22S:172:002

<u>Topics in Statistics</u>

Subtitle: An introduction to Modeling and Likelihood Inference with Stochastic Differential Equations

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9:30A-10:20 A MWF 151 SH

In this course we will approach a topic which stands at the interface of probability theory, real analysis, measure theory, numerical analysis, statistical inference and computation. The models and methods we will consider are employed by several diverse scientific areas such as econometrics, engineering, chemistry, statistical physics and biology. Thus, unavoidably, **we will have to be selective**.

We will handle processes which evolve continuously in time such as asset prices, interest rates and exchange rates. We will postulate a class of stochastic models called diffusion processes for describing the dynamics of continuous-time processes. The models will be specified up to some unknown parameters, and we will show how to estimate the parameters using likelihood methods, based on an observed data set.

We will start the course by going over some basic concepts in the modeling of deterministic processes via ordinary differential equations. We will then move to the construction of stochastic differential equations, the solutions of which are diffusion processes. The last part of the course will show how to obtain a likelihood function under such models and how to proceed to statistical inference.

Our priority throughout will be to understand the main concepts intuitively, thus mathematical proofs will be kept to a minimum. The material has been selected with a view of being general enough to bring out the main challenges of the topic, but not so general as to require a much richer mathematical background than the one we will assume.

It is worth mentioning that statistical inference for diffusion processes is a research topic of intensive current investigation.

GRADING will be based on a few take home assignments.