Interaction-aware planning for autonomous driving requires an exploration of a combinatorial solution space when using conventional search- or optimization-based motion planners. With Deep Reinforcement Learning, optimal driving strategies for such problems can be derived also for higher-dimensional problems. However, these methods guarantee optimality of the resulting policy only in a statistical sense, which impedes their usage in safety critical systems, such as autonomous vehicles. Thus, we propose the Experience-Based-Heuristic-Search algorithm, which overcomes the statistical failure rate of a Deep-reinforcement-learning-based planner and still benefits computationally from the pre-learned optimal policy. Specifically, we show how experiences in the form of a Deep Q-Network can be integrated as heuristic into a heuristic search algorithm. We benchmark our algorithm in the field of path planning in semi-structured valet parking scenarios. There, we analyze the accuracy of such estimates and demonstrate the computational advantages and robustness of our method. Our method may encourage further
investigation of the applicability of reinforcement-learning-based planning in the field of self-driving vehicles.

Stichworte:
learning (artificial intelligence); mobile robots; optimal control; path planning; robust control; search problems; statistical analysis; deep Q-network; experience-based-heuristic-search algorithm; deep-reinforcement-learning-based planner; search-based motion planners; self-driving vehicles; semistructured valet parking scenarios; path planning; pre-learned optimal policy; statistical failure rate; autonomous vehicles; safety critical systems; higher-dimensional problems; optimal driving strategies; optimization-based motion planners; combinatorial solution space; autonomous driving; interaction-aware planning; deep Q-learning; robust motion planning; Planning; Heuristic algorithms; Autonomous vehicles; Path planning; Standards; Mathematical model

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