University of Basel

Computer Science:
Fundamental Science for the 21st Century

Master Info Day, 2025-03-20

The Role of Computer Science

- Computer Science increasingly influences our daily life
- Provides **key technology** for **modern science** and economy
  - New products and insights mostly due to advances in Computer Science

Example: Systems that Learn

- Autonomous vehicles
  - Learn to perceive, operate and navigate in complex situations
  - Object recognition and identification, context and location detection
- Speech and text processing:
  speech recognition, natural language processing, text understanding & summarization
- Data Science: derive added value (hidden information) out of data

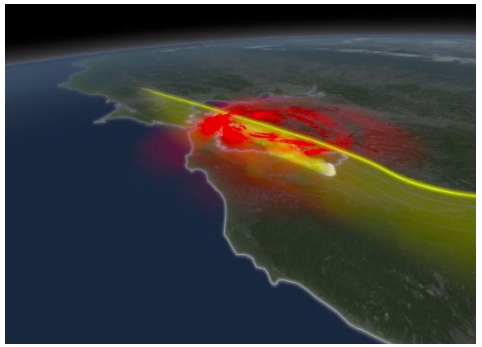
➢Disciplines: Biology, Medicine, Economics, Humanities, Mechanical Engineering, …

In 2026, there will be 11.5 million jobs in data science and analytics. [Source: US Bureau of Labor Statistics]

Example: Simulation of Complex Systems

- Prediction of natural phenomena
  (e.g., earthquakes, tsunamis)
- Prediction of Social Systems
  (e.g., pension funds, insurances)
- Compute-intensive algorithms
  - Large number of parameters
  - High Performance Computing

➢Disciplines: Civil Engineering, Meteorology, Geophysics, Humanities, Social Sciences, …

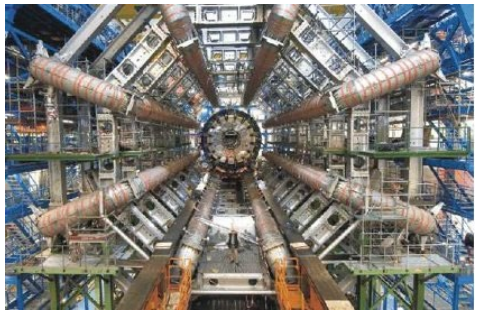


Golden Gate Bridge or the airport terminal in San Francisco: Engineers use computers to expose buildings to the shock waves of the 1906 earthquake ... [Source: Der Spiegel]

Example: Complex Distributed Systems

- Infrastructure for Natural Sciences („eSciences“)
- Big Data: Huge volumes of data
  - Storage, retrieval, analysis
- Large number of globally networked computers
- Automatic configuration, self-management

➢ Disciplines: High Energy Physics, Astronomy, Biology, …



When the LHC starts operating [...], it will be the most data-intensive physics instrument on the planet, producing more than 1500 megabytes of data every second for over a decade [www.cern.ch]

Example: Reliable Systems

- Patient monitoring in healthcare
- Control of safety-critical systems
- Again: autonomous vehicles
- “Systems their users can count on”

➢Disciplines: Healthcare, Process Engineering, (Power) Plant Control, Engineering, …

Between 2015 and 2050, the proportion of the world's population over 60 years will nearly double from 12% to 22%. All countries face major challenges to ensure that their health and social systems are ready to make the most of this demographic shift.

[Source: WHO Report, 2021]

The Role of Computer Science

Contribution

- Problem Understanding and Solutions (Theory)
- New Methods and Processes (Technology)
- Adequate Tools (Products)

– **Sound education of Computer Scientists**

– **Innovative research in Computer Science**

Computer Science Research in Basel

- Machine Intelligence

Data Analytics

Prof. Ivan Dokmanić

Artificial Intelligence

Prof. Malte Helmert

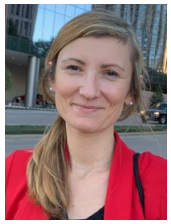
Optimization of Machine Learning Systems

Prof. Aurélien Lucchi

Biomedical Data Analysis

Prof. Volker Roth

- Distributed Systems



High Performance Computing

Prof. Florina Ciorba

Databases and Information Systems

Prof. Heiko Schuldt

Computer Networks

Prof. Christian Tschudin

Cyber Security

Prof. Isabel Wagner

Master's Program in Computer Science at the University of Basel

- Research-oriented …
  - Modern core Computer Science courses
- … but also with emphasis on projects / applications
  - Focus on teamwork, communication
- International
  - Course language is English
- Start: both in autumn and spring semester
  - But start in autumn is recommended

