

Stochastic optimization

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Main goal : introduction to stochastic optimization, that aims to optimize (in the mathematical way) while taking the uncertainty into account.

Plan

- uncertainty and optimization ;
- stochastic programming with recourse ;
- two-stage linear stochastic programming, compact and extended formulations, L-Shaped method ;
- multistage problems ;
- convex and non convex problems
- sampling methods and consistency analysis ;
- stochastic gradient descent – stochastic approximation.

Prerequisite

- good mathematical and statistical background ;
- it is advised to have some background in optimization ;
- basic knowledge in programming.

Main reference

- John R. Birge et François Louveaux, *Introduction to Stochastic Programming*, Springer-Verlag, 1997.

Suggested books

- Peter Kall et Stein W. Wallace, *Stochastic Programming*, John Wiley & Sons, 1994.
- Andrzej Ruszczyński et Alexander Shapiro, *Stochastic Programming*, Elsevier, 2003.

Software

- Julia (<http://www.julialang.org>),

The evaluation modalities will be discussed in the class. The main elements are

- 4 homeworks (15% each) ;
- oral presentation of a scientific paper (40%)

Introduction to stochastic optimization, i.e.

- get familiar with the terminology, the possibilities and main limitations of stochastic programming models ;
- learn how to formulate analytical models incorporating uncertainty as stochastic programs ;
- learn the basic theory ;
- learn the main algorithms used to solved the associated problems.