Saint Joseph University — Academic Year 2021-2022

Faculty of Engineering - ESIB

Doctoral Studies Department

Master in Artificial Intelligence - Semester 2

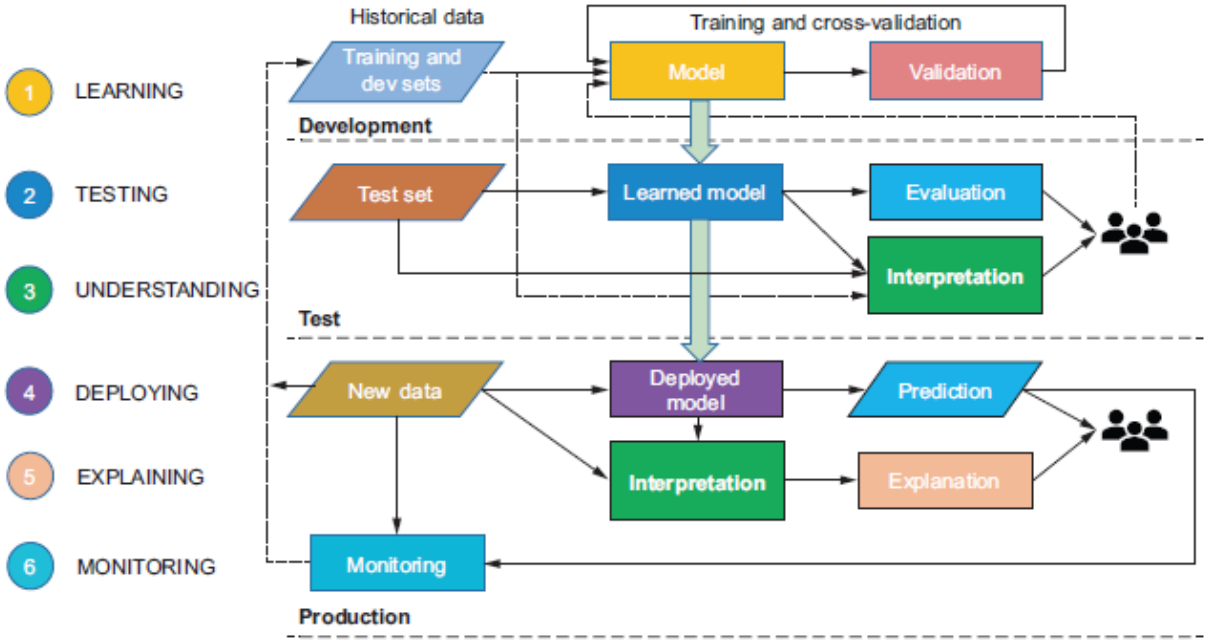
Parallel Computing

Project – Duration: 4 weeks

While there are several open source frameworks for GPU-based AI algorithms currently available to the general public - for example, Google's TensorFlow and Keras, Microsoft's CNTK, Facebook's Caffe2, and PyTorch - it is very instructive to go through an implementation of one from scratch, which will give us a greater insight of the underlying technologies required for AI algorithms.

Next, you will use your accumulated knowledge of GPU programming to implement a AI algorithm (machine learning or deep neural network algorithm) with **PyCUDA**. AI algorithms was one of the first applications (outside of rendering graphics) that were able to show the true power of GPUs by leveraging their massive parallel throughput, which ultimately helped NVIDIA rise to become a major player in the field of artificial intelligence.

The process of building a robust AI system is the following:



You will work in groups of 2 students. You found below the list of algorithms to develop:

1. Linear regression
2. Logistic regression
3. Decision tree
4. SVM algorithm
5. Naive Bayes algorithm
6. KNN algorithm
7. K-means
8. Random forest algorithm
9. Dimensionality reduction algorithms
10. Convolutional Neural Networks (CNNs)
11. Long Short Term Memory Networks (LSTMs)
12. Recurrent Neural Networks (RNNs)
13. Generative Adversarial Networks (GANs)
14. Radial Basis Function Networks (RBFNs)
15. Multilayer Perceptronss (MLPs)

An algorithm must be chosen by only one group. The steps are the following:

- Write the sequential version of the algorithm from scratch (using only Math and Numpy modules).
- Define the sequential part and the parallel part of the algorithm.
- Use pycuda to develop a parallel version of the algorithm
- Train and test your model on a small dataset (example: the well-known Iris dataset).

Delivrable:

At the end of the project each group must prepare and submit:

- A detailed report
- A Powerpoint presentation for 10 minutes
- A technical demonstration for 10 minutes
- The code