Welcome meeting for new master students. CS:applied mathematics and risk analysis

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Overview

120 credits altogether (long master):

- 60 credits courses. 60 credits thesis
- Deadline for the master's agreement: December 1st (supervisor(s), course plan, project description).
- Common to choose a special curriculum (10 credits). Typically connected to topics needed in the thesis
- Must have two of
  - FYS-STK 4155(A) Applied Data Analysis and Machine Learning
  - IN4200(S) High performance computing and numerical projects
  - MAT4110(A) Introduction to Numerical Analysis
- Cross-disciplinary. Other spesializations at CS besides amra: Astrophysics, Bioinformatics, Bioscience, Chemistry, Geoscience, Imaging and Biomedical computing, Materials Science, Mechanics, Physics.
- Data Science is another cross-disciplinary master program (5 specializations)

Can be mathematically heavy, but can also focus more on the following, when compared to other directions of mathematics.

- algorithms,
- construction and testing of numerical algorithms,
- software development,
- visualization/graphics,
- Signal- and image analysis,
- find useful information in large datasets (risk in a compelx project/portefolio, an oil reservoir in seismic data, a tumor in a medical image),
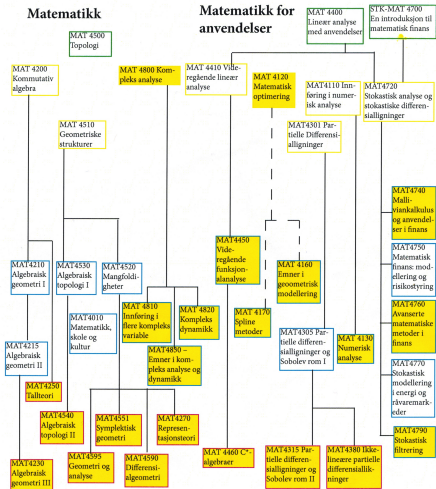- simulation of physical phenomena.

- Formulation of mathematical models,
- Use of heavy computing resources,
- partial differential equations,
- machine learning.
- complexity theory.

- Modelling of surfaces in 3D
- Minimal surfaces and 3D printing
- Reconstruction of 3D-models from segments with machine learning
- Recommender systems analysis by compressed sensing
- Stability of adaptive neural networks for image reconstruction.
- Use machine learning for solving partial differential equations.
- Buffering in risk- and reliability analysis
- Numerical analysis of solvers for non-linear ordinary differential equations
- Computational barriers in statistical estimation and reconstruction

- MAT4120(A) Mathematical optimization (nårbert)
- MAT4130(S) Numerical Analysis
- MAT4160(S/A) Topics in geometric modelling (nårbert)
- MAT4170(S) Spline methods (nårbert)
- MAT4400(S) Linear analysis with applications
- MAT4410(A) Advanced Linear Analysis
- MAT4450(S) Advanced Functional Analysis (nårbert)
- MAT4500(A) Topology

Matematikk

Matematikk for anvendelser

MAT 4500 Topologi

MAT 4200 Kommutativ algebra

MAT 4800 Kompleks analyse

MAT 4510 Geometriske strukturer

MAT 4410 Videregående lineær analyse

MAT 4400 Lineær analyse med anvendelser

STK-MAT 4700 En introduksjon til matematisk finans

MAT 4120 Matematisk optimering

MAT4110 Innføring i numerisk analyse

MAT4720 Stokastisk analyse og stokastiske differensialligninger

MAT4301 Partielle Differensialligninger

MAT4210 Algebraisk geometri I

MAT 4530 Algebraisk topologi I

MAT 4540 Mangfoldigheter

MAT 4450 Videregående funksjonalanalyse

MAT 4160 Emner i geometrisk modellering

MAT4740 Mallianvskalkulus og anvendelser i finans

MAT4750 Matematisk finans: modellering og risikostyring

MAT 4010 Matematikk, skole og kultur

MAT 4810 Innføring i flere komplekse variable

MAT 4820 Kompleks dynamikk

MAT 4170 Spline metoder

MAT4760 Avanserte matematiske metoder i finans

MAT 4215 Algebraisk geometri II

MAT 4850 – Emner i kompleks analyse og dynamikk

MAT 4305 Partielle differensialligninger og Sobolev rom I

MAT 4130 Numerisk analyse

MAT4770 Stokastisk modellering i energi og råvaremarkeder

MAT4250 Tallteori

MAT4540 Algebraisk topologi II

MAT4551 Symplektisk geometri

MAT 4270 Representasjonsteori

MAT4790 Stokastisk filtrering

MAT4230 Algebraisk geometri III

MAT4595 Geometri og analyse

MAT 4590 Differensialgeometri

MAT 4460 C*-algebraer

MAT4315 Partielle differensialligninger og Sobolev rom II

MAT4380 Ikke-lineære partielle differensiallikninger

Geometri/topologi
Operatoralgebraer
Flere komplekse variable
Algebra/algebraisk geometri

Lineær optimering og kombinatorisk matriseteori
Partielle differensiallikninger
Stokastisk analyse

- IN4190(A) Digital signal processing.
- IN5520(A) Digital image analysis
- IN4070(A) Logics
- IN5580(S) Computability theory
- IN4110(A) Problemløsning med høynivå-språk
- IN5270(A) Numerical methods for partial differential equations
- IN4050(S) Introduction to Artificial Intelligence and Machine Learning (overlap with FYS-STK4155)
- IN5400(S) Machine Learning for Image Analysis

Courses related to machine learning

- FYS-STK 4155(A) Applied Data Analysis and Machine Learning
- IN4050(S) Introduction to Artificial Intelligence and Machine Learning (overlap with FYS-STK4155)
- IN5400(S) Machine Learning for Image Analysis
- STK-IN4300 (A) Statistical Learning Methods in Data Science
- IN-STK5000 (A) Adaptive methods for data-based decision making

- MAT4301(A) Partial differential equations
- MAT4380 Nonlinear partial differential equations (nårbert)
- MAT4305(S) Partial differential equations and Sobolev spaces I
- MAT4315 Partial differential equations and Sobolev spaces II (nårbert)
- STK-IN4300(A) Statistical learning methods in Data Science
- STK4400 Risk- and reliability analysis (nårbert)
- MAT4720(A) Stochastic analyse and stochastic differential equations
- MAT4770(S) Stochastic modelling in energy and raw material markets

Potential supervisors

- Michael Floater (approximation theory. geometrical modelling. numerical analysis)
- Ulrik Skre Fjordholm (numerical analysis. Stochastic- and partial differential equations)
- Håkon Hoel (numerical methods for stochastic- and partial differential equations)
- Arne Bang Huseby (risk analysis)
- Kenneth Karlsen/Nils Henrik Risebro/Snorre Christiansen (partial differential equations)
- Anders Hansen (ach70@cam.ac.uk) (compressive sensing, machine learning)
- Geir Dahl (optimisation)
- Kent-Andre Mardal (Biomechanics, machine learning with applications to medicine)
- Øyvind Ryan (compressive sensing, optimisation)

- Program page:
  https://www.uio.no/studier/program/computational-science-master/studieretninger/applied-mathematics/index.html
- List of open and completed master projects, with supervisor:
  https://www.mn.uio.no/math/english/research/groups/cm/complete-master-projects.html
- This file:
  https://www.mn.uio.no/math/personer/vit/oyvindry/slides_amra.pdf