Required: W.B. Croft, D. Metzler, and T. Strohman. Search Engines: Information Retrieval in Practice, Pearson, 2009.
 - Other books will be suggested during the course, but are not required and could be found in the university library

Lecture
6 ECTS

Numerical Computing

Instructor Olaf Schenk

Description Numerical computing is an interconnected combination of computer science and mathematics in which we develop and analyze algorithms for solving important problems in science, engineering, medicine, and business---for example, simulating an earthquake, choosing a stock portfolio, or detecting cancer tumors in medical images. The students will learn principles and practices of basic numerical computation. This is a key aspect of scientific computation. This class will cover several topics, including: one-dimensional nonlinear equations; understanding and dealing with sources of error; linear equations and linear least-squares; data fitting; and ordinary differential equations. As much as possible, numerical methods will be presented in the context of real-world applications.

References

- First Course on Numerical Methods (Computational Science and Engineering), Uri M. Ascher, Chen Greif, SIAM Book, 14. July 2011.
- A Practical Introduction to Programming and Problem Solving Paperback, Stormy Attaway, Matlab, Third Edition, July 1, 2013.

Atelier
9 ECTS

Software Atelier 5: Field Project

Instructor Michele Lanza, Mauro Prevostini

Description The Field Project Atelier consists of an internship either within a company or within a research group of the faculty. The goal is for the students to obtain hands-on experience with real world problems. The field project atelier can be done individually or as a group, depending on the given context.

List of companies (2017/18):

- Best Vision Solutions
- Città di Lugano
- CODIT
- Coopar
- Comunica SA
- Cryms Sagl
- CSRD @SI
- Dolphin Engineering Sagl
- ExMachina Sagl
- Fimax AMS SA
- FinconsGroup
- Garloc Swiss
- Hugo Boss
- Impress
- Omnibus
- Sofistar
- Stagend.com

 Lecture
 6 ECTS

Languages & Compilers

Instructor Nate Nystrom

Description Programming languages allow us to express our intentions to computers and to each other. This course teaches you how to analyze programming languages, focusing on semantics, the meaning of programs in languages. To understand the semantics of a programming language, we take an engineering approach, building interpreters and compilers for the language. We use this approach to understand a variety of constructs in functional and objectoriented languages and to understand how these constructs interact with each other in real-world languages.

 Lecture
 6 ECTS

Optimization Methods

Instructor Rolf Krause

Description Optimization is of fundamental importance in virtually all branches of science and technology. As a consequence, optimization methods find their applications in numerous fields, starting from, e.g., network flow and ranging over shape optimization in engineering to optimal control problems. This course provides an introduction into the most important methods and techniques in discrete and continuous optimization. We will present, analyze, implement, and test -along selected problems- methods for discrete and continuous optimization. Particular emphasis will be put on the methodology and the underlying mathematical as well as algorithmic structure. Starting from basic methods as the Simplex method, we will consider different central methods in convex as well as non-convex optimization. This will include optimality conditions, the handling of linear and non-linear constraints, and methods such as interior point methods for convex optimization, Newton's method, Trust-Region methods, and optimal control methods.

Lecture
6 ECTS

Theory of Computation

Instructor Antti Hyvärinen

Description The class introduces the fundamental mathematical properties of computer hardware, software, and certain applications thereof. It explores what can and cannot be solved on a computer, how quickly, with how much memory, and on which type of computational model. The class is divided into two major parts: computability theory and complexity theory. Computability theory deals primarily with the question of whether a problem is solvable at all on a computer. Complexity theory considers how efficiently the problem can be solved. Two major aspects are considered: time complexity and space complexity, which respectively address a problem of how many steps does it take to perform a computation, and how much memory is required to perform that computation. The subjects have strong connections with engineering practice. Practical exercises will involve experimentation with various tools.

References

- Introduction to the Theory of Computation; Michael Sipser, 2006, second edition (Required)

Project
18 ECTS

Bachelor Project

Instructor Mauro Pezzè

Description The bachelor project gives the student the opportunity to work independently to develop a solution to a significant (i.e., large) problem. The student learns and demonstrates both independence and a systematic approach to problem solving. The bachelor project gives 18 ECTS, which correspond to the work of 3 typical bachelor-level courses. The students are expected to work throughout the semester under the supervision of their project advisor on the substance of the work, and meet regularly as a group with the Bachelor Project Coordinator to receive instructions about the purpose and mechanics of implementing a long-term project. At the end of the semester, the students produce:

- A project report
- A poster and poster presentation
- A product (if applicable) such as an algorithm, a software library, or application.

Masters in informatics

 4 Semesters' programme
 120 ECTS

Informatics

| | |
|-----------------------------|---|
| Director | Kai Hormann, Evanthia Papadopoulou |
| Goals and contents | <p>The Master of Science in Informatics prepares students for current and emerging technologies in computer science by deepening their theoretical knowledge and sharpening their practical skills. The programme is designed for both Bachelor students who wish to complete their education and professionals seeking to refresh their knowledge and sharpen their skills. The Master combines the study of fundamental aspects of computer science with a practical hands-on approach, preparing professionals for successfully pursuing a career in research and development across any application domain.</p> <p>The Master of Science in Informatics is characterized by a broad offering of topics and subjects that can be freely combined in a learning path tailored to the needs and interests of each student. At USI, students learn how to understand, design, simulate, and optimize complex software-intensive systems. They master the ability to develop automated solutions, introduce them in different business and application domains, and predict and assess their positive impact in the real-world. Students experience the need for a rigorous approach to guarantee the quality of their work while following the most appropriate software engineering methodologies, techniques and state-of-the-art tools. Students can benefit from the research excellence of our teaching staff by getting involved in ongoing research activities as part of their master thesis project (which can be carried out across the entire second year of the Master). We offer the unique opportunity to obtain a double Master's degree in collaboration with Politecnico di Milano</p> |
| Career opportunities | <p>Informatics is both the infrastructure and the engine of today's society. In Switzerland, it plays a key role in industry (pharma, manufacturing of machinery, chemistry, etc.) as well as in the service sector (banking, insurance, trade, transport, administration, etc.). The national education and research institutions have acquired a considerable reputation worldwide, in particular in the field</p> |

