Lagrangian Duality in Online Algorithms

Advisor: Christoph Dür and Nguyen Kim Thang
Email: Christoph.Durr@lip6.fr, thang@ibisc.fr
Location: University Paris 6 and University Evry Val d’Essonne

Online algorithms is a domain studying problems with uncertainty about future. In general, requests arrive overtime and one needs to make irrevocable decisions without any information about the future. The problems appears in many practical settings, for example in decision making, stock investment, network routing, etc. Hence, it is important to design algorithms/strategies with performance guarantee in uncertain environment.

The most successful technique until now in online algorithms is the potential argument. However, the technique has its limit (it does not give much insight about the problems, etc.) Currently, there is a trend looking for a principled approach to design and analyze online algorithms. A direction [2, 3, 1] is to exploit the power of mathematical programming and use the Lagrangian duality. The method is powerful and flexible as it is based on natural relaxations (even non-convex ones) and it successfully gives theoretical evidence for practical algorithms.

Our project is to develop this technique and the internship is a part of the project. The goal is to study concrete online optimization problems (online network routing/online scheduling/matching/paging etc) using the approach. Besides, we will make connections to other domains such as algorithmic game theory and machine learning through the mathematical programming as a traversal tool. Ideally, a research publication could be derived at the end of the internship.


References

