Ph.D. in Information Technology:

Pirotta Final Dissertations

DEIB Seminar Room

January 18th, 2016

11.30 am

Ph.D. presentation and discussion:

Matteo PIROTTA – XXVIII Cycle

"Reinforcement Learning: from Theory to Algorithms"

Supervisor: Prof. **Luca Bascetta**

Abstract:

This thesis is mainly based on the idea that the design of an algorithm must be supported by theoretical results. Instead of starting from an algorithm and analyzing its properties and guarantees, we have derived theoretical results and we have investigated their applicability to design practical algorithms. All the analysis will be performed in the reinforcement learning framework, i.e., a mathematical framework for learning by interaction.

My main line of research focuses on three fields: safe, multi-objective and inverse reinforcement learning. Safe reinforcement learning aims to provide algorithms with strong theoretical guarantees, both in terms of performances and time complexity. We suggest algorithms that, by exploiting a lower bound to the expected performance gain, are able to guarantee a monotonic performance improvement overtime. However, to face many real applications reinforcement learning must be able to handle problems with multiple objectives. We presented three new algorithms that exploit gradient methods to construct a (continuous or discrete) approximation of the Pareto frontier. On the top of that, we have shown that the multi-objective framework is a natural way to explain the problem of inverse reinforcement learning with linear reward parametrization. The goal of inverse reinforcement learning is to recover the motivations that make an agent to behave optimally. We will exploit the connection between multi-objective and inverse learning to derive algorithms with strong error guarantees that differ for the amount of information required. Moreover, we have presented an algorithm that removes the assumption of linear parametrization.