Attention-based efficiently coordinated motion planning

MSc. Project Proposal at the Autonomous Multi-Robots Lab, Cognitive Robotics, TU Delft

Brief description: Multi-agent robotic systems are increasingly being deployed in dynamic and uncertain environments to perform tasks such as three-dimensional exploration, structural inspection and urban surveillance. Hence, safe navigation and efficient coordination are crucial when navigating through cluttered dynamic environments. In collision avoidance tasks, [1] uses distributed optimal control and communication to safely guide each drone to its goal. However, this approach requires each drone to broadcast their path intentions to the rest of the team regardless of whether this information is needed or they represent a collision risk. This is not efficient in terms of bandwidth usage. Other methods using Reinforcement Learning, deal with coordination as a sequential learning task to encode other agents' state and coordinate their actions [2]. Following the recent success of attention models [3] in sequential learning tasks, this projects aims to employ these to develop a new algorithm to efficiently coordinate a multi-robot team in motion planning tasks.

Desired qualities:

- Motivated and independent
- Good problem solving skills
- Experience/interest in reinforcement learning, optimization algorithms and/or autonomous navigation
- Experience in C++ programming, Python and Robot Operating System (ROS)

For further questions or to apply, please contact A. Serra-Gomez <a.serragomez@tudelft.nl>, B. Brito <bruno.debrito@tudelft.nl> or Ass. Prof. Dr. J. Alonso-Mora <j.alonsomora@tudelft.nl>. When applying, please provide a short motivation, up to date CV, a transcript of your current degree program and intended start date.

Group information: http://www.autonomousrobots.nl/

References:

[1] H. Zhu and J. Alonso-Mora. "Chance-Constrained Collision Avoidance for MAVs in Dynamic Environments." in 2019 *IEEE Robotics and Automation Letters* (RA-L). IEEE, 2019, pp.775-783

[2] M. Everett, Y. F. Chen and J.P. How. "Collision Avoidance in Pedestrian-Rich Environments with Deep Reinforcement Learning." arXiv preprint arXiv:1910.11689 (2019).

[3] A. Vaswani, N. Shazeer, N. Parmar, J. Uszkoreit, Ll. Jones, A. Gomez, L. Kaiser, I. Polosukhin. "Attention is all you need." in 2017 in *Advances in Neural Information Processing Systems*, pp. 6000-6010.