FSF3960 Algebraic Statistics 7.5 credits

Algebraisk statistik

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for FSF3960 valid from Autumn 2009

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

Masters degree in mathematics, or in computational mathematics or in computer science/engineering with at least 30 cu in mathematics and 20 cu in statistics.

Suitable prerequisites are courses: SF2935 Modern Methods of Statistical Learning and SF2737 Commutative Algebra and Algebraic Geometry

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

By the end of the course, the participants

- will be able to explain how statistical models for discrete random variables are relevant to (semi) algebraic varieties and ideals.
- will be able to deal use algebraic methods on 1) Independence models 2) CI (=conditional indepencence) models with hidden variables 3) CI axioms from algebraic point of view 4) Primary Decomposition of CI Ideals
- Apply algebraic methods to Exponential families, Sufficient statistics
- Apply geometry of CI
- Compute the algebraic invariants of the ideals associated to discrete models.
- Use matrix Schubert varieties in Gaussian conditional independence models
- Solve a maximal likelihood estimation of an implicit model with algebraic methods
- Deal with identifiability and singularity issues in models with algebraic tools.
- know the open problems in this developing field.

Course contents

1. Probability Primer
2. Algebra Primer
3. Conditional Independence
4. Statistics Primer
5. Exponential Families
6. Likelihood Inference
7. The Cone of Sufficient Statistics
8. Fisher's Exact Test
9. Graphical Models
10. Hidden Variables
11. Identifiability
12. Singular Learning Theory
13. MAP Estimation

Disposition

Lectures and seminars

Course literature

Algebraic Statistics by Seth Sullivant. (Available as a preprint)

Lectures on Algebraic Statistics by Mathias Drton, Bernd Sturmfels and Seth Sullivant.

Oberwolfach Seminars Volume 39, 2008, Springer Science \& BusinAess Media

Examination

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Home assignments and computer work

Other requirements for final grade

The examination is computer project P/F and homework assignments (80 % correct).

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.