

Zahra Marvi and Bahare Kiumarsi, 2021, Robust satisficing cooperative control barrier functions for multirobots systems using information-gap theory, *International Journal of Robust and Nonlinear Control*, December 2021, DOI: 10.1002/rnc.5914.

Abstract This paper integrates control barrier functions (CBFs) and information-gap theory to present robust safe controllers for collision avoidance problem in multi-agent systems with different levels of measurement accuracy. It is assumed that agents have uncertain and inaccurate measurements about the relative distance to neighboring agents. A cooperative framework for the construction of CBFs for each two agents is employed to avoid collision and ensure the safety of the overall system. To maximize the horizon of uncertainty under which the safety of the overall system is satisfied, the information-gap theory is leveraged to determine the contribution and share of each agent in the construction of CBFs. This results in the highest possible robustness against measurement uncertainty. It is shown that the overall system can tolerate higher measurement uncertainty and safely operate if the agent that is more confident about its measurement contributes more to the construction of the CBF. By employing the proposed approach in constructing CBF, the possible failure of one agent in gathering accurate local data can be compensated by cooperation between agents. The effectiveness of the proposed method is demonstrated via performing simulations for multirobot systems.

Keywords barrier certificate function; barrier function; control barrier function; Information Gap; linear quadratic regulation; model predictive control.