


Autonomous Vehicles: From Individual Navigation to Challenges of Distributed Swarms

Sándor P. Fekete

Department of Computer Science, TU Braunschweig, 38106 Braunschweig, Germany

s.fekete@tu-bs.de

 <https://orcid.org/0000-0002-9062-4241>

Abstract

Recent years have seen impressive advancements in the development of robots on four wheels: autonomous cars. While much of this progress is owed to a combination of breakthroughs in artificial intelligence and improved sensors, dealing with complex, non-ideal scenarios, where errors or failures can turn out to be catastrophic is still largely unsolved; this will require combining “fast”, heuristic approaches of machine learning with “slow”, more deliberate methods of discrete algorithms and mathematical optimization. However, many of the real challenges go beyond performance guarantees for individual vehicles and aim at the behavior of swarms: How can we control the complex interaction of a distributed swarm of vehicles, such that the overall behavior can measure up to and go beyond the capabilities of humans? Even though many of our engineering colleagues do not fully realize this yet, there is no doubt that this will have to be based to no small part on expertise in distributed algorithms.

I will present a multi-level overview of results and challenges, ranging from information exchanges of small groups all the way to game-theoretic mechanisms for large-scale control. Application scenarios do not just arise from road traffic (where short response times, large numbers of vehicles and individual interests give rise to many difficulties), but also from swarms of autonomous space vehicles (where huge distances, times and energies make distributed methods indispensable).

2012 ACM Subject Classification Theory of computation → Distributed algorithms, Theory of computation → Algorithmic game theory and mechanism design

Keywords and phrases Autonomous vehicles, interaction, robot swarms, game theory

Digital Object Identifier 10.4230/LIPIcs.DISC.2018.1

Category Invited Talk



© Sándor P. Fekete;

licensed under Creative Commons License CC-BY

32nd International Symposium on Distributed Computing (DISC 2018).

Editors: Ulrich Schmid and Josef Widder; Article No. 1; pp. 1:1–1:1

Leibniz International Proceedings in Informatics



LIPICs Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany