Portfolio of my projects

Pierre Cavalier

My website

Presentation

I'm Pierre Cavalier, a french student in my second year of a master's degree in mathematics and AI at Paris Saclay University. Before that, I did a double degree in mathematics and physics and a year at Centrale Supelec engineering school. My favorite topics are deep learning, unsupervised learning and graphs. Apart from that I'm a great sports enthusiast, mainly bouldering and workout at the moment.

Contents (icons are clickable)

Intership projects

Noise reduction

During a four-month internship in Japan, I worked on reducing Brownian noise within the KAGRA gravitational wave detector. The goal was to use the Scinet AI model to reduce this noise without losing useful signal.

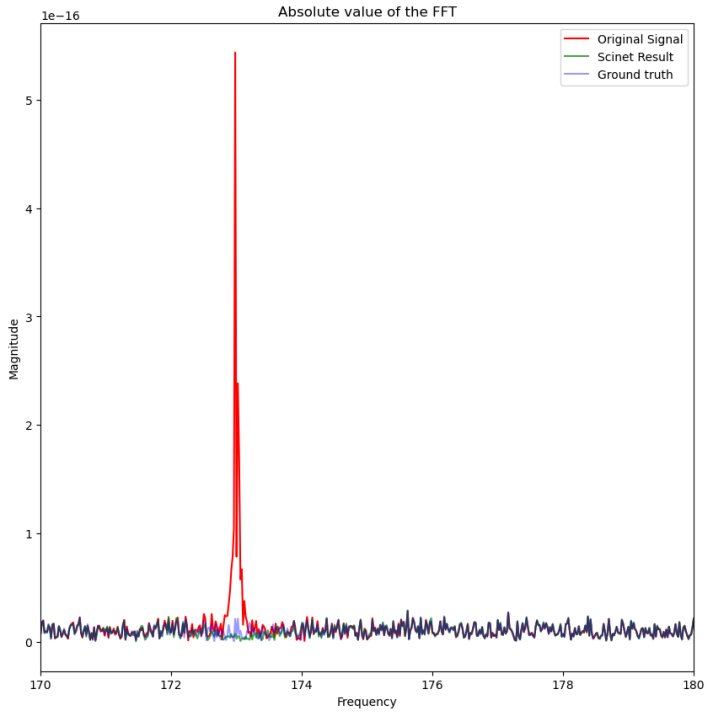
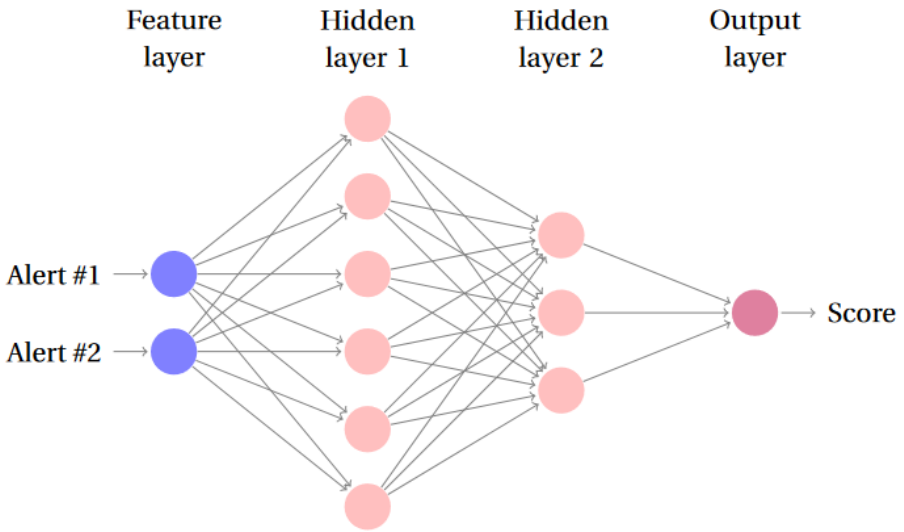