of Information Technology. Many IT companies, some of them world leaders, have or are planning to have research and development centres in Switzerland. Considering this, graduates in Informatics have excellent opportunities on the job market. The demand for well-educated specialists in Informatics is very high and is expected to grow even more. Graduates of the Master of Science in Informatics are prepared to become, for example, a business-savvy software designer for the highly competitive software industry of the 21st century, a system engineer with the skills to design, implement, and maintain reliable, secure, and large distributed systems, or be trained to solve complex problems in interdisciplinary areas like graphics and special effects, intelligent search engines, computer vision and face recognition, or robotics.

Study plan

The study programme consists of four semesters full-time study (120 ECTS). Students select 24 ECTS of foundational courses (over the two years) and 66 ECTS of electives based on their interests, plus a substantial Master's thesis (30 ECTS).

To broaden the student's perspective, in addition to courses from the other master programmes of the Faculty, up to 6 ECTS of electives can be obtained by following any Master course offered at USI.

A specialisation can be obtained by writing the Master's thesis and taking 18 ECTS of courses in one of the following research areas:

- Computer Systems
- Geometric and Visual Computing
- Information Systems
- Programming Languages
- Theory and Algorithms

| | Course | Instructor | ECTS |
|------------------------|--|-----------------------|------|
| Fall semester | | | |
| Foundational Courses | Advanced Programming & Design | Walter Binder | 6 |
| | Algorithms & Complexity | Evanthia Papadopoulou | 6 |
| | Distributed Systems | Fernando Pedone | 6 |
| | High Performance Computing | Olaf Schenk | 6 |
| | Machine Learning | Jürgen Schmidhuber | 6 |
| Electives *** | Advanced Networking* | Antonio Carzaniga | 6 |
| | Distributed Algorithms | Fernando Pedone | 6 |
| | Mobile Computing | Ivan Elhart | 6 |
| | Numerical Algorithms | Kai Hormann | 6 |
| | Software Engineering | Giovanni Denaro | 6 |
| | Software Performance | Matthias Hauswirth | 6 |
| | User Experience Design | Monica Landoni | 6 |
| | | Marc Langheinrich | |
| Spring semester | | | |
| Foundational Courses | Information Security | Marc Langheinrich | 6 |
| Electives *** | Advanced Computer Architectures | Laura Pozzi | 6 |
| | Business Process Modeling, Management and Mining | Cesare Pautasso | 3 |
| | Compilers | Nate Nystrom, | 6 |
| | Computer Aided Verification* | Natasha Sharygina | 6 |
| | Computer Vision & Pattern Recognition* | Michael Bronstein | 6 |
| | Data Analytics | Fabio Crestani | 6 |
| | Geometric Algorithms | Evanthia papadopoulou | 6 |
| | Geometric Deep Learning* | Michael Bronstein | 3 |
| | Geometry Processing* | Kai Hormann | 6 |
| | Information & Physics | Stefan Wolf | 3 |
| | Physical Computing | Marc Langheinrich | 6 |
| | Quantum Computing | Stefan Wolf | 6 |
| | Robotics | Alessandro Giusti | 6 |
| | Master thesis ** | Faculty | 30 |
| ETCS Total | | 120 | |

* please note that these courses will not be offered in the academic year 2017/18

** Master Thesis can be started in the 3rd semester.

*** Electives from other master programmes of the Faculty of Informatics
 MSc in Artificial Intelligence
 MSc in Computational Science
 MSc in Cyber-Physical and Embedded Systems
 MSc in Software & Data Engineering
 MSc in Management & Informatics
 MSc in Financial Technology and Computing

| | Course | Instructor | ETCS |
|---|---|--------------------------------------|------|
| Specialisation in Computer Systems | | | |
| Fall | Advanced Networking | Antonio Carzaniga | 6 |
| | Distributed Algorithms | Fernando Pedone | 6 |
| | Mobile Computing | Ivan Elhart | 6 |
| Spring | Advanced Computer Architectures | Laura Pozzi | 6 |
| | Computer Aided Verification | Michael Bronstein | 6 |
| | Physical Computing | Marc Langheinrich | 6 |
| Specialisation in Geometric and Visual Computing | | | |
| Spring | Computer Vision & Pattern Recognition | Michael Bronstein | 6 |
| | Geometric Algorithms | Evanthia papadopoulou | 6 |
| | Geometric Deep Learning | Michael Bronstein | 3 |
| | Geometry Processing | Kai Hormann | 6 |
| | Robotics | Alessandro Giusti | 6 |
| Specialisation in Information Systems | | | |
| Fall | Distributed Algorithms | Fernando Pedone | 6 |
| | Mobile Computing | Ivan Elhart | 6 |
| | User Experience Design | Monica Landoni, Marc Langheinrich | 6 |
| Spring | Business Process Modeling, Management and Mining | Cesare Pautasso | 3 |
| | Compilers | Nate Nystrom | 6 |
| | Data Analytics | Fabio Crestani | 6 |
| | Physical Computing | Marc Langheinrich | 6 |
| Specialisation in Programming Languages | | | |
| Fall | Software Performance | Matthias Hauswirth | 6 |
| Spring | Advanced Computer Architectures | Laura Pozzi | 6 |
| | Compilers | Nate Nystrom | 6 |
| | Computer Aided Verification | Natasha Sharygina | 6 |
| Specialisation in Theory and Algorithms | | | |
| Fall | Numerical Algorithms | Matthias Hauswirth | 3 |
| Spring | Computer Aided Verification | Nate Nystrom | 6 |
| | Geometric Algorithms | Evanthia papadopoulou | 6 |
| | Information & Physics | Stefan Wolf | 3 |
| | Quantum Computing | Stefan Wolf | 6 |

