Continuous Optimization Algorithms

EENG-699R

Spring Quarter, 2019
Time and location TBD

Instructor: Clark Taylor
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Office Hours: TBD
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Course Website: As needed
Course Schedule: Google Sheet here

Meetings outside of office hours: I in my office all day Monday through Friday. You are free to drop by my office anytime. To ensure I will be there when you come by, I recommend sending an e-mail first so that we can confirm a time.

Prerequisites

- Linear Algebra
- Calculus (multi-variable preferred)
- Experience with a programming language (MATLAB, Julia, or Python preferred)
- (preferred) Sufficient introduction to thesis topic to define an optimization problem

Course Description

Optimization algorithms are the core of many (most) engineering problems and solutions. While an overview of all optimization techniques is beyond the scope of any course, we will focus on two classes of optimization algorithms in this course: (1) algorithms that use the derivative of the function to minimize the cost function and (2) biological/stochastic algorithms that do not require the gradient to find a minimum. In addition, because I believe that we learn best when we apply our knowledge to real problems, the assignments in this course can hopefully be used to solve problems related to student thesis projects.

Required Materials

We will be using the book “Numerical Optimization (2nd Edition)” by Jorge Nocedal and Stephen J. Wright as the primary text.

While this book is excellent for covering gradient-based optimization techniques, it does not even broach the subject of evolutionary algorithms. For evolutionary algorithms, we will primarily be looking at papers, but the books “Optimization Techniques and Applications with Examples” or “Engineering Optimization – An Introduction to Metaheuristic Applications”, both by Xin-She Yang are introductory references.

Course Learning Outcomes

1. Understand the basic of continuous optimizations
2. Be able to identify and describe what makes a particular cost function more applicable / easier to solve by different algorithms
3. Ability to code and implement optimization algorithms for their own research

Classroom Procedures

This is going to be a very informal class, closer to a lab class than a formal lecture classroom. You are responsible for (a) coming prepared to class and (b) asking questions where you are confused. Because I am only one person, this class will work best if each of you help your fellow classmates with any problems they have. This class is only for you to learn, so have fun and get what you can out of this class!

Assessment Breakdown

The students will be assessed on the following learning activities:

- Homeworks (~7 different assignments) 30% of grade
- Midterm -- 15% of grade
- In-class presentations, 20% of grade
- Final project, 35% of grade

The presentations and midterm will be the only portion that you will be required to do completely alone. Everything else in the class can be done in a group. The final project group sizes will be limited.