Introduction to Stochastic optimization

Fabian Bastin
`fabian.bastin@cirrelt.ca`
Université de Montréal – CIRRELT – IVADO –Fin-ML

4 janvier 2020

Goals

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.

Organization

Prerequise

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

References

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 Ruszczynski et Alexander Shapiro, *Stochastic Programming*, Elsevier, 2003.

Software

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

Class material

- https://github.com/fbastin/SP_Introduction

Evaluation

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

- 2 homeworks (20% each) ;
- 1 project (30%)
- oral presentation of a scientific paper (30%)

Objectives

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.