MATH-746 **Topics in continuous optimization**

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Cursus	Sem.	Type
Mathematics		Obl.

Language of teaching	English
Credits	3
Session	
Exam	Oral presentation
Workload	90h
Hours	**50**
Courses	20
Project	30
Number of positions	

Frequency

Only this year

Remark

Postponed

Summary

Students study advanced modern topics and techniques in continuous optimization, give lectures on them, and discuss potential research avenues that emanate from them. For transferable skills, the course design actively aims to help the students improve their technical presentation skills.

Content

The course will be structured as a student seminar.

Working in groups of 2 or 3 on each topic, the students give two presentations per group:

* One about mathematical background that is necessary to approach the topic at hand.
* One about the main contributions of the topic itself.

The presentations will be open to the public. They are followed by class discussions (for course participants only).

Students may also be asked to prepare lecture notes, exercises and / or a blog post about their work.

The course is structured to foster conversations both about the technical contents themselves and about the oral presentations.

Illustrative list of papers (not exhaustive; students are welcome to propose papers too, but the instructor will determine if they are of broad enough appeal):

1. Rod Flow: A Continuous-Time Model for Gradient Descent at the Edge of Stability
https://arxiv.org/abs/2602.01480

2. Basic Inequalities for First-Order Optimization with Applications to Statistical Risk Analysis
https://arxiv.org/abs/2512.24999

3. On Approximate Computation of Critical Points
https://arxiv.org/abs/2601.21917

4. The matrix-vector complexity of $Ax = b$
https://arxiv.org/abs/2602.04842

5. Linear Systems and Eigenvalue Problems: Open Questions from a Simons Workshop
https://arxiv.org/abs/2602.05394

Keywords

Continuous optimization, technical oral communication

Learning Prerequisites

Required courses

Foundations in continuous optimization and numerical analysis, solid general mathematical education

Learning Outcomes

By the end of the course, the student must be able to:

- Integrate into and communicate about advanced technical topics in optimization

Resources

Bibliography

See list of papers in description.

Références suggérées par la bibliothèque

- [External resource] Rod Flow / Regis
- [External resource] Basic Inequalities for First-Order Optimization with Applications to Statistical Risk Analysis / Paik
- [External resource] On Approximate Computation of Critical Points / Ahmadi
- [External resource] The matrix-vector complexity of $Ax = b$ / Derezinski
- [External resource] Linear Systems and Eigenvalue Problems / Amsel

Moodle Link

- https://go.epfl.ch/MATH-746