Combining metric and topological navigation of simulated robots

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Mobile robotics and robot navigation is a growing area of scientific research. Robot simulators are useful designing and analyzing tools of this domain.

Webots ([1]) is a well-known representant of these programs, a three-dimensional mobile robot simulator. Various guidance principles can be developed in C/C++ or Java programming language with the use of Webots controller programs.

During the current talk a short overview is given about the problems arising in the process of the navigation, and a short taxonomy is presented about the possible problem solving methods ([2]). A brief introduction to the probabilistic navigation techniques concerning Kalman filter and expectation maximization is included with a special focus on occupancy grid. Another representational aspect of the navigation – also mentioned – is whether the map is metric or topological.

In CSCS'2002 the authors presented a metric navigation method based on occupancy grid working in the Webots simulation environment ([3]). As a continuation of that research the authors created an enhancement of the former processes, a hybrid metric-topological navigation mechanism. A topologic layer is introduced in the environment exploration phase replacing the older value iteration ([4]). The implementation of a topologic graph of the explorable places using the metric map enables the robot to navigate in a more efficient manner. A comparison of the pure metric and the new hybrid methods is also given.

References

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[3] R. Szabó. Navigation of simulated mobile robots in the webots environment. *To appear in Periodica Polytechnica*, 2004.

[4] S. Thrun. Learning metric-topological maps for indoor mobile robot navigation. *Artificial Intelligence*, 99(1):21–71, 1998.