Online Financial Optimization with Predictions

**Areas of interest:** Theoretical computer science, operations research, artificial intelligence.

**Place:** Laboratoire d’Informatique de Paris 6 (LIP6), Sorbonne Université, Paris.

**Team:** Recherche Opérationnelle.

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**Director of host laboratory:** Fabrice Kordon (Fabrice.Kordon@lip6.fr).

**General presentation of the topic**

This internship focuses on problems related to *online* financial optimization. In online algorithms, the input is not entirely known to the algorithm; instead it is revealed in “pieces”, in the form of a request sequence. Online computation is a prolific field of theoretical computer science, which also has had significant impact on many other areas such as AI, Operations Research, and Machine Learning (see e.g. the book [2]).

Many settings motivated by financial transactions can be formulated as online problems, and such studies have been ongoing since the last 20 years. Examples include problems such as the *time series search problem*, where one would like to sell an indivisible asset at as high price as possible, *one-way trading*, in which one would like to exchange an amount in, say EUR, to USD over a window of time (without knowing the exchange rates in advance), and the more general *portfolio management* problem, in which the exchange involves a portfolio of currencies. All such problems have been studied from the point of view of competitive analysis of online algorithms (see the corresponding chapter in [2] and the survey [5]).

The above studies assume that very little information, if any at all, is known about the market prices. Recently, a new framework for analysis has emerged, in which the algorithm has access to some machine-learned *prediction* concerning the input. For example, the seller may have a prediction concerning the future market prices. See the survey [4] for more details on this recent framework of *learning-augmented* online algorithms. A first study of some financial optimization problems has very recently appeared in [6][1].

**Objectives** The purpose of this internship is to continue the study of online financial optimization with predictions, by working first on extensions of the time-search problem, such as [3] (specific problems to be discussed with the interested student). The evaluation
of the algorithms will be predominantly theoretical/analytical, but there is also ample room for experimental validation, depending on the skills and interests of the applicant. The supervisor is supported by a CNRS Emergence project on this specific topic, and the intern will have the opportunity to interact with other members of this project.

Qualifications

- A solid background and general interest in theoretical analysis of algorithms are essential.
- Experience in coding and experimental evaluation will be considered a plus.
- Willingness to do research in a very active area.

References


