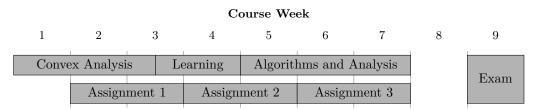# FRTN50 - Optimization for Learning

Course Program Autumn 2020

Lecturer and Course Responsible: Pontus Giselsson
TAs: Martin Morin, Hamed Sadeghi and Manu Upadhyaya

Overview

Course Week

1	2	3	4	5	6	7	8	9

Convex Analysis		Learning	Algorithms and Analysis			Exam

Assignment 1	Assignment 2	Assignment 3

The course is roughly divided into three blocks covering the fundamental convex analysis, some classic supervised learning problems, and the analysis of first order optimization algorithms. The course work consists of graded assignments and ungraded exercises with a final exam.

Covid-19 Policy

The following policies are based on the departements general guidelines: Link.

- If you feel unwell with cold symptoms, cough or fever, you must stay at home. This applies even if you only feel slightly unwell. Do not return to the university for at least two days after you have recovered.

- All lectures will be given as video lectures only. The videos will be available no later than the day indicated in the LTH schedule.

- No physical office hours or exercise sessions will be held, nor will spontaneous drop-ins at the department be allowed. Instead will digital alternatives be used, see below for more information.

Lectures, Literature and Exercise Material

No official course book exists and the course content is meant to be covered fully by the lectures videos and slides. Videos, slides will be uploaded on `Canvas` each week. A compendium of exercise material is also available on `Canvas`. It will be updated with exercises that cover the lecture topics at least one week in advance. An overview of the weekly lecture topics and suggested exercises can be found below.

Help Sessions and Forums

The exact teaching formats may change based on feedback and demand. All sessions are voluntary and can be attended based on preference.

Discussion Board On the discussion board on `Canvas` you can ask questions regarding the course publicly. The teaching staff will spend time answering questions there but we encourage students to participate in the discussions as well.

Office Hours Office hours will be hosted on `Zoom`, there you can ask questions directly to the teaching staff. The lecturer's office hours are targeted at questions regarding the lecture material. The TAs' office hours are open for questions on all aspects of the course but mainly focus on the exercises and the assignments.

In the `Zoom` meetings, some sort of queuing system will be used for talking to the teacher one-on-one. How exactly this will be handled depends on the amount of people joining the sessions. If you want technical help with the exercises or assignments it is recommended that you have some way of showing your work over zoom. The most basic solutions is a movable camera and/or screen-sharing.

Discussion Seminars Discussion seminars will be held on `Zoom`. The main focus of these seminars will be discussing concepts and putting things into context. At the start of each session will the teacher gather input from the room regarding what topics and exercises should be discussed. The teacher then acts as a discussion leader and lecturer, trying to cover these and maybe some other pre-planned topics in greater detail.

Examination

The examination consists of two parts, mandatory assignments and a written exam. A passing grade on the exam and all assignments are required to pass the course. The final grade is then based on the final score of the exam.

Assignments There are three mandatory assignments. They covers some of the practical aspects of optimization and demonstrate some of the key concepts. They will require access to a computer and will be available on `Canvas` roughly two weeks before their deadline.

These are done in groups of 2 and are graded with a pass/fail. Submissions are done via `Canvas`, see the corresponding assignment for instructions. Two re-submissions on the first assignment are allowed if the original submission fail. Only one re-submission is allowed on the other two assignments. Late submissions count towards the re-submissions.

Exam The written exam will most likely be held in some digital form. The exact format will be announced later. It will be graded with a points score between 0-25. The preliminary limits for the grades are:

3 – 12 points.
4 – 17 points.
5 – 22 points.

The exam mainly covers the first and last course block, i.e., the fundamental convex analysis, the first order methods and the convergence analysis.

Course Summary

The chapter and exercise numbers refer to the exercise compendium on `Canvas`.

w.	Lecture	Suggested Exercises
1	L1 – Course Introduction. Convex Sets. L2 – Convex Functions.	'Introduction to Julia' Ch 1: 1-9, 12-20
2	L3 – Subdifferentials. Proximal Operators. L4 – Convex Conjugates. Fenchel Duality.	Ch 1: 21-25 Ch 2: 1-4, 15-16, 5-6, 8-10
3	L5 – Proximal Gradient (Basics). L6 – Least Squares.	Ch 2: 11-13 Ch 3: 1-2, 4, 6-7, 10-15, 17
4	L7 – Logistic Regression. L8 – Support Vector Machines.	Ch 3: 16, 18-19, 21 Ch 4: 1-9
5	L9 – Deep Learning. L10 – Algorithm Convergence.	Ch 5: 1-9 Ch 6: 1-5
6	L11 – Proximal Gradient (Analysis). L12 – Stochastic Gradient.	Ch 6: 6-10 Ch 7: 1-7
7	L13 – Coordinate Gradient Descent. L14 – Newton's Method.	Ch 7: 8-15

Schedule

There is a total of 14 lectures with new videos being uploaded two time per week. There are four office hour sessions and one discussion session per week, all held over `Zoom`. The times and attending teachers for the different sessions are given below. The invite links to the `Zoom` calls can be found on `Canvas`. Note that the physical sessions in the `timeedit` schedule are NOT used.

Video Lecture Uploads:

Mondays
Wednesdays

Office Hours:

Mondays	13.15–15.00	Pontus Giselsson (Primarily for questions on lectures)
Tuesdays	15.15–17.00	Manu Upadhyaya
Thursdays	08.15–10.00	Hamed Sadeghi
Thursdays	15.15–17.00	Martin Morin

Discussion Seminar:

~~Fridays 10.15–12.00 Martin Morin~~ (Canceled)

The graded course work have the following deadlines.

Graded Tasks:

Assignment 1	Week 3 - Sunday	Sep 20
Assignment 2	Week 5 - Sunday	Oct 4
Assignment 3	Week 7 - Sunday	Oct 18
Exam	Week 9 - Monday	Oct 26

Contact Information

The department offices are located at Kemicentrum at the third floor of building 4. The course lab is on the bottom floor.

Phone and Addresses

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