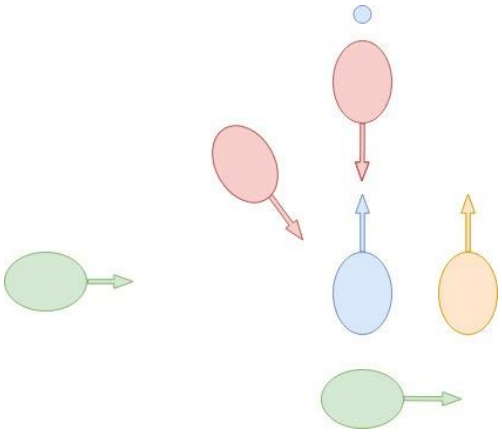
Learning efficient communication policies for predictable multi-robot motion planning.

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. [2] addresses this issue by using Multi-agent Reinforcement Learning (MARL) to make each drone learn to decide which of the other drones' path intentions are useful to reach safe navigation. However, this method does not account for the predictability issues that arise from updating (communicated) trajectory plans at every timestep. The aim of this project is to employ recent advances on Multi-Agent Hierarchical Reinforcement Learning [3] to improve behavior predictability in multi-agent systems, thus lowering the number communications and updates of trajectory plans in motion planning tasks.



Desired qualities:

- Motivated and independent.
- Good problem solving skills.
- Experience/interest in reinforcement learning, optimization algorithms and/or motion planning.
- 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> 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] Serra-Gómez, Á., Brito, B., Zhu, H., Chung, J., & Alonso-Mora, J. (2020). With Whom to Communicate: Learning Efficient Communication for Multi-Robot Collision Avoidance. *ArXiv*, *abs/2009.12106*.

[3] Han, Dongge & Böhmer, Wendelin & Wooldridge, Michael & Rogers, Alex. (2019). Multi-agent Hierarchical Reinforcement Learning with Dynamic Termination.