Improving consensus algorithms with predictive mechanisms

Dr. Guy-Bart Stan (Cambridge University) 28/11/2008.

Considering some predictive mechanisms, we show that ultrafast average-consensus can be achieved in networks of interconnected agents with simple integrator dynamics. More specifically, by predicting the dynamics of the network several steps ahead and using this information in the design of the consensus protocol of each agent, drastic improvements can be achieved in terms of the convergence speed towards consensus, without changing the topology of the network. Furthermore, using these predictive mechanisms, the allowable discrete-time interval between two consecutive communication instants can be expanded compared with the classical consensus protocol. This study provides a mathematical basis for the roles of some predictive mechanisms in widely-spread biological swarms, flocks, and consensus networks. From the engineering application point of view, inclusion of an efficient predictive mechanism allows for a significant increase in the convergence speed towards consensus and also for a reduction of the communication cost required to achieve a predefined consensus performance.