Figure 1: Example of noise reduction

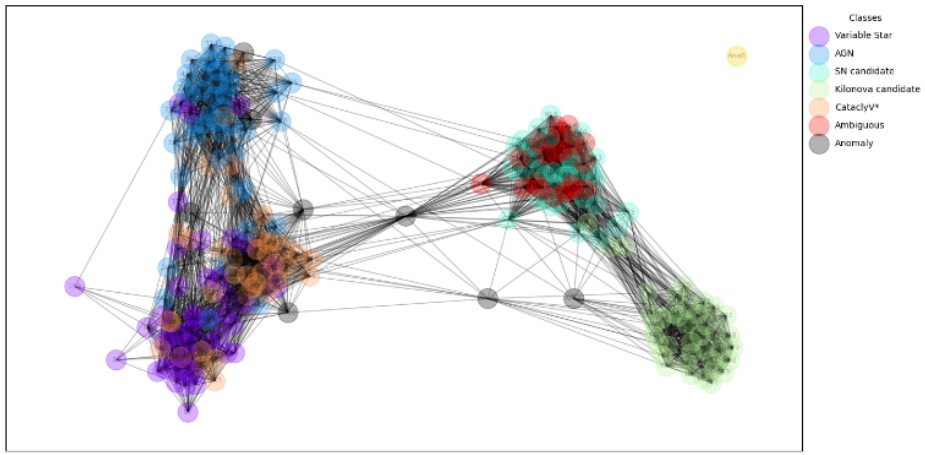
Noise reduction

Learning on Graph

During a 4-month placement at Fink in the CNRS (National Centre for Scientific Research), I was able to develop graphs on the various celestial bodies in order to detect anomalies and create a notion of similarity between these bodies.



(a) Neural Network used

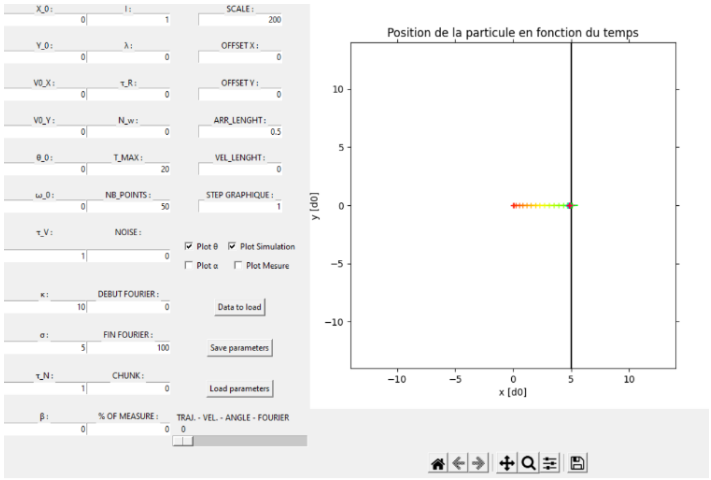


(b) Graph generated

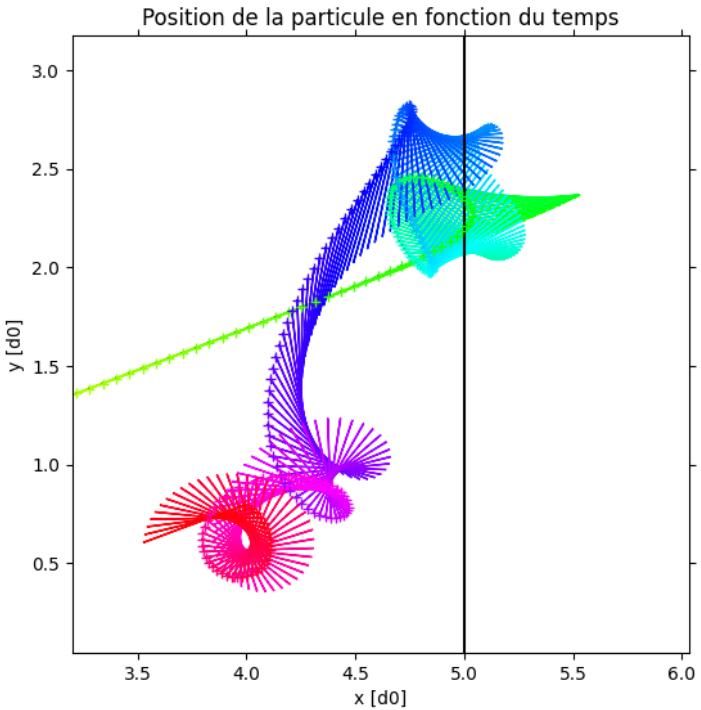
Initially, a study of the dataset was carried out using unsupervised learning, followed by the creation of supervised methods such as neural networks.