Variants of the Master's Program in Computer Science

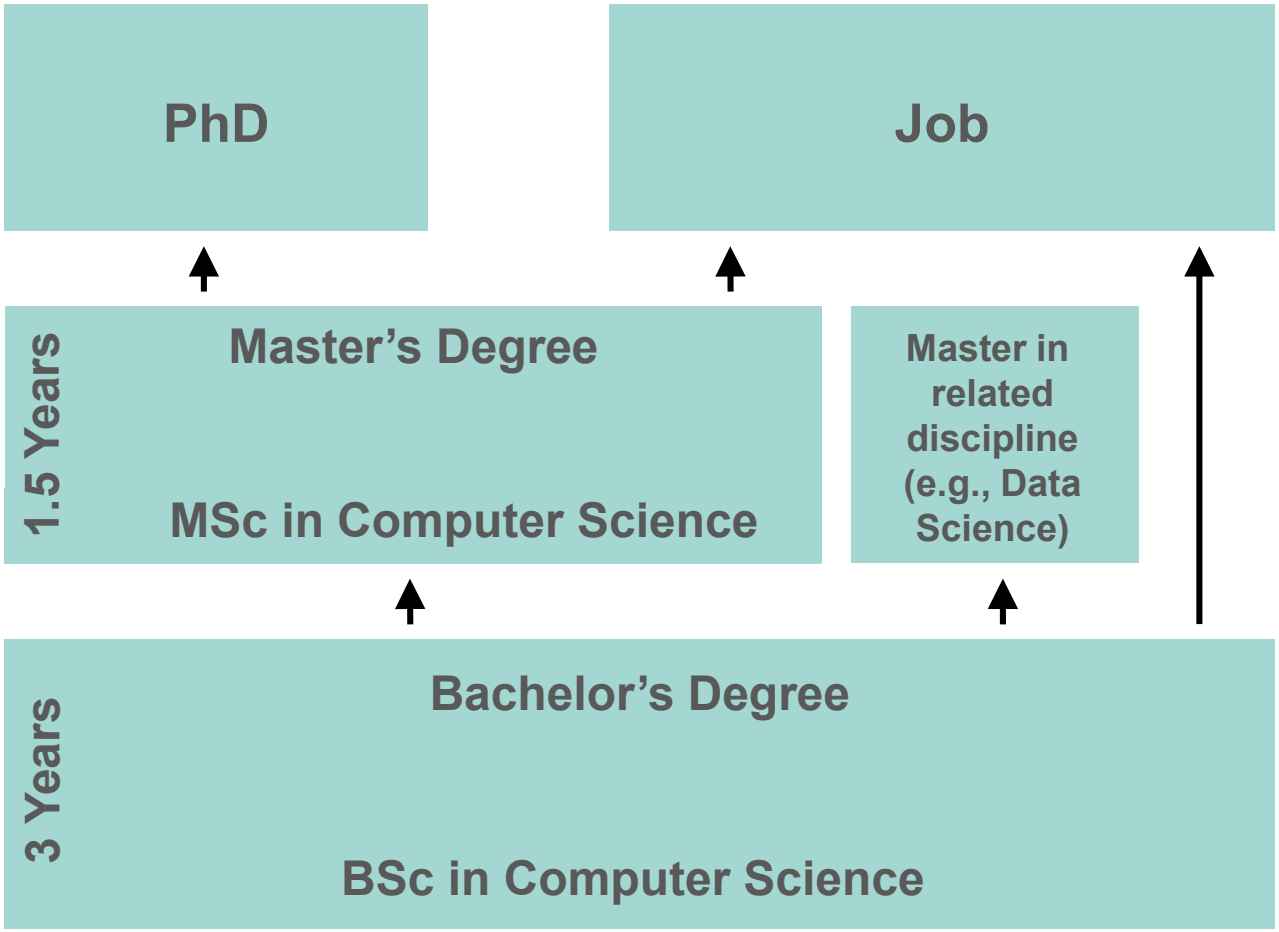
- Computer Science as *principal subject* **(Master of Science)**
  - Faculty of Science
  - Qualification for research
  - 90 ECTS (1 ECTS ~ 30 hrs of work)
  - Two majors (specializations)
    - MSc in Computer Science, Major in Machine Intelligence
    - MSc in Computer Science, Major in Distributed Systems
- Computer Science as *secondary subject* **(Master of Arts)**
  - Part of studies in the Humanities or in Culture
  - as complement, e.g., Philosophy and Computer Science
  - 35 ECTS

