Advanced Course on Deep Learning and Geophysical Dynamics.

November-December 2021

Advanced Course on Deep Learning and Geophysical Dynamics.

First edition of the course in the framework of AI Chairs OceaniX, DL4CLIM, ANITI-DAML and AI4Child (Prof. R. Fablet, P. Gallinari, S. Gratton and F. Rousseau) and LEFE-MANU program.

General objectives:

- Theoretical aspects of deep learning and its application to geophysical dynamics, especially regarding the exploitation of physical priors.

- Practice-oriented training for the implementation of deep learning schemes for geophysical dynamics

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PROJET FINANCÉ PAR L'ANR - PROJECT FUNDED BY THE ANR - ANR

ISblue

IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

Practical information

All information available on discord server DLGD2021. Invitation link: https://discord.gg/KnjNFc2f

Remote participation through the following zoom link: https://imt-atlantique.zoom.us/j/98658614714?pwd=SGwrazVDWVNNeEc4dlZ3aFJpdW9UUT09

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On-site participation:

- PNBI, 2nd floor, conference room on Nov. 16, Nov. 23, Nov. 30 and Dec. 7
- IMT Atlantique, morning lecture (room B01-10), project session (room B01-14)

Organization of the course: Lectures

November 9. 9h30-12h30

Introduction to Deep Learning and Differentiable Physics

F. Rousseau

November 16. 9h30-12h30

Deep Learning and Optimisation

L. Drumetz

S. Gratton

November 23. 14h30-17h30

Deep Learning and Generative Models

P. Gallinari

November 30. 9h30-12h30

Deep Learning and Dynamical Systems

S. Ouala

December 7. 9h30-12h30

Deep Learning and Inverse Problems

R. Fablet

Organization of the course: Project Sessions

Nov. 9. 14h00-17h00

Introduction to Pytorch and Pytorch Lightning + Session #1

Q. Febvre

Nov. 16. 14h00-17h00 **Session #2**

Nov. 23. 9h30-17h30 **Session #3**

Nov. 30. 14h00-17h00 **Session #4**

Dec. 7. 14h00-17h00 **Session #5**

Theme #1: Interpolation

M. Beauchamp

Theme #2: Forecasting

S. Ouala

S. Benaïchouche

Theme #3: Data Assimilation

M. Beauchamp

Q. Febvre

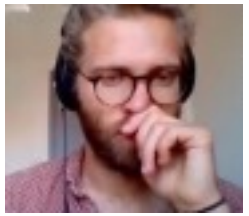
Theme #4: Neural closures

S. Ouala

Theme #5: Segmentation

A. Colin

Theme #6: GAN & trajectories



A. Roy

Organization of the course: Project Sessions
Proposed workplan

Sessions #1-2

- **Selection of the project theme for each group**
- **Discovery of the dataset**
- **Problem Statement:**
  - Which neural network ?
  - Which training / validation / test dataset ?
  - Which training criterion / scheme ?
  - Which performance metrics ?
  - Selection of three approaches / models for inter-comparison purposes

- **Deliverable:** 2-to-4-slide presentation (Nov. 17), to be posted on discord

Sessions #3-4

- **Implementation and evaluation of the considered approaches**

- **Tentative workplan:**
  - **First approach/baseline:** Nov. 23
  - **Refinement and other approaches:** Nov. 30

- **Deliverable:** updated presentation with baseline approach (Nov. 23)

Sessions #5

- **Synthesis**

- **Short presentation (~ 10',** (virtual) poster session**)**