

10. SRH INTERNATIONAL WEEK 2019: Course description

Title of Course:	Optimization for Data Science
Language:	English
Course Type:	Seminar
Work Load:	20 hours (including exams on Friday)
Lecturer Position Home University Email	Dr. Zoran D. Jelcic Head of Automation and Control System Group University of Novi Sad, Serbia jelcic@uns.ac.rs
Course description/ Contents:	<p>The course will cover basic principles of optimization focusing on methodologies and algorithms that have recently found fruitful applications in data science and related disciplines, including machine learning, deep learning, soft computing and other various facets of computational intelligence. In the first part of the course, we will discuss how classical first and second order methods such as gradient descent and Newton's method in theory and in practice. Some new algorithms and paradigms of global optimization that could be used in the context of data science will be discussed as well. The emphasis won't be so much on the application of these methods, but on understanding and analyzing the methods themselves.</p> <p>During the second part of the course, data science (and machine learning) by exploration of basic problems: classification and regression, supervised and unsupervised learning will be discussed. The main objective of the second part is to enable participants to recognize data science problems as well as to develop low- complexity solutions for the problems that are frequently encountered in the practical scenarios.</p>
Learning outcome:	After completing the course and passing the exam, the student will be able to understand the theoretical and practical aspects of relevant optimization methods used in data science and to deal with optimization problems arising in data science using general paradigms.
Examination:	The approximate grade breakdown of the course will be 50% homework 50% final exam. Exam consist of multiple choice and short answer questions. Test material will be taken from required readings, class lectures, and discussions
4 questions to be prepared by the students prior to arrival:	<p>1. Think of an optimization problem. Define the following for this optimization problem of your choice:</p> <ol style="list-style-type: none"> Objective Analysis variables (Parameters) Design variables (Variables) Equality constraints Inequality constraints Continuous variables Discrete variables <p>2. Find two nonnegative numbers whose sum is 9 and so that the product of one number and the square of the other number is a maximum.</p> <p>3. You are organizing an International week at SRH. The total number of students attending will be either 100 or 200 (with equal probability), but you will not find out the exact number until the day of the workshop. However, you need to commit today to firm dinner arrangements for all attendants.</p> <p>The cost of a restaurant dinner is the following: €30 per person for the first 150 guests, and €35 per person for every additional guest (over the first 150). Additionally, in case you cannot afford a restaurant dinner for everybody, you can order pizzas for the remaining guests at a cost of €5 per person.</p> <p>The total initial budget is €3000.</p> <p>(a) Formulate an optimization problem, where you maximize the expected value of the</p>

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	number of guests that will enjoy a restaurant dinner at the workshop. 4. Solve problem 3. using the MATLAB or Excel.
Essential reading:	Exposure to numerical computing, optimization, and application fields is helpful but not required; the applications will be kept basic and simple. Basic familiarity with MATLAB is helpful. http://www3.imperial.ac.uk/pls/portallive/docs/1/7288263.PDF https://people.eecs.berkeley.edu/~varaiya/Download/Varaiya-Optimization.pdf (Chaperts 1-4)