Master's Programme in Image Analysis and Machine Learning

Programme and Course Presentation

Department of Information Technology

Uppsala University

HT2022

The program - summary

Content: **State-of-the-art deep and machine learning approaches for image and video analysis**, as well as **modern image processing methods**.

Approach: Students will have an opportunity to build **a strong theoretical foundation**, as well as learn **best practices of utilisation** of the latest and most effective tools and methods for visual data analysis in a variety of applications.

Career paths: Training for **careers in industry**, in many companies in a need of deep and machine learning, image and video analysis, **as well as in research-oriented institutions**, towards a continued academic career.

Programme

Master thesis

Spec.1 Spec.2 Spec.3 Spec.4 Spec.5

Applications

Machine learning for Image analysis

Image analysis Machine learning

Bridging courses

Specialisations:

- **Medical IA**
- **IA for Life Sciences**
- **IA for Digital Humanities**
- **Visualisation**
- **Social robotics**

Pedagogical approach

Active student-centered learning

Teaching methods combine
    lectures,
    practical work for hands-on experience related to the theoretical concepts,
    seminar discussions,
    study visits,
    project work in real industrial environment,
    oral and written presentations, team working, project management

Study plan

Semester 1			Semester 2		
Introduction to image analysis (10hp)			**Specialisations (7.5hp)** • Digital imaging systems • Computer graphics • Social robotics and human robot interaction		**Reinforcement learning (7.5hp)**
Data ethics & law (5hp)		**Statistical machine learning (5hp)**			
Bridging courses (10hp)			**Theoretical foundation of data science/** **Data Engineering I, 7.5**		**Deep learning for image analysis (7.5hp)**
Semester 3			Semester 4		
Advanced probabilistic machine learning 7.5hp		**Specialisations (7.5hp)** • Advanced image analysis • Scientific visualisation • Intelligent interactive systems	**Master project (E) (30hp)**		
Software development project in image analysis and machine learning (15hp)					

The red thread

Master project (and degree) in Image Analysis and Machine Learning (30hp)

Specializations in Image Analysis and Machine Learning (15 hp)

Software development project in image analysis and machine learning (15hp)

Deep Learning for Image Analysis (7.5hp)

Data, Ethics and Law (5hp)

Statistical Machine Learning (5hp)

Introduction to Image Analysis (7.5hp)

Programming II

Linear Algebra II

Multivariate Calculus

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Study plan
the road toward the master degree

Semester 1		Semester 2	
Introduction to image analysis (10hp)		**Specialisations (7.5hp)** • Digital imaging systems • Computer graphics • Social robotics and human robot interaction	**Reinforcement learning (7.5hp)**
Data ethics & law (5hp)	**Statistical machine learning (5hp)**		
Bridging courses (10hp)		**Theoretical foundation of data science/ Data Engineering I, 7.5**	**Deep learning for image analysis (7.5hp)**
Semester 3		Semester 4	
Advanced probabilistic machine learning 7.5hp	**Specialisations (7.5hp)** • Advanced image analysis • Scientific visualisation • Intelligent interactive systems	**Master project (E) (30hp)**	
Software development project in image analysis and machine learning (15hp)			

Bridging courses (so far)

- Computer Programming II (Python)
- Linear Algebra II (Linear Algebra for Data Science)
- Multivariate calculus (Multivariate Calculus for Data Science)

Make sure that you cover(ed) them all!

Specialisations
included courses

Image Analysis (Medical, Biomedical, Humanities)

- Digital imaging systems
- Advanced image analysis

Visualisation

- Computer graphics
- Scientific visualisation

Social Robotics

- Social robotics and human robot interaction
- Intelligent interactive systems

Specialisations, prerequisites

Image Analysis (Medical, Biomedical, Humanities)	Visualisation	Social Robotics
• Introduction to image analysis • Deep Learning for Image Analysis	• Computer programming II	• 60 hp computer science, including human-computer interaction • 60 hp computer science, of which min 20 hp in programming/algorithms & data structures

