

Labex INTERACTIFS (<https://labex-interactifs.pprime.fr/>)
I. Informations générales :

Employeur de l'intervenant <i>Employer</i>	☐ UP ☐ ENSMA ☒ CNRS
TITRE du cours en français <i>French title</i>	APPRENTISSAGE AUTOMATIQUE POUR LES PHYSICIENS
TITRE du cours en anglais <i>English title</i>	MACHINE LEARNING FOR PHYSICISTS
Adéquation avec les thèmes du Labex <i>Adequacy with Labex Research project topics</i>	☒ 1 - COUPLAGE ENTRE LES MATERIAUX ET DES CONDITIONS SPECIFIQUES D'ENVIRONNEMENT ☒ 2 - FONCTIONNALISATION DES SURFACES ☒ 3- FLUIDES ET PHENOMENES ELECTRIQUES AUX INTERFACES
Enseignant <i>Teacher</i>	Nom : CORDIER Prénom : Laurent Tel : 05 49 49 69 22 Email : Laurent.Cordier@univ-poitiers.fr

Nb d'heures de cours :	10	ENSMA
Tuesday, December 3rd	17:30 pm to 19:30 pm	A201
Wednesday, December 4th	17:30 pm to 19:30 pm	B138
Friday, December 6th	17:30 pm to 19:30 pm	B138
Tuesday, December 10th	17:30 pm to 19:30 pm	B138
Thursday, December 12nd	17:30 pm to 19:30 pm	B138

II. Description du cours proposé, objectifs et plan

Voir verso.

Machine Learning for Physicists

Course proposal – Labex INTERACTIFS

10 h

Lecturer: Laurent CORDIER (Laurent.Cordier@univ-poitiers.fr) - Directeur de Recherche CNRS – Directeur du GDR « Contrôle des Décollements » Pprime UPR 3346.

Language: This course may be given in English depending on the audience.

In recent years, Machine Learning methods have become increasingly important in many areas of Physics. This is mainly due to three reasons: an unprecedented abundance of data, considerable computational power associated with remote platforms (cloud computing), and freely available libraries written in Python. The objective of this introductory course on Machine Learning is to show that many problems at the heart of our disciplinary issues can be addressed by generic approaches. Machine learning is classically divided into three branches: supervised learning methods, unsupervised learning methods and reinforcement learning methods, see figure. We will illustrate each of these branches with emblematic techniques.

Table of contents

1/ Introduction.

2/ Preliminaries

- 2.1/ Gradient algorithms (Newton, stochastic gradient)
- 2.2/ Neural networks
- 2.3/ Backpropagation algorithm

3/ Supervised methods

- 3.1/ Regression:
 - Linear, polynomial, Ridge, LASSO, Elastic Net
- 3.2/ Classification:
 - Logistic regression, Bayesian inference

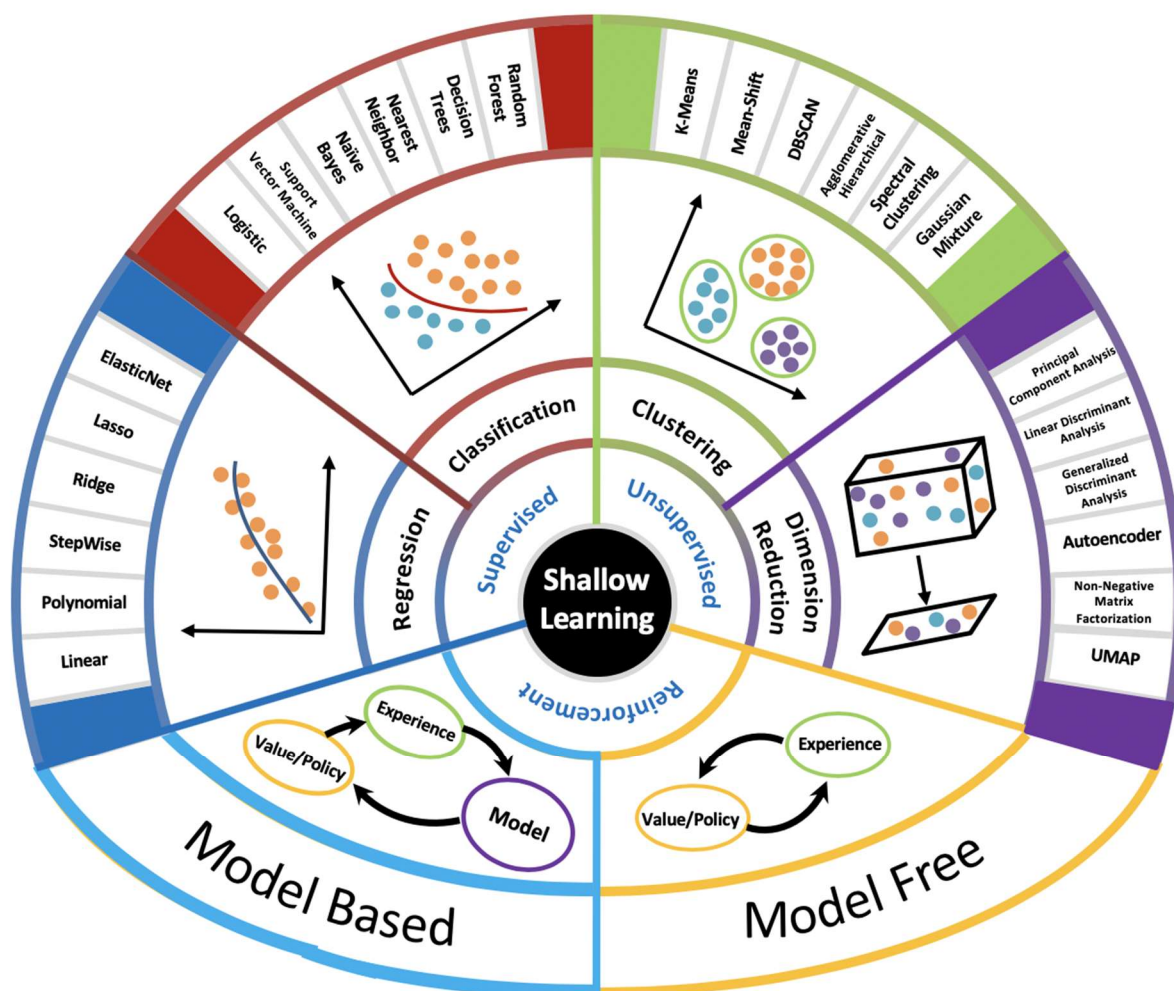
4/ Unsupervised methods

- 4.1/ Clustering:
 - K-means, spectral clustering
- 4.2/ Dimensionality reduction:
 - Principal Component Analysis, AutoEncoder, Multidimensional Scaling

5/ Reinforcement learning

- 5.1/ Principle
- 5.2/ Application to the control of the Lorenz system

We will illustrate the methods as much as possible with Jupyter notebooks or Python programs.



Classification of machine learning methods.