Numerical Optimisation (COMP0120)

Description

Aims:
The aim is to provide the students with an overview of the optimization landscape and a practical understanding of most popular optimization techniques and an ability to apply these methods to problems they encounter in their studies e.g. MSc project/dissertation and later in their professional carrier.

Learning outcomes:
On successful completion of the module, a student will be able to:

1. practically understand a comprehensive set of optimization techniques and their range of applicability;
2. implement mathematical methods;
3. apply these techniques to problems they encounter in their studies e.g. MSc project/dissertation and later in their professional carrier;
4. critically evaluate the results, which the methods produced for a given problem;

Content:
This module teaches a comprehensive range of state of the art numerical optimization techniques. It covers a number of approaches to unconstrained and constrained problems, methods for smooth and non-smooth convex problems as well as basics of non-convex optimisation;

Syllabus:
- Mathematical formulation and types of optimisation problems;
- Unconstrained optimization theory e.g.: local minima, first and second order conditions;
- Unconstrained optimization methods e.g.: line-search, trust region, gradient descent, conjugate gradient, Newton, Quasi-Newton, inexact Newton;
- Least Squares problems;

Key information

Year: 2019/20
Credit value: 15 (150 study hours)
Delivery: PGT L7, Campus-based
Reading List: View on UCL website
Tutor: Dr Marta Betcke
Term: Term 2
Timetable: View on UCL website

Assessment

- Report: 40%
- Coursework: 20%
- Coursework: 40%

Find out more

For more information about the department, programmes, relevant open days and to browse other modules, visit ucl.ac.uk

Disclaimer: All information correct as of August 2019. Please note that aspects of the module may be subject to change. UCL will make best efforts to inform applicants of major changes.
- Constrained optimization theory e.g.: local and global solutions, first order optimality, second order optimality, constraints qualification, equality and inequality constraints, duality, KKT conditions;

- Constrained optimization methods for equality and inequality constraints e.g.: constraints elimination, feasible and infeasible Newton, primal-dual method, penalty, barrier and augmented Lagrangian methods, interior point methods;

- Non-smooth optimization e.g. subgradient calculus, proximal operator, operator splitting, ADMM, non-smooth penalties e.g. L1 or TV;

**Requisites:**
In order to be eligible to select this module, a student must be registered on a programme for which it is a formally-approved option or elective choice AND must have (i) strong competency in Linear Algebra and Analysis; (ii) fluency in matrix calculus; and (iii) working knowledge of Matlab.

The Coursework needs to be completed using Matlab and all the solutions are provided in Matlab.