THE UNIVERSITY OF HONG KONG

Department of Mathematics

C O L L O Q U I U M

Location Estimation from the Ground Up

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Abstract

The talk will describe a new elective course I have taught twice to an audience of undergraduate and graduate students in math and computer science, as well as an upcoming book based on the course. The topic of the course is location estimation, which includes, for example, the algorithmic and mathematical techniques used in GPS. Unlike existing courses on location estimation or more generally on statistical estimation, which mostly target statistics or electrical engineering students, the new course targets math and computer science students and the material is presented accordingly, rigorously, with an emphasis on algorithms and efficiency, and without relying on prerequisites that math and CS students do not have, like the sampling theorem.

While the topic may seem a bit specialized, it does enable the presentation and motivation of many ideas and algorithms in a context that is easy to understand with no background in physics or engineering. Among the topics that the course and the book present are linear, non-linear and mixed-integer least-squares problems and solvers, maximum-likelihood estimation and its connection to least squares and to cross-correlation, the use of the FFT to cross-correlate, Kalman filtering and its connection to sparse QR factorizations, error estimation, and the Cramer-Rao bound. Along the way, the course provides interesting and meaningful examples of fundamental results such as the Cauchy-Schwarz inequality, the implicit-function theorem, and and techniques like symbolic computation of derivatives.

The talk will describe the overall structure of the course, innovative ways to present certain topics (e.g., the Paige-Saunders Kalman filtering algorithm), and will discuss ways to enhance understanding of the limitations of various techniques. The course should be easy to adopt (once the book is published), but the talk also aims to encourage consideration of application-driven courses based on other applications and covering other basic techniques.

Date:	**August 12, 2019 (Monday)**
Time:	**11:00am – 12:00noon**
Venue:	**Room 210, Run Run Shaw Bldg., HKU**

All are welcome