

# Stochastic Processes II

PhD in Statistics & Computer Science, Bocconi University

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## Course Description:

The course deals with some fundamental classes of continuous time stochastic processes, widely used in Statistics and Machine Learning. Their main distributional and sample path properties are presented. The key tools and concepts will be illustrated by means of several notable examples.

## Course Syllabus:

- Lévy processes: definition, main concepts and tools, Poisson and compound Poisson processes, infinitely divisible distributions and Lévy-Khinchine representation, additive processes.
- Subordinators and increasing additive processes: representation and distributional properties, gamma and stable subordinators and generalizations.
- Random measures: Poisson random measures and their transformations, completely random measures, notable examples.
- Brownian motion: definition and basic properties, rigorous construction of a one-dimensional Brownian motion and some ideas about the n-dimensional Brownian motion, non-differentiability of sample paths, quadratic variation.
- Stochastic integrals: construction of Ito integral and its main properties, stochastic differentials, product rule and chain rule.
- Stochastic differential equations (SDE): definition and examples, existence and uniqueness of solutions, elementary properties of solutions, linear SDEs and explicit formulas for the solutions.

## Exam:

Oral presentation