

Dr Francois Rivest, undergraduate projects list:

Brand New Time-adaptive Deep Neural Networks (up to 3 students, 1 or 2 semesters):

Deep neural networks have made tremendous progress over the past few years. Yet, learning on-line from long sequence of data is still very hard, requiring large amount of data, thousands of training epochs, and with relatively low success on long-term dependencies (such as the game of Montezuma). In contrast, animals can learn timing within few trials, independently of the time-scale. In this project, you will implement, train, and test, novel machine learning algorithms based on the time-adaptive drift-diffusion model of animals' learning algorithm. Some brand new deep learning networks!

Satellite Scheduling using Deep Learning (pointer network) (1 student, 1 or 2 semesters):

Deep learning has made tremendous progress in numerous fields over the past few years. In this project, you will train and evaluate pointer networks on NP satellite-scheduling problems.

Model of Animal Learning (1 student, 1 or 2 semesters):

Unlike artificial intelligence, animals are learning stimulus-reward association "and timing" within only few trials. The time-adaptive drift-diffusion model (TDDM) is an algorithm able to reproduce this basic ability. Yet, some very interesting behaviours occur when different stimuli are associated to different durations. If a long and a short stimuli are presented together, the animal tend to react after the averaged duration. But when the two stimuli appear one after the other, then the animal switch its attention to the second stimuli. This project consists in expanding the TDDM model to account for this experimental data set.

Educational Data Structure Simulator (1 student, 1 or 2 semesters):

This project consist in writing a data structure simulator (e.g. Binary Search Trees) in Unity and to turn it into an educational application. A Unity game can easily include a tutorial, a simulator for the students to experiments with the data structure, and automatically marked questions or activities that the student has to complete. The project must include all those three parts, but the topic itself (e.g. Binary Search Trees) could be different.

I am also open to supervise other machine learning projects.