A supervisor's review of PhD Thesis
Heuristic Learning for Domain-independent Planning
from RNDr. Ing. Otakar Trunda

The doctoral thesis is devoted to a hot research topic of integrating symbolic and neural approaches to AI. Specifically, Otakar Trunda studies how deep neural networks can contribute to learning heuristics for model-based automated planning.

Three categories (types) of heuristic learning are suggested in the thesis: learning heuristics for a particular problem, learning heuristics for all problems in a given domain, and learning heuristics applicable in all domains. The thesis is devoted to the second category. The first research contribution is a so-called heuristic adjustment, i.e., modifying existing heuristics based on past data. The significant contribution is, however, the proposal of a deep learning approach to learn heuristics for forward planning. The heuristic estimates the distance from a current state to a goal state. The framework is based on extracting features of states and learning the function than maps these features to distance to a goal state – heuristic. An object graph has been proposed to represent a state, and features are extracted from that graph. Experiments show that the system can learn heuristic values from past examples without any human assistance, and these heuristics are competitive and even better than human-designed heuristics. Finally, theoretical guarantees on the performance of learned heuristics are proved.

The thesis provides new results in a coherent area of fully automated learning of heuristics from data. The text is well written, its flow is appropriate for the topic, and the claims are well justified. Part of the results was published at the CORE B conference ICAART, where the paper was evaluated among the best contributions and invited to a special LNCS issue. It is a pity that the results did not materialize in more publication outputs; the thesis has the potential for further publication. On the other side, the student has other publications in automated planning that are not directly reflected in the thesis.

Student demonstrated capabilities to perform independent research and achieve peer-reviewed international results. It is essential to highlight that the research involved diverse areas, such as symbolic automated planning on one side and sub-symbolic deep neural learning on the other. Moreover, the research work included implementation, experiments, and theoretical results, so the student demonstrated diverse capabilities. I suggest the work to be accepted as PhD thesis.

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