Master of Science in Artificial Intelligence

4 Semesters' programme
120 ECTS

Artificial Intelligence

Director Luca Maria Gambardella, Jürgen Schmidhuber

Goals and contents

Artificial Intelligence (AI) is one of the most popular areas in computer science and engineering. AI deals with intelligent behavior, learning, and adaptation in machines, robots and body-less computer programs. AI is everywhere: search engines use it to improve answers to queries, to recognize speech, to translate languages, email programs use it to filter spam, banks use it to predict exchange rates and stock markets, doctors use it to recognize tumors, robots use it to localize themselves and obstacles, autonomous cars use it to drive, video games use it to enhance the player's experience, adaptive telescopes use it to improve image quality, smartphones use it to recognize objects / faces / gestures / voices / music, etc etc.

People are discussing the possibility of superintelligence and AI risks. Big players such as Google, Amazon, Baidu, Microsoft etc are investing billions in AI, and the AI-related job market is growing extremely rapidly. In this exciting context the first AI master in Switzerland is offered in Lugano, profiting from the competences of the Faculty of Informatics and the Swiss AI Lab, IDSIA, Dalle Molle Institute for Artificial Intelligence, a common institute with SUPSI and one of the world's leading research institutes in this field. For example, in 2016, IDSIA got the Swiss Special ICT award for its bio-inspired research activities and one of the ten NVIDIA "Pioneers in AI research" awards.

Career opportunities

Students graduating from this programme will develop a taste for working on complex problems. In their future careers they will be able to apply their knowledge in many interdisciplinary areas including robotics, business forecasting, intelligent search, video games, music and entertainment, chat bots, medical diagnostics, self-driving cars, to name a few.

| | Course | Instructor | ETCS |
|-------------------------|--|---|------|
| First semester | | | |
| Core Courses 18 ECTS | Machine Learning | Jürgen Schmidhuber | 6 |
| | Deep Learning Lab | Paulo Rauber | 3 |
| | Algorithms & Complexity | Evanthia Papadopoulou | 6 |
| | Numerical Algorithms | Kai Hormann | 3 |
| Electives 12 ECTS | Advanced Networking* | Antonio Carzaniga | 6 |
| | Cyber-security | Francesco Regazzoni | 3 |
| | High-Performance Computing | Olaf Schenk | 6 |
| | Introduction to Partial Differential Equations | Rolf Krause | 6 |
| | Mobile Computing | Ivan Elhart | 6 |
| | Simulation & Data Sciences Seminar | Spyros Angelopoulos, Maksym Byshkin | 3 |
| | User Experience Design | Monica Landoni, Marc Langheinrich | 6 |
| | | | |
| Second semester | | | |
| Core Courses 24 ECTS | Computer Vision & Pattern Recognition* | Michael Bronstein | 6 |
| | Data Analytics | Fabio Crestani | 6 |
| | Stochastic Methods | Illia Horenko, Olga Kaiser | 6 |
| | Robotics | Alessandro Giusti | 6 |
| Electives 6 ECTS | Advanced Computer Architectures | Laura Pozzi | 6 |
| | Business Intelligence and Applications | Piero Fraternali, Davide Martinenghi | 6 |
| | CPS-Intelligence | Cesare Alippi | 6 |
| | Geometric Algorithms | Evanthia Papadopoulou | 6 |
| | Multiscale Methods | Rolf Krause | 6 |
| | Quantum Computing | Stefan Wolf | 6 |
| | Software Atelier: | Olaf Schenk | 6 |
| | Simulation, Data Science & Supercomputing | | |
| | | | |
| | | | |

| | Course | Instructor | ETCS |
|-------------------------|--|---|------|
| Third semester | | | |
| Core Courses 21 ECTS | Artificial Intelligence* | Luca Maria Gambardella | 6 |
| | Distributed Algorithms* | Fernando Pedone | 6 |
| | Master Thesis* | Faculty | 9 |
| Electives 9 ECTS | Advanced Networking* | Antonio Carzaniga | 6 |
| | Cyber-security | Francesco Regazzoni | 3 |
| | High-Performance Computing | Olaf Schenk | 6 |
| | Introduction to Partial Differential Equations | Rolf Krause | 6 |
| | Mobile Computing | Ivan Elhart | 6 |
| | Simulation & Data Sciences Seminar | Spyros Angelopoulos, Maksym Byshkin | 3 |
| | User Experience Design | Monica Landoni, Marc Langheinrich | 6 |
| | | | |
| Fourth Semester | | | |
| Core Courses 24 ECTS | Geometric Deep Learning* | Michael Bronstein | 3 |
| | Master Thesis* | Faculty | 21 |
| Electives 6 ECTS | Advanced Computer Architectures | Laura Pozzi | 6 |
| | Business Intelligence and Applications | Piero Fraternali, Davide Martinenghi | 6 |
| | CPS-Intelligence | Cesare Alippi | 6 |
| | Geometric Algorithms | Evanthia Papadopoulou | 6 |
| | Multiscale Methods | Rolf Krause | 6 |
| | Quantum Computing | Stefan Wolf | 3 |
| | Software Atelier: | Olaf Schenk | 6 |
| | Simulation, Data Science & Supercomputing | | |
| | | | |
| | | | |
| ETCS Total | | | 120 |

* This course will not be offered in the academic year 2017/18 for this Master programme.

