Learning robots to rescue

*The RoboCup Rescue as training ground*

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The RoboCup Rescue as training ground

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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 extinguish 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.

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

Context
- After the Great Hanshin Earthquake of 1995 in Kobe, the Japanese government decided to promote research related to the problems encountered during large-scale urban disasters.
- A major outcome of this initiative was the RoboCup Rescue competitions. This lead to both versatile robots as control software for large teams of rescue agents.

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:

Results 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 is designed to maximize the average result achieved on all joint action-observation histories.

Learning Coordination Policies

Bayesian Game – independent decisions based on a joint policy found for a type of histories. Courtesy Emery-Montemerlo

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Based on the individual action $a_i$, observation $z_i$, the actions of all the other agents are inferred, relying on a common knowledge assumption, by finding match to the type $\Theta$.

References

More information: http://wiki.robocup.org/Rescue_Simulation_League