

Course content for International Master program „Mathematical modeling, computation and optimization“

Course name	Methods of algebraic statistics
Contents and Objectives	<p><u>Content:</u></p> <ul style="list-style-type: none"> • Basics from probability theory (random variables, expectation, conditional independence). • Basics from algebra (ideals in polynomial rings, primary decomposition, Gröbner bases). • Basics from statistics (statistical models, parameter estimation, hypothesis testing). • Exponential families and toric varieties. • Maximum likelihood estimation from an algebraic perspective. • Cone of sufficient statistics of an exponential family. • Statistical models with hidden variables. • Phylogenetic models. <p><u>Objectives of the course:</u> This course gives an introduction to algebraic statistics, a rather recent discipline concerning the applications of algebraic methods to statistical problems. One important topic is (algebraic) exponential families and relations to toric geometry. Also computational aspects will be treated. The lecture will set the stage for applications, e.g., to computational biology.</p>
Teaching	<p>This course consists of lectures and exercise classes.</p> <ul style="list-style-type: none"> • Lecture: Methods of algebraic statistics (3h/week) • Exercise class: Methods of algebraic statistics (1h/week)
Prerequisites	Basic notions of Algebra and Probability Theory
Examination	Oral exam (30 minutes)
Credits	6 ECTS points
Frequency	This course is given at least every second year.
Workload	The estimated total working time for this course is 180 hours.
Duration	This course is given during one semester.