Master of Science in Computational Science

4 Semesters' programme
120 ECTS

Computational Science

Director Olaf Schenk

Goals and contents

The Master in Computational Science (MCS) at USI offers the unique opportunity to acquire a focused and in-depth set of knowledge and skills in computer science, mathematics, and scientific computations. It is a unique programme in Switzerland aiming at building deep competences in computer science, mathematics and computational science with a strong connection to applications in natural sciences, life sciences, medicine, and engineering.

The Master in Computational Science (MCS) at USI offers thrilling new perspectives for understanding complex processes in almost all areas of our life – ranging from natural sciences over economy, finance, and social science to life sciences and medicine. Through numerical simulation and mathematical modeling, computational science made possible what was unthinkable only a few years ago: problems that were impossible to test in an experimental setting were made accessible by developing models that can be solved by increasingly powerful supercomputers. The master programme has a unique combination of courses from mathematics and computer science, and additional courses from various applications domains aiming at building deep application-oriented competences in computational science. It has a strong background both in computer science and mathematics and in the development of scientific simulation software. The successful student will acquire strong competences in abstract thinking within a methodology and application-oriented education, which will provide the ability to deal with complex models in various applications areas.

The students' individual choice of elective courses enables them to tailor the focus of their interdisciplinary personal programme - either method-oriented, or computer science-specific. As a result, the programme not only prepares students for current and evolving technologies in computer sciences but will also strongly deepen their knowledge in mathematical and algorithmic methodologies. Along with the mentor, each student will individually set up a study

plan for selecting the appropriate elective courses. The mentor will advise and accompany the student through her/his study.

Career opportunities

The multidisciplinary programme offers a streamlined blend of cutting-edge scientific research and practical application, thus providing an excellent foundation for a corporate, industrial, or academic career. Our students receive a firm grounding in programming, mathematical modeling and numerical simulation. The Master in Computational Science opens the doors to industry in software engineering, environmental engineering, financial services, and chemical and pharmaceutical R&D. It is also a strong asset for a PhD in computational science.

Study plan

The Master of Science in Computational Science program consists of four semesters of full-time study (120 ECTS). It offers courses in numerical mathematics and computer science, together with a wide range of more application-oriented courses. It finishes with a master's thesis in the form of a half-year project, worth 30 ECTS, which can be carried out in an industrial or research setting. Selected block courses are taught by distinguished professors from other prominent academic institutions and international research centres, e.g., Stanford, University of Erlangen, University of Texas at Austin, The University of British Columbia, or Massachusetts Institute of Technology (MIT).

With the guidance of the Master Director, students will be encouraged to set up an individual study plan that includes appropriate elective courses. The Master Director will advise and accompany students through the entire two-year course of study.

| | Course | Instructor | ETCS |
|-------------------------|--|---|--------|
| First semester | | | |
| Mandatory 24 ECTS | Deterministic Methods | Illia Horenko, Lukas Pospisil | 6 |
| | High Performance Computing | Olaf Schenk | 6 |
| | Introduction to Ordinary Differential Equations | Rolf Krause | 3 |
| | Introduction to Partial Differential Equations Numerical Algorithms | Rolf Krause Kai Hormann | 6 3 |
| Electives I 6 ECTS | Introduction to Statistics | Antonietta Mira | 6 |
| | Simulation & Data Science Seminar | Spyros Angelopoulos, Maksym Byshkin | 3 3 |
| | Software Atelier: Partial Differential Equations Software Tools in Computational Science | Drosos Kourounis Vittorio Limongelli | 3 3 |
| Second semester | | | |
| Electives II 30 ECTS | Advanced Computer Architectures | Laura Pozzi | 6 |
| | Bioinformatics | Vittorio Limongelli | 6 |
| | Computer Vision & Pattern Recognition* | Michael Bronstein | 6 |
| | Fast Solvers | Stefano Serra Capizzano | 3 |
| | Geometric Algorithms | Evanthia Papadopoulou | 6 |
| | Geometric Deep Learning* | Michael Bronstein | 6 |
| | Molecular Dynamics and Monte Carlo Methods | Igor Pivkin | 6 |
| | Multiscale Methods | Rolf Krause | 6 |
| | Node-Level Performance Engineering | Georg Hager, Gerhard Wellein | 3 |
| | Simulations Using Particles: from DNA to the Universe | Petros Koumoutsakos | 3 |
| | Software Atelier: Simulation, Data Science & Supercomputing | Olaf Schenk | 6 |
| | Stochastic Methods | Illia Horenko, Olga Kaiser | 6 |
| | USI-CSCS Summer School on Effective High Performance Computing | Olaf Schenk | 3 |

| | Course | Instructor | ETCS |
|--------------------------|---|---------------------|------------|
| Third semester | | | |
| Mandatory 6 ECTS | Advanced Discretization Methods | Igor Pivkin | 6 |
| Electives III 24 ECTS | Computational Biology and Drug Design | Vittorio Limongelli | 6 |
| | Computational Fluid Dynamics** | Dominik Obrist | 6 |
| | Data Assimilation | Sebastian Reich | 3 |
| | Machine Learning | Jürgen Schmidhuber | 6 |
| | Software Tools in Computational Science*** | Vittorio Limongelli | 3 |
| | Preparation Master's Thesis | Faculty | 6 |
| Fourth Semester | | | |
| Mandatory 24 ECTS | Master Thesis | Faculty | 24 |
| Electives 6 ECTS | Choose from the electives of the 2nd semester. | | 6 |
| ETCS Total | | | 120 |

* This course will not be offered in the academic year 2017/18 for this Master programme.