Swarm Robotics

2-month end-of-bachelor internship at ESPCI in the Gulliver. The aim was to study the oscillating behavior of kilobots against a wall by modelling and simulating their interaction.



(a) Graphic interface



(b) Kilobot spinning against the wall

The results were interesting and enabled us to model these kilobots more accurately.

Course Projects

Latent Topic Block Model

Study and implementation of LTBM based on the paper The latent topic block model for the co-clustering of textual interaction data by Laurent R. Bergé, Charles Bouveyron, Marco Corneli, Pierre Latouche (2019).

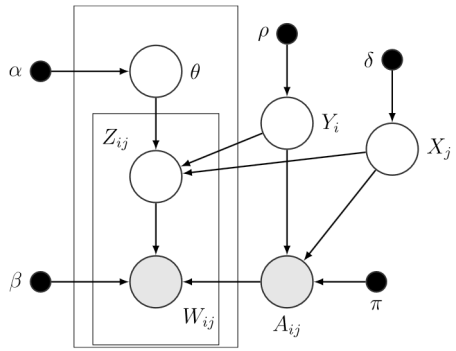
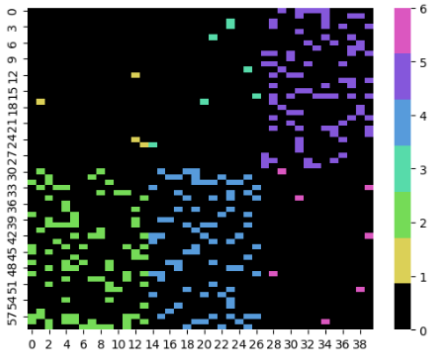


Fig. 1. Graphical representation of LTBM.

(a) Model used



(b) Coclustering of the 2x3 clusters

The aim of this project was to understand and reproduce some results, at a lower scale with our means. We were able to apply our knowledge acquired in the advanced unsupervised learning course.

Residual Network

Study and implementation of residual networks based on the paper Deep Residual Learning for Image Recognition by Kaiming He, Xiangyu Zhang, Shaoqing Ren, Jian Sun (2015).

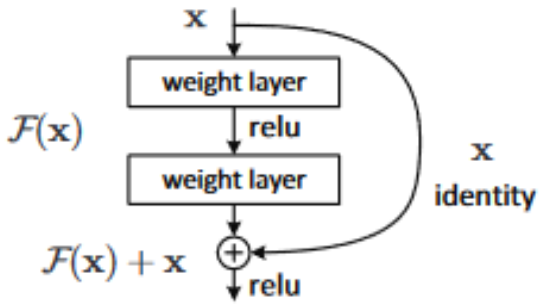
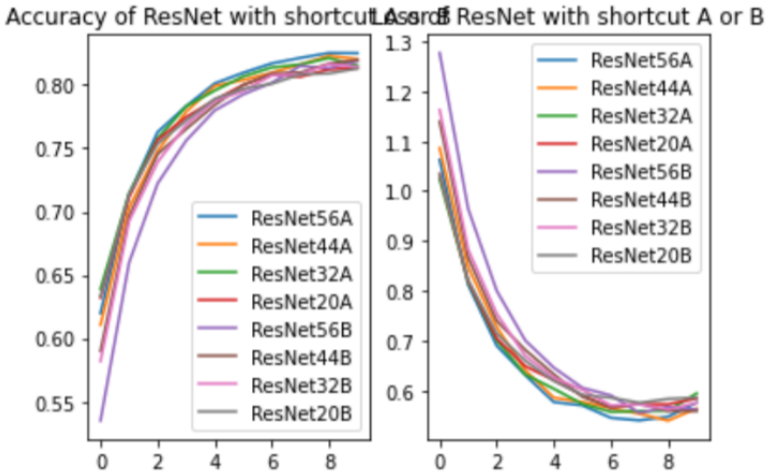


Figure 2. Residual learning: a building block.

(a) Model used



(b) Accuracy of the models trained

The aim of this project was to reproduce the results of the paper and understand the importance of residual networks, but with fewer resources.

Blob Project

In this group project, we modelled the behaviour of a blob by representing it as a network with certain nodes acting as food sources and sinks.