Structure of the CS Study Program

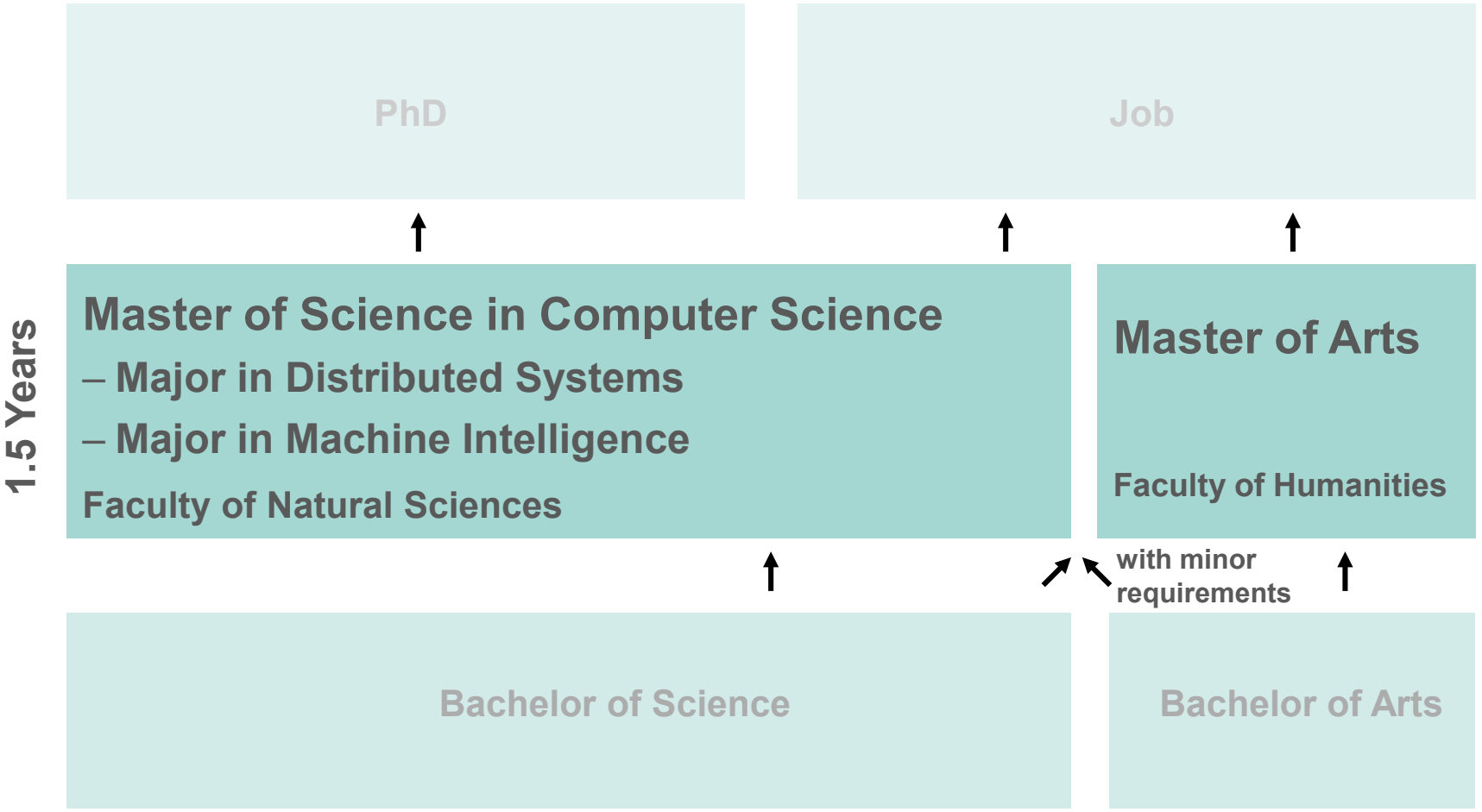
- Research
- Management
- …

- Project Management
- System Development
- …

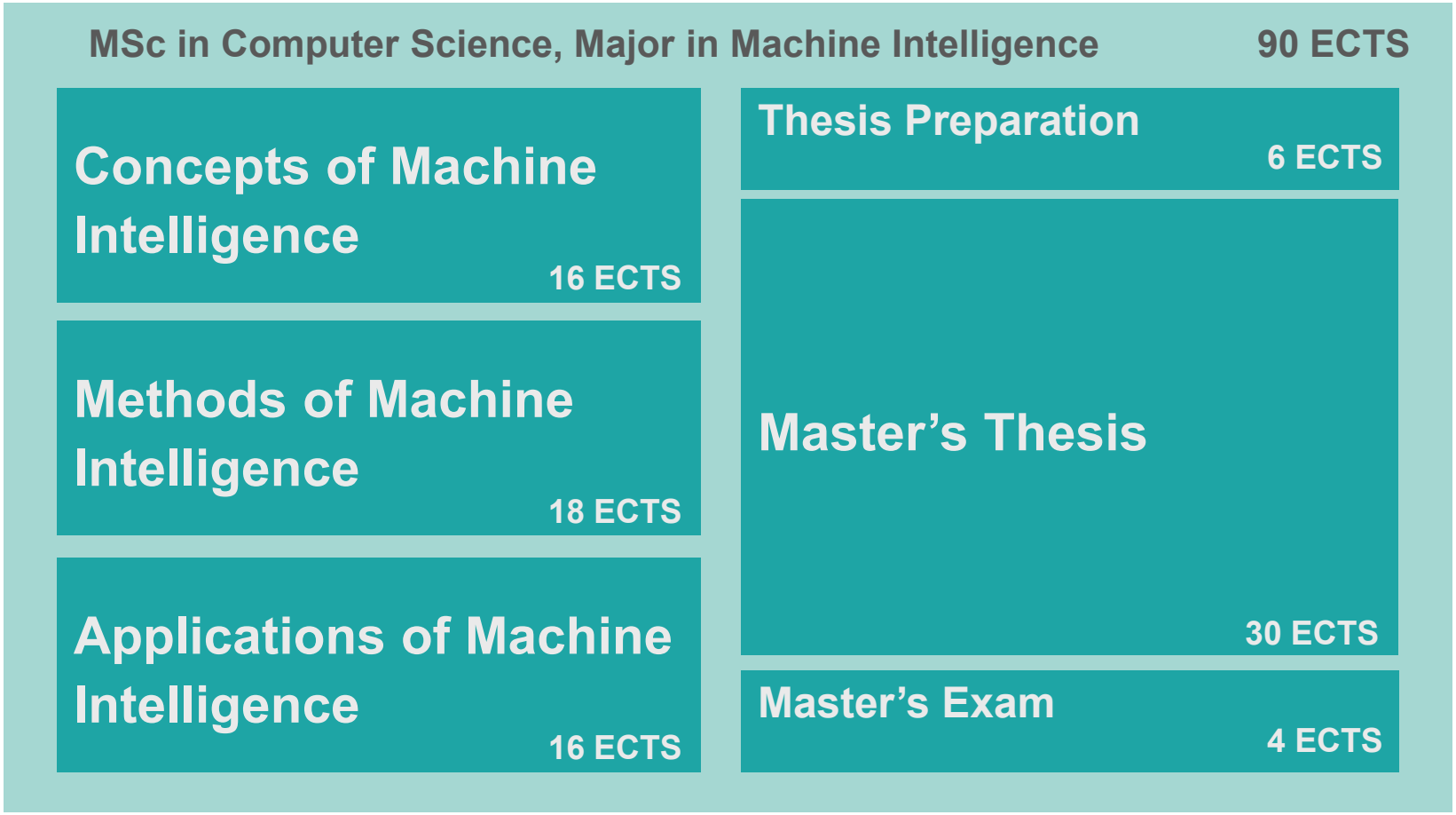
- Application Development
- Web Development
- DevOps
- …