** Some of these courses will be offered on a bi-yearly basis

*** If not already taken in the 1st year

Master of Science in Informatics and Economics

4 Semesters' programme
120 ECTS

Financial Technology and Computing

Directors Marc Langheinrich, Erik Nowak, Fernando Pedone, Paul Schneider

Goals and contents The Master of Science in Financial Technology and Computing has been designed to provide graduates with a strong background in informatics with the necessary tools and skills for understanding core challenges in finance while, at the same time, learn about the advanced technology that is needed to drive the next generation finance services.

This Master offers a highly challenging programme that delivers key skills in a novel interdisciplinary domain. A two-tiered structure starts students off with a set of well-balanced core courses from both informatics and finance in the first year, followed by a broad set of electives that can be chosen in the second year, according to personal interests and abilities. A fourth semester Master's thesis that can be done within the context of a university research group, or in collaboration with industry, embedded in our Fintech Laboratory. Since English is the unique teaching language, graduates are well-prepared to work in international companies in Switzerland and beyond.

Career opportunities The primary labor market for the graduates of the programme is to be found in small Fintech startups, medium to large companies in the finance sector (e.g., banks, insurers, hedge funds) as well as the public sector, both in Switzerland and abroad. Many existing financial companies struggle with keeping up with recent developments in finance technology and thus are in great need of informatics professionals who have a thorough understanding of finance. Potential job profiles range from system architect to system developer to service designer to financial consultant. With a FinTeC master, students will be able to help banks, trading companies, and insurers master this new reality, or, alternatively, be well positioned to challenge existing players with their own startup.

Study plan

This full time programme stretches over two years. It allows students to personalize their study curricula according to their interests. The core skills are acquired in the first two semesters. The third semester is dedicated to more specialized courses and electives that can be chosen according to the students' preference.

| | Course | Instructor | ETCS |
|-------------------------|--|-----------------------|------|
| First semester | | | |
| Core Courses 30 ECTS | Capital Markets** | Francesco Franzoni | 6 |
| | Financial Econometrics** | Loriano Mancini | 6 |
| | Financial Modelling** | Francesco Franzoni | 6 |
| | Distributed Systems | Fernando Pedone | 6 |
| | High-Performance Computing | Olaf Schenk | 6 |
| Second semester | | | |
| Core Courses 24 ECTS | Data Analytics | Fabio Crestani | 6 |
| | Compilers | Nate Nystrom | 6 |
| | Information Security | Marc Langheinrich | 6 |
| | Risk Management** | tbc | 6 |
| Electives 6 ECTS | Banking | tbc | 6 |
| | Derivatives** (required for "Advanced Derivatives") | Giovanni Barone Adesi | 6 |

| | Course | Instructor | ETCS |
|--------------------------|-------------------------------------|--|------|
| Third semester | | | |
| Core Courses 12 ECTS | Asset Pricing for Fintech* | tbc | 3 |
| | Financial Instruments & Technology* | tbc | 3 |
| | Machine Learning* | Jürgen Schmidhuber | 6 |
| Electives *** 18 ECTS | | | |
| Informatics | Advanced Networking* | Antonio Carzaniga | 6 |
| | Distributed Algorithms* | Fernando Pedone | 6 |
| | Enterprise Resource Planning* | Chiara Francalanci | 6 |
| | Mobile Computing* | Ivan Elhart | 6 |
| | Software Performance* | Matthias Hauswirth | 6 |
| | User Experience Design* | Monica Landoni, | 6 |
| | Validation and Verification* | Marc Langheinrich Natasha Sharygina | 6 |
| Finance | Advanced Derivatives*/** | tbc | 3 |
| | Asset Pricing II* | tbc | 3 |
| | Financial Engineering*/** | tbc | 6 |
| | Fixed Income Markets*/** | tbc | 6 |
| | Marketing Research* | tbc | 6 |
| Project Management* | tbc | 3 | |
| Fourth Semester | | | |
| Core Course 30 ECTS | Master Thesis | Faculty | 30 |
| ETCS Total | | | 120 |

* This course will not be offered in the academic year 2017/18 for this master programme.

** To obtain the SFI accreditation, students have to achieve 45 ECTS among these courses.

*** Students choose 18 ECTS of electives from the Informatics and Finance courses listed, and from other courses from the Master programmes offered by the Faculty of Informatics and the Faculty of Economics (upon approval of the Master's director).