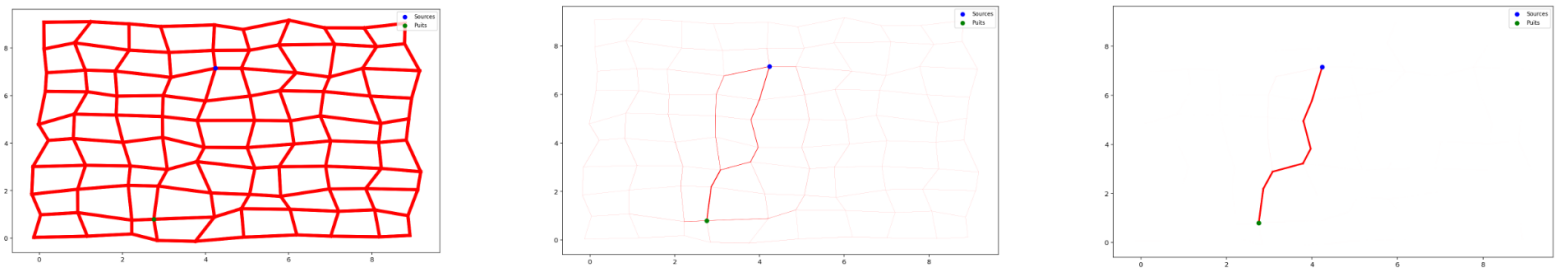
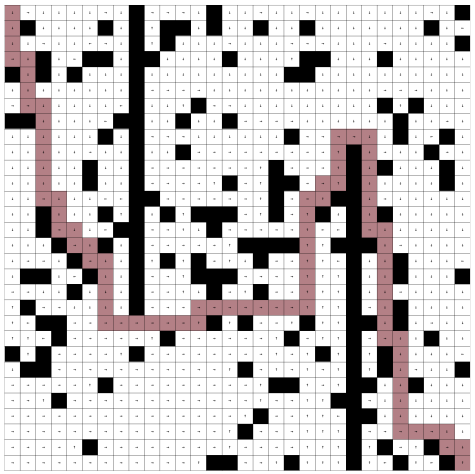


Figure 6: Evolution of a blob over time

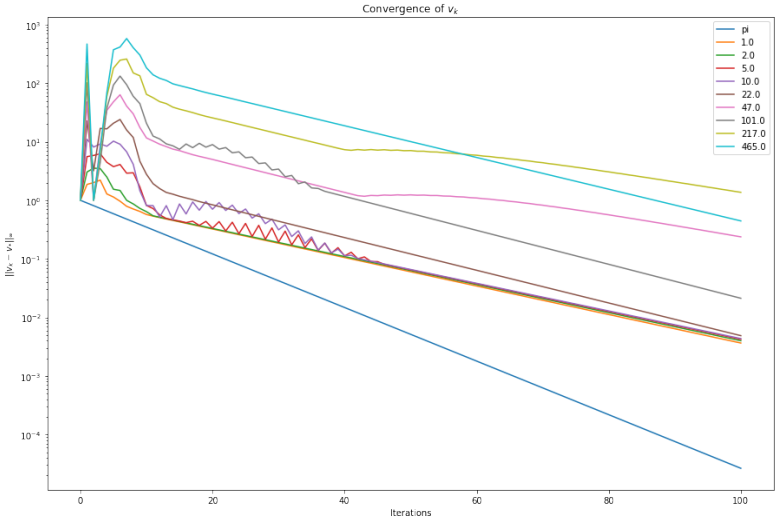
Working in groups of 5, we had to divide the tasks between us while building on each other's strengths. The mesh modelling the blob was a parameter we had to play with a lot and got us quite interesting result.

Reinforcement learning

The aim of this project was to evaluate the Ada-FP method in the context of reinforcement learning. The Markov-Decision Process chosen was that of a maze of size 30 by 30.



(a) Maze and its solution path



(b) Ada-FP evaluation

In addition to simply finding the solution, the goal was to find which algorithm converged the fastest and which learning rate was the most appropriate.

Data Challenge

The aim of this project was to implement and compare supervised learning methods for two types of problem, regression and classification.

