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Probability Syllabus

Teacher: Paolo Gibilisco

Elements of a probability space. Algebras of events and information about random experiments. Introduction to combinatorial calculus. Finite probability spaces, probability measures, introduction to Kolmogorov theory. Conditional probability, total probability formula, Bayes formula. Independent events. Random variables and their properties. Probability distribution, distribution function and densities function of a random variable. Expectation and variance of a random variable and their properties. Expectation and variance for the main kinds of random variables. Covariance and scale-invariance of the correlation coefficient. Random vectors and their properties. Probability distribution, distribution functions and densities functions of a random vector. Independent random variables, covariance and correlation. Conditional expectation of a random variable and its properties. Conditional expectation as best estimator. Geometric approach to the conditional expectation. Sequences of random variables. Convergence in probability and in law. The (weak) law of large numbers. The characteristic function. Central limit theorem. Multivariate Gaussian distribution. Conditional expectation for the bivariate gaussian.

References

Any edition of the following books or of any book covering the basic theorems of probability.

G. Casella & R.L. Berger. Statistical Inference. Duxbury
P. Billingsley. Probability and Measure (Wiley Series in Probability and Statistics)
S. Ross. A First course in Probability.
J.P. Romano & A.F. Siegel. Counterexamples in Probability And Statistics (Wadsworth and Brooks/Cole Statistics/Probability Series).