UE reinforcement learning and optimal control

Level
Baccalaureate +5

ECTS
3 credits

Component
UFR PhITEM (physique, ingénierie, terre, environnement, mécanique)

Semester
Printemps

- **Teaching language(s):** English
- **Open to exchange students:** Yes
- **Code d'export Apogée:** PAXXMIAB

Presentation

Description

This course is supported by the "College Doctoral" of Grenoble University. It is given in English upon request at the beginning of the session.

Summary:

Data assimilation is often presented as the art of combining various sources of information (most often, measurements and numerical models) to estimate the state of a partially observed dynamical system. In geophysics, it is now a research topic per se. It is mainly used to:

- define as precisely as possible a physical state (atmosphere, ocean, ...) of a system to predict its temporal evolution;
- optimally estimate a system state over a period of time for example, to study its variabilities;
- identify systematic errors in models;
- optimize the design of observation networks;
- extrapolate values of non observed variables;
- estimate parameters in physical laws.

The course aims at introducing the theoretical concepts and practical implementation aspects of modern data assimilation with a peculiar focus on high dimensional, non linear systems, as usually met in geosciences.
Necessary background for the course:

- Basic notions in probability and statistics (Expectation, variance, covariance matrix)

- Basic notions in linear algebra
- Basic notions in differential calculus

Program:
Part 1: Data assimilation based on estimation theory

1. Introduction to ensemble data assimilation
2. Notions in estimation theory
3. The BLUE
4. The Kalman filter
5. Ensemble Kalman filters
6. Non linear filters

Part 2: Data assimilation based on control theory

1. Introduction to variational data assimilation
2. Variational data assimilation for time-independent problems
3. The adjoint method
4. Variational Data assimilation : Practical aspect
5. Adjoint coding

Course parts

UE Introduction to data assimilation - CM	Lectures (CM)	32h

Period : Semester 10

Useful info

Place

Grenoble

Campus

Grenoble - Scientific Polygon