SC42050 Literature Assignment

Learning Social Behaviour

Bruno Ferreira de Brito

A mobile robot which navigates in an urban environment has to deal with pedestrians, cyclists, other human-driven vehicles and, in a near future, with other robots. It can be found in the literature several multi-robot coordination algorithms which can successfully coordinate a group of robots, allowing each of them to move to their goal without any collision. However, dealing with humans adds another level of complexity. A robot must reason about the future paths the humans are like to take, otherwise, they can get "frozen" (Trautman et al., 2013). In order to safely navigate, a model of how humans interact, navigate and follow some social rules should be incorporated into the navigation function. After reading (Kretzschmar et al., 2016) answer the following questions:

1. The title of the proposed article is "Socially Compliant Mobile Robot Navigation via Inverse Reinforcement Learning (IRL)". However, IRL is only referred to the related works. Is the method proposed by the IRL class? What is IRL?
2. What is the meaning of the principle of maximum entropy?
3. The author discusses the use of Markov Chain Monte Carlo versus Hybrid Monte Carlo Algorithm with Metropolis Hastings algorithm. Explain those methods. What are the differences and why the author decided to implement the second one?
4. Explain the concept of homotopic trajectories. Why does the author use this concept?
5. What is the advantage of learning a distribution model with respect to learning from demonstrations?
6. List and explain the drawbacks of the approach. Can you name more drawbacks then those mentioned in the conclusion of the paper?
7. What could be another possible approach to deal with some of the previous drawbacks?

References

Kretzschmar, H., Spies, M., Sprunk, C., and Burgard, W. (2016). Socially compliant mobile robot navigation via inverse reinforcement learning. *The International Journal of Robotics Research*, 35(11):1289–1307.

Trautman, P., Ma, J., Murray, R. M., and Krause, A. (2013). Robot navigation in dense human crowds: the case for cooperation. In *IEEE International Conference on Robotics and Automation*, pages 2153–2160.