

Informal Review of Multi-Agent Reinforcement Learning Literature

Sean Carver @ Data Machines Corporation

May 6, 2021

1 May 6, 2021

1.1 Positioning COMMS and JAMMERS to Defeat Each Other

Quite by accident, I discovered a body of literature that I deem very relevant to my COMMS and JAMMERS problem.

This work has an intersection with Multi-Agent Systems in that all the drones are autonomous systems moving to achieve some goal under partial information. It seems that the authors I have read so far do not specifically use reinforcement learning in their solution but their solution begs to be extended to an RL framework. (That said, see [1] for a non-adversarial MARL-example.)

Also, as far as I know, so far, no one [I am not certain of this, yet], specifically talks about the problem I am interested in with COMMS and JAMMERS—at least not in the way I have framed it—but the relevance should be clear.

The problem they discuss is how to control a sensor network (in my case, move the UAVs) in order to bring in the most information from the sensors. They use information-theoretic criteria as their objective functions. Beyond information theoretic criteria there are other objectives that do similar things.

I'll list 2 scantily cited papers [2, 3]. One more cited but less recent paper is [4]. There are certainly more papers available on Google Scholar, but I haven't yet dug into the literature yet. The first paper (2007) was found in [5], a bound collection of papers and not available otherwise. The second is a more recent IEEE paper (2018) that is not available for free, and I have only seen the abstract—but looks even more relevant. There are dozens more, but I would have to read more than the titles to determine relevance, which I will do, of course, in time.

The choice facing me now is to go after *depth* to solve the COMMS/JAMMERS problem or *breadth* with to understand the full scope of the MARL field—or some combination. Actually, maybe it is two separate projects, so I will await direction from stakeholders.

References

- [1] Enrico Testi, Elia Favarelli, and Andrea Giorgetti. Reinforcement learning for connected autonomous vehicle localization via UAVs. In *2020 IEEE International Workshop on Metrology for Agriculture and Forestry (MetroA-griFor)*, pages 13–17. IEEE, 2020.
- [2] David Nicholson, Sarvapali D Ramchurn, and Alex Rogers. Information-based control of decentralised sensor networks. In *Defense Industry Applications of Autonomous Agents and Multi-Agent Systems*, pages 15–32. Springer, 2007.
- [3] Anna Guerra, Nicola Sparnacci, Davide Dardari, and Petar M Djurić. Collaborative target-localization and information-based control in networks of UAVs. In *2018 IEEE 19th International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, pages 1–5. IEEE, 2018.
- [4] Ben Grocholsky, Alexei Makarenko, Tobias Kaupp, and Hugh F Durrant-Whyte. Scalable control of decentralised sensor platforms. In *Information Processing in Sensor Networks*, pages 96–112. Springer, 2003.
- [5] Michal Pechoucek, Simon G Thompson, and Holger Voos. *Defense Industry Applications of Autonomous Agents and Multi-Agent Systems*. Springer, 2008.