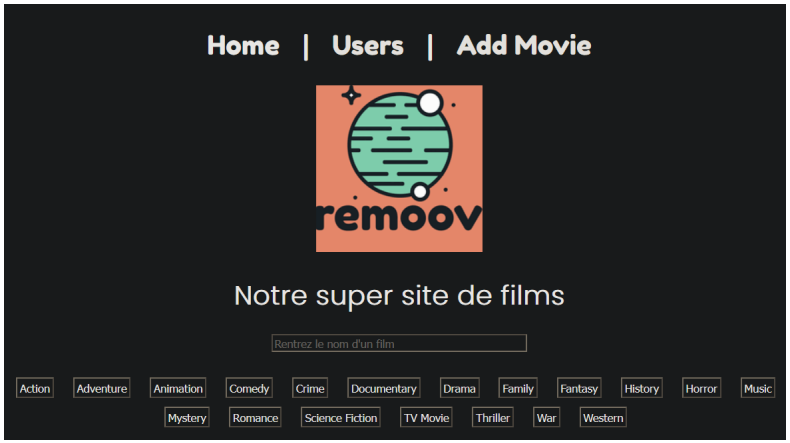
(a) Celestial bodies classification

(b) Wine score regression

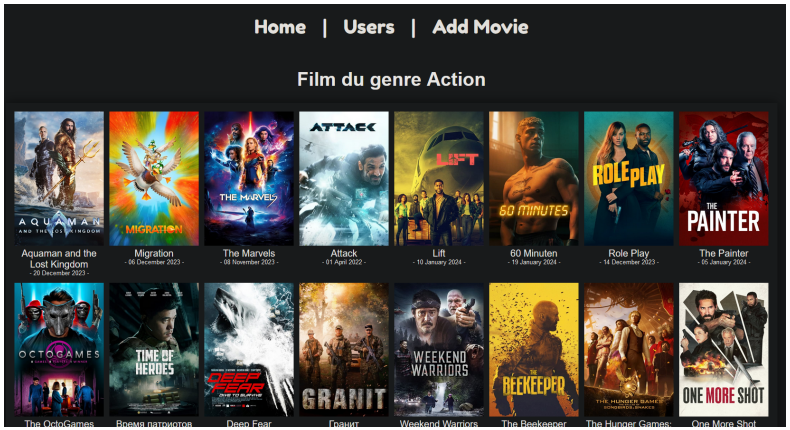
A major emphasis was placed on the study of data and variables. Methods such as linear regression, Principal Component Analysis (PCA), Random Forests (RF), Supported Vector Machine (SVM) and Gradient boosting were used.

Movie recommendation site

The aim of this project was to create a site that would allow users to have films recommended to them according to their tastes.



(a) Website



(b) Classification by type

To do this, we had to create a backend to save the films and create a recommendation algorithm. For the frontend, we created a site with Vue.js where users can rate their favorite or less liked films.

Personal Projects

Discord bot

Lelexou is a discord bot inspired from one of our friend and mimic behavior of some users from our group while staying respectful. This project enabled me to learn how to use APIs, in particular OpenAI and discord, as well as SQLite.

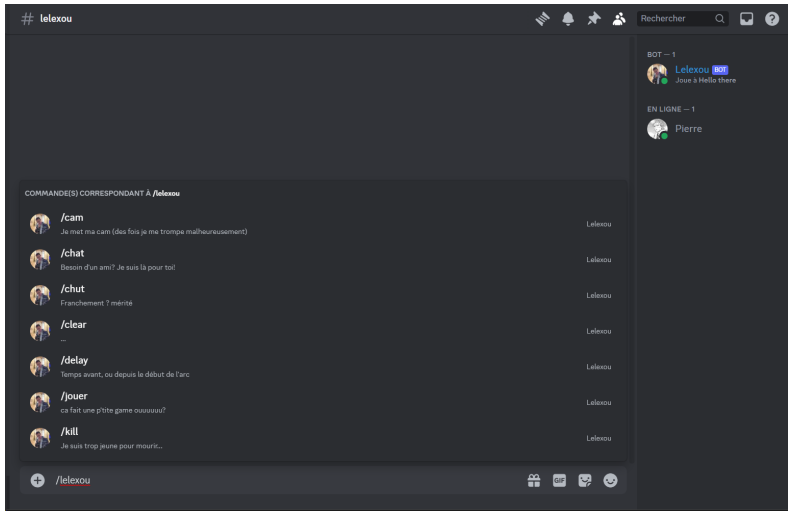


Figure 10: List of commands available

Taking feedback into account is (as it's still going on) an enriching part of the project, as opening up a discussion on user expectations is an area rarely seen in an academic setting.