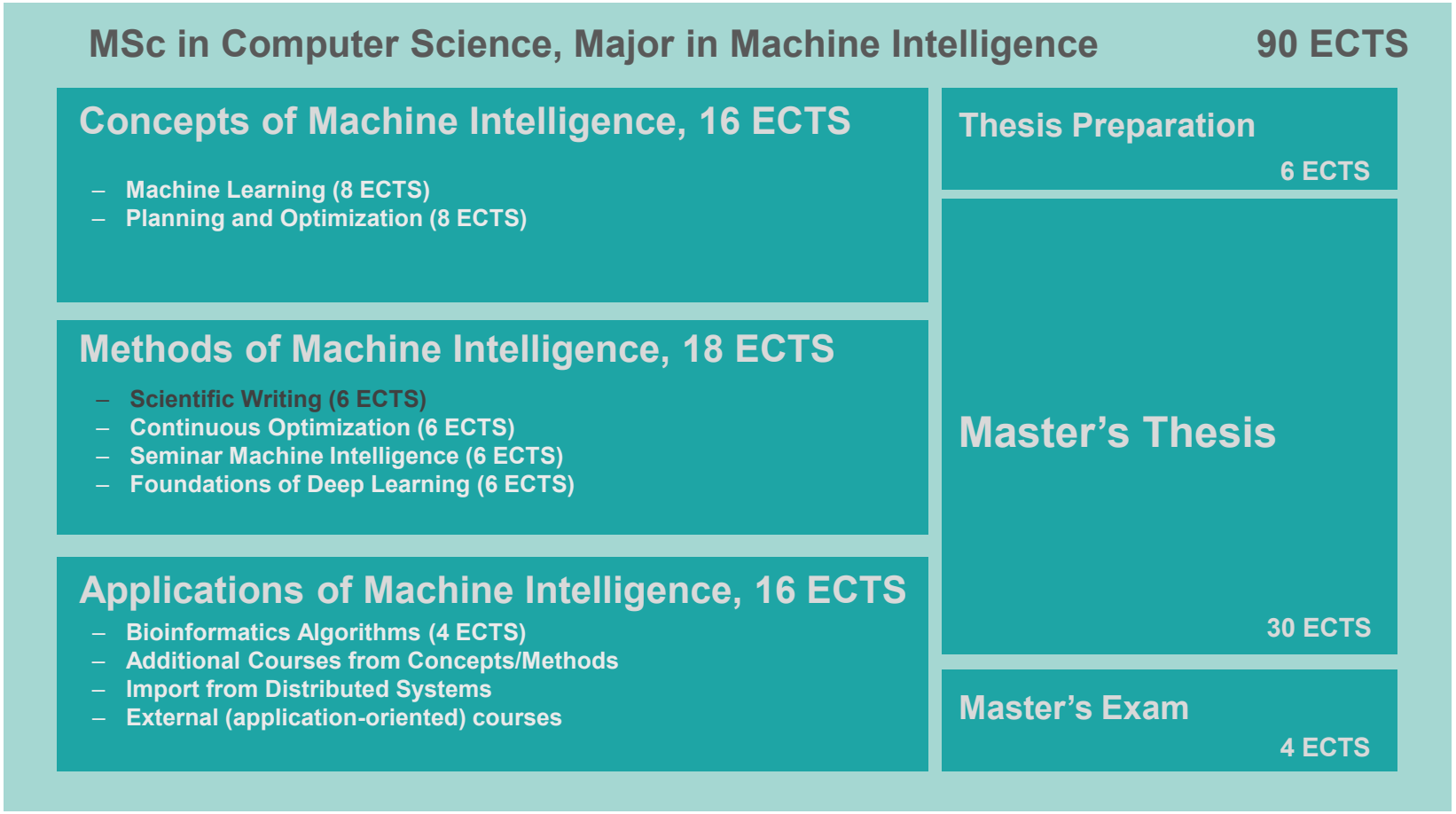
Structure of the Master Program