Master of Science in Informatics and Economics

4 Semesters' programme
120 ECTS

Management and Informatics

Director Marc Langheinrich, Nikolaus Beck

Goals and contents

This Master offers a balanced combination of courses that cover the necessary back-ground in management, fundamental aspects of current and evolving IT, as well as specialised topics at the interface between management and informatics, such as enterprise resource planning. Since the programme is taught entirely English, graduates are well prepared to work in international companies. Moreover, the interdisciplinary approach of this Master provides a general skill to work across traditional areas. This full-time programme stretches over two years. It allows students to personalise their study curricula according to their interests. The first year focuses on the acquisition of foundational knowledge. Students who obtained a Bachelor's degree in informatics or a related field (mathematics, engineering, physics, etc.) enter the programme in the Informatics track and follow a set of courses that provide them with a solid background in management disciplines. In contrast, the Management track targets students with a background in economics or management, and teaches the fundamental principles of informatics. In addition, all students attend mandatory courses that cover the interface between management and informatics. The second year offers specialised courses and electives that students can choose according to their preferences. A mandatory practical field project lets student gain practical consulting experience by working for real clients in small project teams. A substantial master's thesis concludes the programme.

Career opportunities

On the one hand, graduates from this Master will have sufficient knowledge in informatics to be able to interact with the IT department of an organization. A profound understanding of the technical issues involved gives graduates the ability to both evaluate technical proposals and articulate possible solutions to the organization or the customer. On the other hand, graduates will also understand the tactical and strategic use of IT to enhance the

efficiency of an organization, or how to explain user requirements in terms that can be understood by the IT department or the client. Graduates of the programme will find work in medium to large companies, as well as the public sector, both in Switzerland and abroad. Most companies struggle with integrating IT in their organization, so people who can be the interface between the technical and organizational parts of a company are in great demand. Potential job profiles range from project management to consulting and include areas such as: evaluating the benefits, and managing the introduction, of a new technology into an organization; designing and implementing small and large scale IT systems; and consulting companies and customers regarding requirements and limitations of particular IT systems.

Study plan

This full time programme stretches over two years. It allows students to personalize their study curricula according to their interests. The basic knowledge is acquired in the first two semesters. Students who obtained a Bachelor's degree in informatics or a related field (mathematics, engineering, physics, etc.) enter the programme in the Informatics track and follow a set of courses that provide them with a fundamental insight into the management disciplines. In contrast, the Management track is tailored for students with a background in economics or management and teaches the basic aspects of informatics. In addition, all students attend mandatory courses that cover the interface between management and informatics. The third and fourth semester are dedicated to specialized courses and electives that can be chosen according to the students' preference. Moreover, the students participate in a practical field project, which is done in groups for a real company, and conclude their studies by writing a substantial master's thesis.

| | Course | | Instructor | ETCS |
|---------------------------------|---|-----|---|------|
| First semester | | | | |
| Core Courses 12 ETCS | Enterprise Resource Planning | | Chiara Francalanci | 6 |
| | Enterprise Resource Planning Lab | | Cinzia Cappiello | 3 |
| | Project Management | | Paulo Gonçalves | 3 |
| Informatics track 18 ETCS | Accounting | | Stefano Calciolari | 6 |
| | Corporate Strategy | | Erik Larsen, Matteo Prato | 6 |
| | Strategic Marketing | | Ivan Snehota, Albert Caruana | 6 |
| Management track 18 ETCS | Fundamentals of Informatics | | Natasha Sharygina | 6 |
| | Introduction to Programming | | Walter Binder | 6 |
| | Probability & Statistics | | Davide Eynard | 6 |
| Second semester | | | | |
| Core Courses 12 ETCS | Business Intelligence and Application | | Piero Fraternali, Davide Martinenghi | 6 |
| | Business Process Modeling, Management and Mining | | Cesare Pautasso | 3 |
| | Operations Management | | Paulo Gonçalves | 3 |
| Informatics track 6 ETCS | Decision Making | | Dirk Martignoni | 3 |
| | Entrepreneurship: Theory and Practice | | Gianluca Colombo | 3 |
| Management track 18 ETCS | Databases | | Fabio Crestani | 18 |
| Electives 12 ETCS | Consumer Behavior | ECO | Michael Gibbert | 6 |
| | Entrepreneurship: writing business plans | ECO | Gianluca Colombo | 3 |
| | Human Resources Management | ECO | Luca Solari | 3 |
| | Innovation | ECO | Natasha Vijay Munshi | 3 |
| | International Business | ECO | Francesco Ciabuschi | 3 |
| | Mergers and Acquisitions | ECO | Gianluca Colombo, Carmine Garzia | 3 |
| | Organizational Learning | ECO | Nikolaus Beck | 6 |
| | Service Marketing | ECO | Andreina Mandelli | 3 |
| | Data Analytics | INF | Fabio Crestani | 6 |
| | Information Security | INF | Marc Langheinrich | 6 |
| | Physical Computing | INF | Marc Langheinrich | 6 |
| | Robotics | INF | Alessandro Giusti | 6 |
| | Software Architecture | INF | Cesare Pautasso | 6 |
| | Software Quality & Testing | INF | Mauro Pezzè | 6 |

| | Course | Instructor | ETCS |
|--------------------------|--|--|------------|
| Third semester | | | |
| Core Courses 6 ETCS | Six Sigma | Paolo Rossetti | 6 |
| Capstone Work 12 ETCS | Field Project | Marc Langheinrich | 12 |
| Electives 12 ECTS | Analytical Thinking | ECO Nikolaus Beck | 3 |
| | Business Dynamics | ECO Paulo Gonçalves | 3 |
| | Digital Marketing | ECO Reto Hofstetter | 3 |
| | Organizational Design & Change | ECO Francesca Palotti | 3 |
| | Organizations and Social Networks | ECO Alessandro Lomi | 3 |
| | Distributed Systems | INF Fernando Pedone | 6 |
| | Machine Learning | INF Jürgen Schmidhuber | 6 |
| | Software Engineering | INF Giovanni Denaro | 6 |
| | User Experience Design | INF Monica Landoni, Marc Langheinrich | 6 |
| Fourth Semester | | | |
| Capstone Work 18 ETCS | Master Thesis | Faculty | 18 |
| Electives 12 ECTS | Choose from the electives of the 2nd semester | | 12 |
| ETCS Total | | | 120 |