Study plan
with focus on Machine learning

Semester 1		Semester 2	
Introduction to image analysis (10hp)		**Specialisations (7.5hp)** • Imaging systems • Computer graphics • Social robotics and human robot interaction	**Reinforcement learning (7.5hp)**
Data ethics & law (5hp)	**Statistical machine learning (5hp)**		
Bridging courses (10hp)		**Theoretical foundation of data science/ Data Engineering I, 7.5**	**Deep learning for image analysis (7.5hp)**

Semester 3		Semester 4
Advanced probabilistic machine learning 7.5hp	**Specialisations (7.5hp)** • Advanced image analysis • Scientific visualisation • Intelligent interactive systems	**Master project (E) (30hp)**
Software development project in image analysis and machine learning (15hp)		

Machine Learning Thread
with prerequisites

Statistical Machine Learning

- Linear algebra II

Theoretical foundation of data science/ Data Engineering I

- Computer programming II
- Scientific computing, bridging
- Database design I

Reinforcement learning

- Linear algebra II
- Computer Programming II

Advanced Probabilistic Machine Learning

- Linear algebra II
- Calculus II
- Statistical Machine Learning

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Bridging courses to select from

Bridging, Period 1
1TD722 Computer programming II
1MA330 Linear algebra for Data Science
1TD045 Scientific computing
1DL210 Algorithms and Data structures I
1DL301 Database design I
1MS036 Probability Theory II

Bridging, Period 2
1MA334 Multivariate calculus for Data Science
1TD184 Optimisation
1MA211 Fourier Analysis
1DL231 Algorithms and Data structures II
1MS035 Inference theory I
1DL301 Database design I
1MD016 Human-computer interaction

Action points

- **Schedule** your individual meeting with Nataša and Olga.
  - Let me know if you want a meeting.
  - Check the time suggested for you.
- **Prepare** a draft of your ISP
  - Read the syllabus of the Programme
  - Read the outline of the Programme
  - Think of a course plan that would suit you!
- **Mail** us the draft **before** coming to the meeting.
  - We will discuss your draft at the meeting, focusing on the open questions.
  - After the individual meeting,Olga will register your courses to Ladok.

Note: Mail us the draft on Wednseday, August 24, latest, if you do not have any questions and you do not want/need a meeting.

ISP template

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Individual study plan Autumn 2022

Program: TBA2M, Master's Programme in Image Analysis and Machine Learning

Name:

P/T-number:

Fee-paying (Y/N):

Arrival to Sweden (date):

Name of course	Credits	Course code	Notes by the administrator (Application code etc.)
Introduction to Image Analysis	10	1MD110	
Data, Ethics and Law	5	1DL002	
Statistical Machine Learning	5	1RT700	

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Place and date

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Available from the Programme info-page
https://uppsala.instructure.com/courses/69570

Action points

- Open your **student account**!

- Regularly follow our programme page in Studium
  https://uppsala.instructure.com/courses/69570

Course Presentations

Core courses

PERIOD 1&2

Introduction to Image Analysis (taken by all of you)
Data, Ethics and Law
Statistical Machine Learning

Bridging courses

PERIOD 1

Algorithms & Data Structures I
Computer Programming II
Database Design I
Linear Algebra for Data Science
Scientific Computing, bridging course
Probability Theory II

Bridging courses

PERIOD 2

Human-Computer Interaction
Algorithms & Data Structures 2
Fourier Analysis
Inference Theory I
Several Variable Calculus for Data Science
Optimisation
Database Design I
Inference Theory II

Contact details

Introduction to Image Analysis Nataša Sladoje
Data, Ethics, and Law   Mikael Laaksoharju
Statistical Machine Learning   Dave Zachariah

Computer Programming II Tom Smedsaas
Scientific Computing, Bridging Davoud Mirzaei
Database design I   Georgios Fakas
Algorithms and Data Structures I Pontus Ekberg
Algorithms and Datastructures II
Human-computer interaction Mike Hazas
Optimisation Di Yuan

For other courses: Contact Olga to get further information.

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