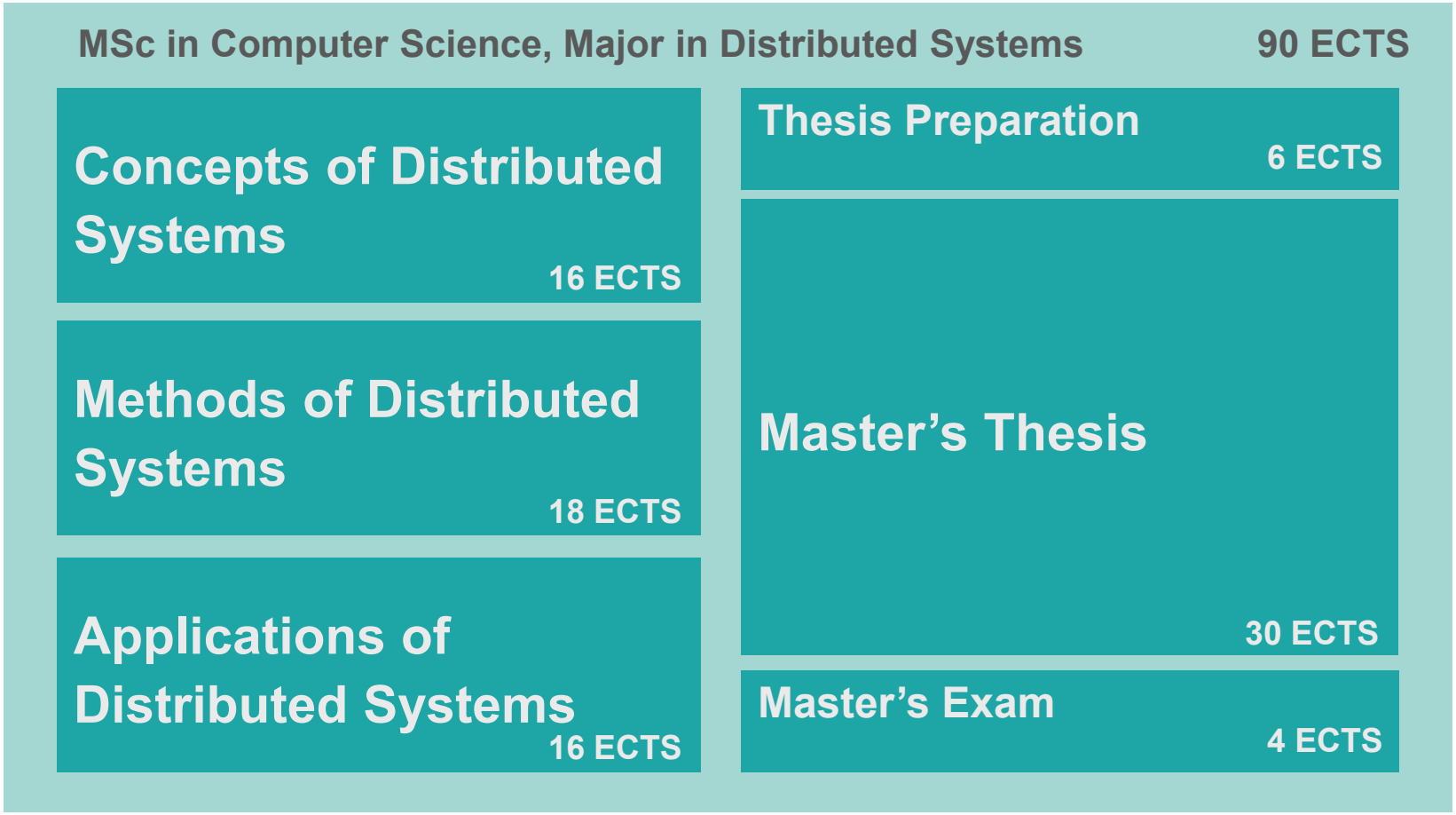
MSc in Computer Science, Major in Machine Intelligence: Structure