Master of Science in Software & Data Engineering

4 Semesters' programme
120 ECTS

Software & Data Engineering

Director Cesare Pautasso, Gabriele Bavota

Goals and contents

The study programme is compounded of four modules: Software Engineering, Data Engineering, Electives, and Master thesis. The Software Engineering module embraces 36 ECTS and provides students with a deep knowledge of state-of-the-art techniques. Topics related to this module are software design, software quality and testing, software architecture, software performance, and software analytics.

The Data Engineering module includes three courses (18 ECTS) teaching students techniques and tools to design and model data (1st semester), to convert data into information (2nd semester), and to transform information into knowledge useful to support decision making activities (3rd semester). The topics studied in the Software and the Data Engineering modules are continuously integrated through the whole course of study. This is done by devoting 18 ECTS to deal with both Software and Data Engineering with project based learning. The Electives module includes 12 ECTS, that the student can freely select from a given list of courses offered at the USI Faculty of Informatics based on his/her personal preference. Finally, the remaining 36 ECTS are dedicated to the MSc thesis. Students will use the 6 ECTS of the 3rd semester to visit the research groups of the Software Institute of the Faculty of Informatics and to prepare a thesis proposal. Then, they will work full time on the thesis in the 4th semester in the research group of their choice.

Career opportunities

Data is the new natural resource to be mined and exploited using software. Data analytics software provides actionable insights at the basis of continuous improvement and decision making processes. Such insights can be found by exploring large quantities of data, by asking the right questions and knowing how to reliably and efficiently find the appropriate answers. Students graduating in this Master will be highly specialized software and data engineers, able to fully understand and manage the complexity

of modern software systems and of the sea of data surrounding them. Mastering how to effectively use software to deal with the data deluge is a key capability for any organization undergoing digital transformation efforts. Also, the demand for software and data engineers is currently very high and it is expected to grow even more in the near future. Besides the expected high employability in industry, graduated students will also represent the perfect candidate for pursuing a PhD degree at USI, by working in one of the research groups of the Software Institute.

Study plan

The study programme is compounded of four modules: Software Engineering, Data Engineering, Electives, and Master thesis. The Software Engineering module embraces 36 ECTS and provides students with a deep knowledge of state-of-the-art techniques. Topics related to this module are software design, software quality and testing, software architecture, software performance, and software analytics.

The Data Engineering module includes three courses (18 ECTS) teaching students techniques and tools to design and model data (1st semester), to convert data into information (2nd semester), and to transform information into knowledge useful to support decision making activities (3rd semester). The topics studied in the Software and the Data Engineering modules are continuously integrated through the whole course of study. This is done by devoting 18 ECTS to deal with both Software and Data Engineering with project based learning.

The Electives module includes 12 ECTS, that the student can freely select from a given list of courses offered at the USI Faculty of Informatics based on his/her personal preference. Finally, the remaining 36 ECTS are dedicated to the MSc thesis.

Students will use the 6 ECTS of the 3rd semester to visit the research groups of the Software Institute of the Faculty of Informatics and to prepare a thesis proposal. Then, they will work full time on the thesis in the 4th semester in the research group of their choice.

| | Course | Instructor | ETCS | 103 |
|------------------------|---|--------------------|------------|-----|
| First semester | | | | |
| Mandatory 24 ECTS | Introduction to Software & Data Engineering | Faculty | 3 | |
| | Software Design & Modeling | Gabriele Bavota | 6 | |
| | Engineering of Domain Specific Languages | Andrea Mocchi | 3 | |
| | Programming Styles | Matthias Hauswirth | 3 | |
| | Design 101 | Michele Lanza | 3 | |
| | Data Design & Modeling | Marco Brambilla | 6 | |
| Electives 6 ECTS | Software Engineering | Giovanni Denaro | 6 | |
| | Advanced Networking* | Antonio Carzaniga | 6 | |
| Second semester | | | | |
| Mandatory 24 ECTS | Software Quality & Testing | Mauro Pezzè | 6 | |
| | Software Architecture | Cesare Pautasso | 6 | |
| | Visual Analytics Atelier | Marco D'Ambros | 6 | |
| | Information Modeling & Analysis Faculty | Faculty | 6 | |
| Electives 6 ECTS | Compilers | Nate Nystrom | 6 | |
| | Information Security | Marc Langheinrich | 6 | |
| Third semester | | | | |
| Mandatory 30 ECTS | Software Analytics * | Gabriele Bavota | 6 | |
| | Software Performance ** | Matthias Hauswirth | 6 | |
| | Knowledge Analysis & Management * | Faculty | 6 | |
| | Hacking Project * | Faculty | 6 | |
| | Software & Data Engineering Seminar * | Faculty | 6 | |
| Fourth Semester | | | | |
| Mandatory 30 ECTS | Master Thesis | Faculty | 30 | |
| ETCS Total | | | 120 | |

