Invitation to PhD course in:
Methods in Causal Inferences for health economic and medical research (2 course credits)
Lecture on May 9-10 and seminars on May 16 and June 4, 2019

Goal
To give an overview and understanding of recent developments in methods for causal inference. To provide skills and experience in applying methods for causal inference in practical research.

Content
The course will give an overview of recent topics in causal inference with an emphasis on using modern machine learning methods. The course consists of two parts. The first part consists of 8 lectures during Maj 9-10 2019 by Professor Guido Imbens, Stanford Graduate School of Business. The second part of the course consists of writing a term paper and applying methods discussed in class.

- The first lecture will cover some basic issues in causal inference from the potential outcome perspective, including the analysis of randomized experiments based on randomization inference.
- The second lecture will cover recent advances in experimental design, focusing particularly on multi-armed bandits and Thompson sampling, that are widely used in experimentation in online settings.
- The third and fourth lectures will discuss estimation of average treatment effects under unconfoundedness under modest number of covariates, and many covariates, respectively.
- The fifth lecture will consider estimation of: (1) average treatment effects conditional on covariates; and (2) optimal assignment policies exploiting heterogeneity in treatment effects.
- The sixth to eighth lecture will focus on advanced topics such as synthetic control methods; regression discontinuity methods, and on combining observational studies and randomized experiments.

After the lectures, students will write a 3-5-page (double spaced) term paper with a proposal for a potential research project were some of the methods for causal inference discussed class are applied. It is important that the term paper describes the causal question of interest, and how the question can be answered methodologically and with which real-world data set, using methods used in lectures.

In order to help students in their work, two seminars will be organized. In a first seminar, about a week after the lectures, students will present and discuss topics for their term paper. In a second seminar, about 4 weeks after the lectures, the student will present and discuss their term papers. Sophie Langenskiöld and Erik Grönqvist will teach at the seminars and be examiners.

Teaching
Lecture (8 x 1,5 hour) on May 9-10
Seminar (5 x 2 hours) on May 16 and June 4

Examination
Hand in of a term-paper
Presentation of the term paper, and active participation, at the seminars.
Presence is required at 6 (of 8) lectures and at the seminars.
Teachers
Guido Imbens (Lecture)
Sophie Langenskiöld (Seminar)
Erik Grönqvist (Seminar)

Registration
http://www2.medfarm.uu.se/utbildning/forskarniva/for_doktorander/kurs571.html
Deadline for registration April 24.
Maximum 20 students

For more information

Contact
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Course Literature

Background reading

1. Causal Inference and Randomized Experiments, Part I

2. Causal Inference and Randomized Experiments, Part II


4. Estimating Average Treatment Effects Under Unconfoundedness, Part II
http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep. 28.2.29

5. Causal Inference: Heterogeneous Treatment Effects
(a) S. Athey and G. Imbens (2016) "Recursive Partitioning for Heterogeneous Causal Effects," *Proceedings of the National Academy of Sciences*.

6. Synthetic Control Methods and Matrix Completion

7. Regression Discontinuity Designs

8. Combining Experimental and Observational Data
(b) Athey, S., R. Chetty, and G. Imbens, “Using Experimental Data to Improve Estimates Based on Observational Data”