Learning robots to rescue

The RoboCup Rescue as training ground

Visser, A.

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Arnoud Visser

Challenge
- After a disaster a team of robots must explore the devastated city. Ambulances have to find as many victims as possible, dig them out and bring them to a hospital. Fire fighters have extinguished fires before the situation goes out of hand. Police can help to patrol and explore, but can also clear the road for the other agents.

Result for different coordination approaches on Rescue Simulation maps. Courtesy Trăichioiu

Learning Coordination Policies
The coordination problem is described as a dec-POMDP, which is interpreted as a series of Bayesian games. In this Bayesian game each robot has some private information (not communicated with the team). This private information is clustered into a type of observation histories. This Bayesian game is used to find a joint policy designed to maximize the average result achieved on all joint action-observation histories.

Results
To apply Bayesian games to realistic RoboCup Rescue scenario's, the decision making is decomposed into a high-level Bayesian game and low-level MDP:

Conclusion
Bayesian Game approximations make it possible to bridge the gap to coordination problems encountered in benchmarks as the RoboCup Rescue. Modeling that each robot has a certain amount of private information, next to a certain amount of common knowledge, is a natural assumption. Also online planning is natural in such dynamic situations.

References