* The course is not offered in the academic year 2017/18

** The course is not offered in the academic year 2017/18 for this master programme

PhD programme

The PhD programme of the Faculty of Informatics at the Università della Svizzera italiana promotes the development of professionals interested in academic or industrial research. A successful PhD student will gain a broad knowledge and understanding of the general field of informatics, as well as an in-depth specialisation in an area of interest. Working with one or more members of the Faculty, who serve as the student's advisors, the student will learn the methods and practical skills to conduct research, and will contribute original, useful, and scientifically valid ideas in their chosen area of interest. PhD students are also encouraged to explore other areas and to interact and collaborate with other students and professors within the Faculty as well as in the broader research community. At present the Faculty awards the following qualifications: PhD in Informatics and PhD in Computational Science. Most students in the PhD programme are supported as assistants. The support covers tuition and provides a stipend. Responsibilities of assistants include both teaching and research duties. Generally students receive support as long as funds are available and the student is making adequate progress through the programme (as described in the regulations). The PhD programme is governed by regulations adopted by the Faculty: www.inf.usi.ch/regolamenti_tutti.htm In order to be admitted, the applicant must have completed a Masters degree in computer science, informatics, or a closely related field prior to joining the programme (but not necessarily prior to applying to the programme). For more information regarding the admission to the programme: www.inf.usi.ch/dottorato_regolamenti.htm

Study plan

The Faculty of Informatics offers PhD courses to students pursuing a PhD at the Faculty. The course Introduction to Doctoral Studies is mandatory for first year PhD students. Master courses may be cross-listed as PhD courses

Lecturers' profiles

Antonio Carzaniga

Antonio Carzaniga joined the Faculty of Informatics at USI when the Faculty was founded in 2004. From 2001 to 2007 he was also an assistant research professor in the Department of Computer Science at the University of Colorado at Boulder, USA. Antonio received the Laurea degree in electronics engineering and the Ph.D. degree in computer science from Politecnico di Milano, Italy. Antonio is a curious researcher. His primary research interests are in the areas of distributed systems and software engineering, specifically in content-based networking, information-centric networking, distributed publish/subscribe systems, middleware, software adaptability and automatic fault tolerance, and testing. He also conducted research in software configuration management and code mobility. Antonio is also a dedicated and passionate teacher. He has developed and taught a number of courses in the Faculty of Informatics at USI, including Algorithms and Data Structures, Computer Networking, and Systems Programming.
antonio.carzaniga@usi.ch

Alippi Cesare

Cesare Alippi was awarded the degree in electronic engineering cum laude and PhD from Politecnico di Milano, Italy.
IEEE Fellow; Board of Governors member, International Neural Network Society; Board of Directors member, European Neural Network

Society; Past Vice-President, IEEE Computational Intelligence Society; AE IEEE Computational Intelligence Magazine, IEEE-Trans. Instrumentation and Measurements, IEEE-Trans. In 2016 he received the International Neural Networks Society Gabor Award and the Outstanding IEEE Transactions on Neural Networks and Learning Systems Paper Award; the 2013 IBM Faculty award; the 2004 IEEE Instrumentation and Measurement Society Young Engineer Award. Current research activity addresses adaptation and learning in non-stationary environments and Intelligence for embedded, cyber-physical systems and IoT. He holds 5 patents, has published one monograph book, 6 edited books and about 200 papers in international journals and conference proceedings.
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Walter Binder

Walter Binder is a professor in the Faculty of Informatics, Università della Svizzera italiana (USI), Switzerland. He holds an MSc, a PhD, and a Venia Docendi from TU Wien, Austria. Before joining USI, he was a post-doctoral researcher in the Artificial Intelligence Laboratory, École Polytechnique Fédérale de Lausanne, Switzerland. His main interests are in the areas of program analysis, virtual machines, parallel programming, and Cloud computing.
walter.binder@usi.ch

Fabio Crestani

Fabio Crestani is a Full Professor at USI since 2007. Previously he was Professor (2000-06) at the University of Strathclyde (UK) and Assistant Professor (1992-97) at the University of Padua (Italy). In between he was Research Fellow at the University of Glasgow (UK), at the International Computer Science Institute in Berkeley (USA), and at the Rutherford Appleton Laboratory (UK). Recently he received a Chair of Excellence at the University Carlos III in Madrid (2011-12), a Visiting Scholarship at Yahoo! Labs (2014), and a Visiting Professorship at the UPMF in Grenoble (2015). Fabio holds a degree in Statistics and Economics from the University of Padua (Italy) and a MSc and PhD in Computing Science from the University of Glasgow (UK). He leads the local Information Retrieval and Text Mining group (see <http://www.ir.inf.usi.ch/> for details). fabio.crestani@usi.ch

Patrick Eugster

Patrick Eugster is a full professor at USI since 2017. He was previously a Professor of Computer Science at TU Darmstadt, where he lead the Distributed Systems Programming group. He is also an Adjunct Associate Professor of CS at Purdue University, where he spent 10 years. He is interested in distributed systems and programming languages, and in particular in the intersection between the two areas. Particular topics of interest currently include cloud computing, big data analytics, and sensor networks. Patrick holds M.S. and Ph.D. degrees from EPFL. He has been recognized for his research by an NSF CAREER award (2007), an ERC Consolidator grant (2013), and induction into the DARPA Computer Science Study Group (2011) and Purdue University's Inventor Hall of Fame (2015). Besides by various funding agencies including NSF, DARPA, DFG, BMBF, and ERC, his research has been supported by several companies such as Google, Amazon, NetApp, Cisco, HP, and Northrop Grumman. patrick.eugster@usi.ch

Ilia Horenko

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