Design Data-Driven Cooperative Control Framework

The development of the unmanned system inspired the demand for multiple agents to cooperatively finish large-scale or complex tasks. Compared with centralized design framework that collects global information then design corresponding stabilizing control law, it can be more flexible and robust for multiple agents to communicate and cooperate with neighbours to locally design the control input. For example, consider a planar transportation task where multiple robots are applied to carry a heavy object, it may be time-consuming to send all the information to centralized processor and return the local control law for each robot. Hence, many decentralized and distributed controller design frameworks are extensively studied in the literature to solve the cooperative control problem in an efficient way.

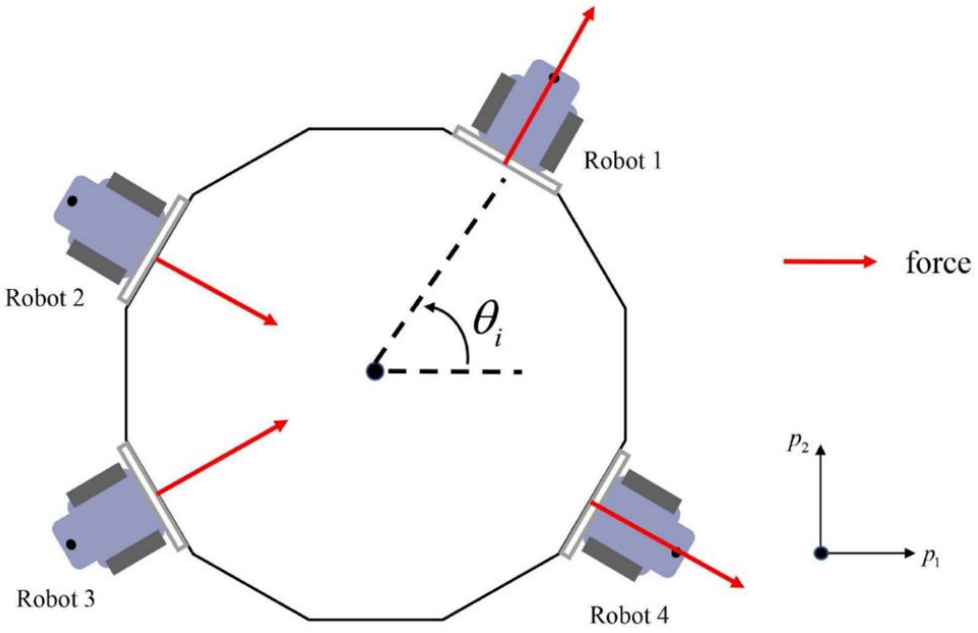
While for practical applications, each agent may not explicitly know the expression of the input matrix, i.e., each agent have no idea of the impact of its own control input on the target system, which makes the model-based design procedure not applicable. What's worse, it is also impossible for the agent to identify the model or design control law only with local input and system state data due to the coupling effect of multiple inputs.

In this work, our main concern is how to design a feasible information sharing mechanism, together with direct or indirect data-driven method,

allowing each agent to communicate with neighbours and locally obtain the globally stabilizing control law.

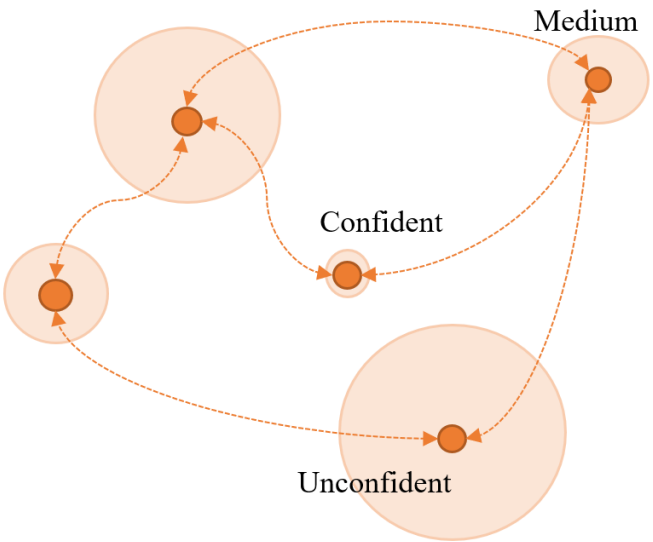
$$x_{k+1} = Ax_k + \sum_{i=1}^{N} B_i u_{i,k}$$

$$B_i = f(x_{1:k}, u_{i,1:k}, \mathcal{I}_{\mathcal{N}_i}) \ ?$$



Model the Information Fusion in Social Network

In this work, we want to study the opinion evolution of social network from the perspective of distributed filtering. Note that everyone in the social network exchanges the information and updates the opinions in a distributed way, which is similar to that each sensor node in distributed sensor network fuse locally obtained information to estimate the state of the whole target system. Both of these two scenarios reflect the essence of reconstructing the global perception with limited local information. Different from most of the fusion mechanisms studied in the field of social network, the distributed filtering framework uses the error covariance to design the fusion weights. As we know, the error covariance represents confidence of the corresponding estimation. Hence, our main concern is that if it is possible to model the information fusion in the opinion evolution of social network with considering the effect of confidence on the evolution dynamics.



Opinion Evolution with Confidence