An Introduction to the Planning Domain Definition Language

Praise for *An Introduction to the Planning Domain Definition Language*

This is a thorough and comprehensive introduction to PDDL. It does an excellent job of demonstrating PDDL's capabilities and will be an essential resource for anyone who wants to use PDDL. It will also be an important resource for anyone who studies AI planning, regardless of whether they ever use PDDL. A book like this has been needed for a long time.

–Dana Nau, *University of Maryland*

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ABSTRACT

Planning is the branch of Artificial Intelligence (AI) that seeks to automate reasoning about plans, most importantly the reasoning that goes into formulating a plan to achieve a given goal in a given situation. AI planning is model-based: a planning system takes as input a description (or model) of the initial situation, the actions available to change it, and the goal condition to output a plan composed of those actions that will accomplish the goal when executed from the initial situation.

The Planning Domain Definition Language (PDDL) is a formal knowledge representation language designed to express planning models. Developed by the planning research community as a means of facilitating systems comparison, it has become a de-facto standard input language of many planning systems, although it is not the only modelling language for planning. Several variants of PDDL have emerged that capture planning problems of different natures and complexities, with a focus on deterministic problems.

The purpose of this book is two-fold. First, we present a unified and current account of PDDL, covering the subsets of PDDL that express discrete, numeric, temporal, and hybrid planning. Second, we want to introduce readers to the art of modelling planning problems in this language, through educational examples that demonstrate how PDDL is used to model realistic planning problems. The book is intended for advanced students and researchers in AI who want to dive into the mechanics of AI planning, as well as those who want to be able to use AI planning systems without an in-depth explanation of the algorithms and implementation techniques they use.

KEYWORDS

AI planning, problem modelling, classical planning, numeric planning, temporal planning, hybrid planning

Till mina nära fjärran
– Patrik

A mis padres, mi hermana y toda la familia, por su apoyo y enseñanzas
para disfrutar de la vida,
a Angela, por el amor, y por ser mi compañera de viaje,
y a los amigos, por tantas buenas tardes de conversaciones y risas.
– Nir

To Maria Fox and Derek Long,
for their invaluable contributions to the planning community,
and for allowing me to stand on their shoulders.
– Daniele

To K & B
– Christian

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Preface

The Planning Domain Definition Language (PDDL) has been a de-facto standard modelling language in the automated planning research community for just over two decades now. In that time, the language has undergone several revisions and extensions. The specification of the syntax and semantics of different subsets of PDDL is spread over several publications and not easily accessible.

Although PDDL is intended as a "high-level" modelling language, the art of modelling planning problems in PDDL is also not easy to master. From its long use, there is a large body of tacit knowledge, such as idioms for modelling common situations, "tricks" to deal with the limitations of the language, and traps to avoid, which are also only infrequently documented.

This book presents a unified account of PDDL, as it is today, along with educational examples of how it is used to model realistic planning problems. We aim to provide an easily accessible introduction that can serve both students/researchers interested in getting into the mechanics of AI planning, as well as those whose interest is being able to use AI planning systems without needing to know too much about how they work. Explanations of some of the algorithmic and implementation techniques used in planning systems are not in the scope of this book, and can be found in general and specialised AI textbooks [Geffner and Bonet, 2013, Ghallab et al., 2004, Russel and Norvig, 2011, for example].

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