Multi-Agent Control based on Signal Processing over Networks

Project Leader

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1. Objective

This project is aimed at:

developing a theoretical framework for the control of *multi-agent systems*, in which agents cooperatively execute a given task by means of a distributed algorithm, based on the notion of *graph signal processing* (GSP) [1]. GSP, a technique for handling signals over networks, has been a hot topic in the signal processing community. The fusion of control and signal processing over networks by introducing the notion of GSP provides the community of multi-agent control with new insights and techniques [2,3].

2. Project Outline

To that end, the project will consist of the following phases:

(a) focusing on specific techniques in GSP and finding connections to multi-agent control;

(b) developing theories and applications of multi-agent control based on those connections; and

(c) verifying the obtained results by means of simulations and experiments.

3. Expected Performance

In this project, the successful candidate would be expected to:

(a) provide ideas towards the solution of each problem in the project and implement those ideas actively;

(b) develop control theories of multi-agent systems (i.e., networked dynamical systems) using *mathematical* techniques, and discuss the obtained results from a mathematical perspective; and

(c) actively present the contributions of the above in journal papers.

4. Required Skills and Knowledge

The successful candidate for this project will have the following knowledge and skills:

(a) basic knowledge of control theory (in particular, of multi-agent systems) and signal processing; and

(b) MATLAB programming skills.

References

[1] A. Sandryhaila and J. M. F. Moura: Discrete Signal Processing on Graphs: Frequency Analysis, *IEEE Transactions on Signal Processing*, Vol. 62, No. 12, pp. 3042–3054 (2014)

[2] S. Izumi et al.: Analysis and Design of Multi-Agent Systems in Spatial Frequency Domain: Application to Distributed Spatial Filtering in Sensor Networks, *IEEE Access*, Vol. 8, pp. 34909–34918 (2020)

[3] S. Izumi et al.: Distributed Spatial Filtering over Networked Systems, *IEEE Control Systems Letters*, Vol. 5, No. 2, pp. 617–622 (2021)

See the project leader's webpage:

http://www.sceng.kochi-tech.ac.jp/izumi/index_e.html

See KUT's admission guidelines:

https://www.kochi-tech.ac.jp/english/admission/ssp_aft19oct/ssp_application_guideline.html

Contact

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