Beginning Robotics Programming in Java with LEGO Mindstorms

Wei Lu
My wife Ling, for her endless love and support over the past five years when I worked on this book.

My daughter Julia and son Ryan, for giving their dad the best fun times when testing all of the robot’s programs with them.
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Introduction

There are many cognitive tasks that people can do easily and almost subconsciously, but that have proven extremely difficult to program on a computer. Artificial Intelligence (AI) is the process of developing computer systems that can carry out these tasks, and it is devoted to the computational study of intelligent behavior. Such intelligent behavior includes a wide range of phenomena, such as perception, problem solving, use of knowledge, planning, learning, and communication in order to take a complicated task and convert it into simpler steps that the robotics system can handle. Based on the Lego Mindstorms robotic system, this book develops a wide range of techniques in the Java programming language for modeling these phenomena, including state-space search, several knowledge representation schemes, and task-specific methods.

The book begins with an introduction to Lego Mindstorms EV3 and leJOS, an open source project created to develop the technological infrastructure, and a tiny Java virtual machine in which to implant software into Lego Mindstorms products using Java technology. It then continues with a discussion of problem-solving techniques, such as breadth-first search, depth-first search, heuristic search, hill-climbing search, and A star (A*) search, and finishes with robotics behavior programming in Java multithreading programming with a set of sensors.

A major goal of AI is to give computers the ability to think, or in other words, mimic human behavior. The problem with this mimicry is that, unfortunately, computers don’t function in the same way as the human brain; that is, they require a series of well reasoned-out steps in order to find a solution. Therefore, one challenge in robotics programming is how to convert something complex into something simple that can be done by algorithms. This book bridges the gap between the theoretical AI algorithms and practical robotics systems by developing a set of algorithms and building them into the well-known Lego Mindstorms EV3 system in order to achieve an enhanced intelligence.