MSc in Computer Science, Major in Machine Intelligence: Details



MSc in Computer Science, Major in Distributed Systems: Structure



MSc in Computer Science, Major in Distributed Systems: Details

MSc in Computer Science, Major in Distributed Systems — 90 ECTS

Concepts of Distributed Systems, 16 ECTS

- Foundations of Distributed Systems (8 ECTS)
- 2 from: Computer Networks (4 ECTS)
  Distributed Information Systems (4 ECTS)
  High Performance Computing (4 ECTS)

Methods of Distributed Systems, 18 ECTS

- Scientific Writing (6 ECTS)
- Distributed Systems Project (6 or 12 ECTS)
- Multimedia Retrieval (6 ECTS)
- Privacy-Preserving Methods for Data Science and Distributed Systems (6 ECTS)

Applications of Distributed Systems, 16 ECTS

- Additional courses from Concepts/Methods
- Import from Machine Intelligence
- External (application-oriented) courses

Thesis Preparation

6 ECTS

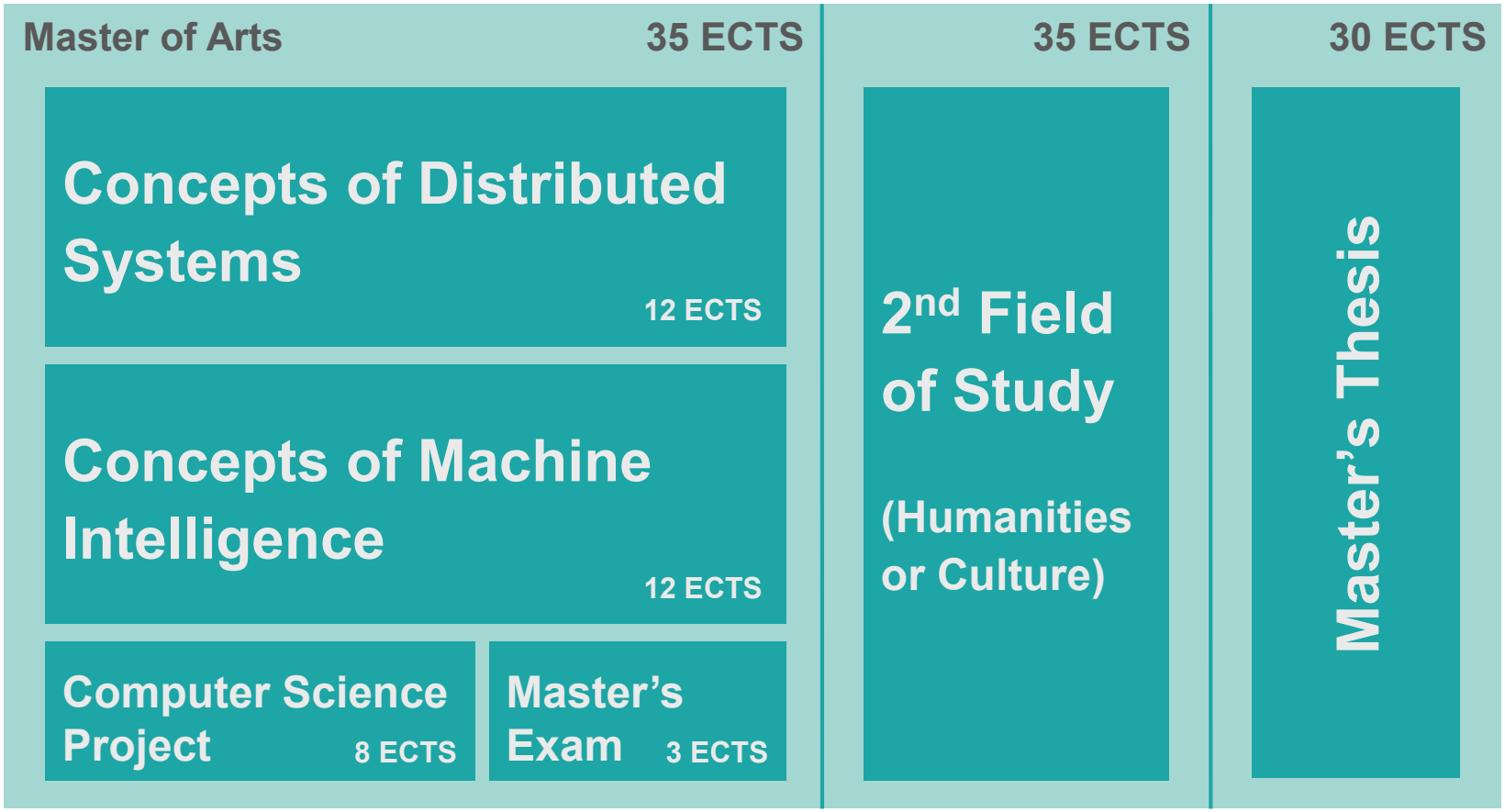
Master's Thesis

30 ECTS

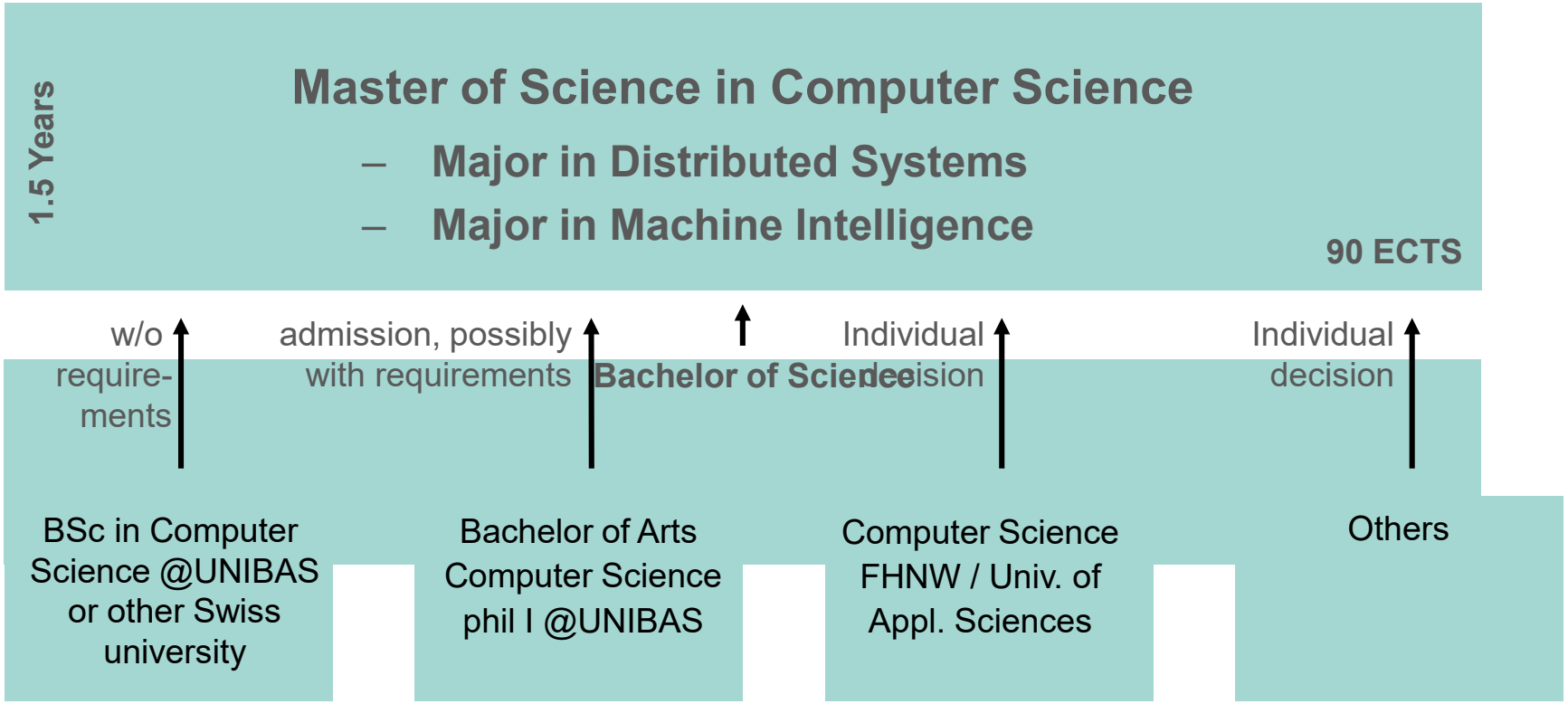
Master's Exam

4 ECTS

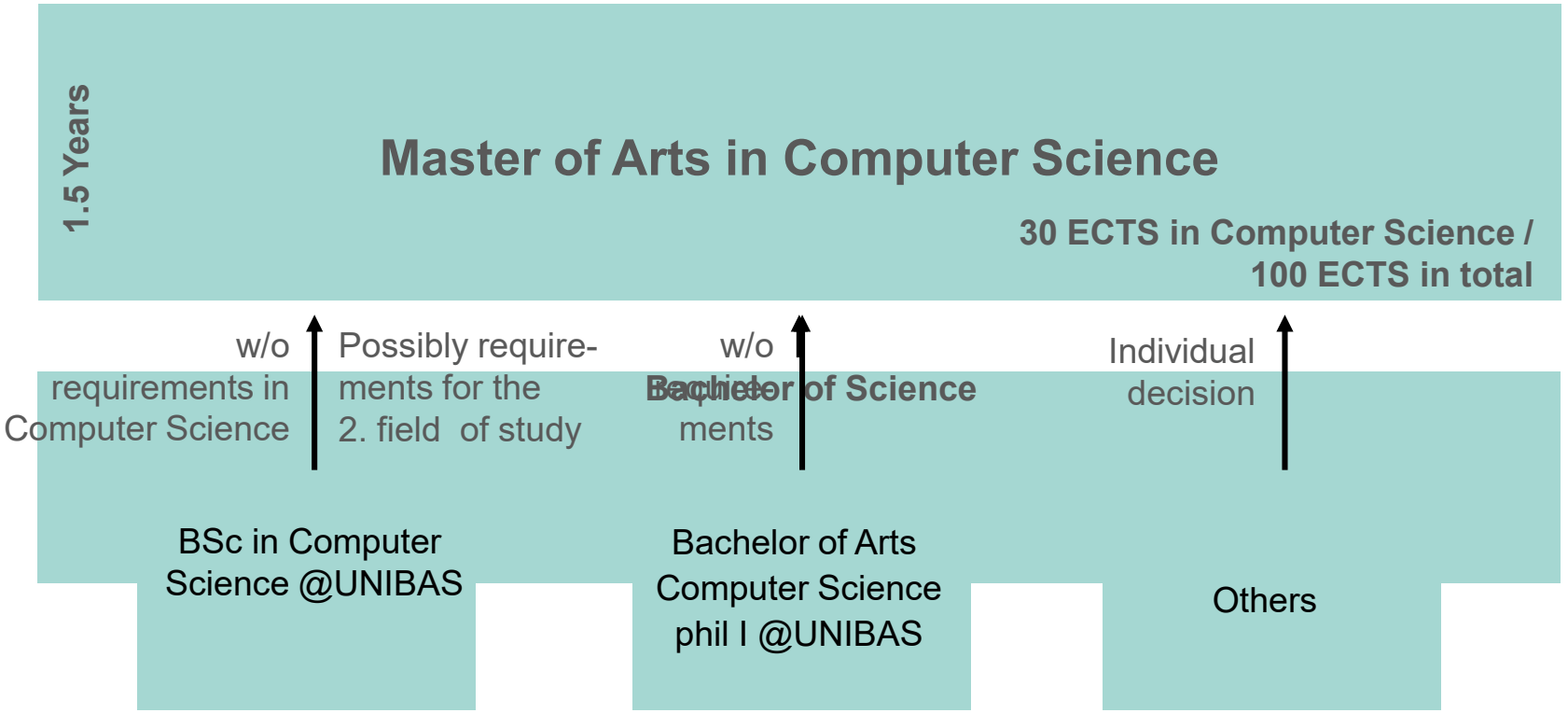
Master of Arts in Computer Science: Structure



Access to the Master of Science Program



Access to the Master of Arts Program



Application & Deadlines

- 30.04.2025 Application for the Master's Program (Start Sep. 2025)
- 15.09.2025 Start Autumn Semester 2025
- 30.11.2025 Application for the Master's Program (Start Feb. 2026)
- 16.02.2026 Start Spring Semester 2026

- Possible requirements can be completed in parallel to the Master courses
- Further Information
  - Application and Admission: https://www.unibas.ch/en/Studies/Application-Admission.html
  - Computer Science in Basel: https://dmi.unibas.ch/

- Contact:
  Dr. Heike Freiberger (degree coordinator)
  office: Spiegelgasse 1, room 00.002, email: heike.freiberger@unibas.ch

University of Basel

Thank you
for your attention.