Machine learning approaches to distributed coordinated communication networks

It is generally admitted that future dense communication networks will highly benefit from various forms of cooperation established between communication nodes. Cooperation can take place over various domains such as power control, beam design, time-frequency resource assignment etc., but generally requires some form of signalling between the cooperating devices or at least the sharing of some common information which reflects partially on the state of the channel. Classical solutions to this coordination problems reside in the realm of team decision (TD) methods that have been utilized in numerous applications such as economics, industrial control, and robotics. However, their application to communications problem is novel and initially motivated by the context of distributed base station cooperation in the presence of limited feedback. In this PhD work, we will open a different avenue altogether based on machine learning, and specifically the use of deep neural networks (DNN), in order to provide new, flexible and efficient tools to solve decentralized coordination. Preliminary work using DNN in this area has revealed some promising results but needs considerable further understanding. First, the optimization of DNN architecture is completely open. Second, we need more understanding on WHY the ML can solve our problem and under what conditions. Finally, we need to investigate scalability issues when the number of agents tends to grow large (hundreds).