

Part 5

Machine learning-based methods

In this final part of the book, comprising two chapters, you'll delve into the dynamic world of machine learning techniques and how they can be harnessed to solve complex optimization problems.

In chapter 11, you'll learn how to use the power of artificial intelligence, machine learning, and deep learning to tackle optimization problems. We'll start with a refresher on these foundational concepts, ensuring you have a strong grounding. You'll then delve into the exciting field of graph machine learning, graph embedding, graph convolutional networks, and attention mechanisms, which are invaluable in solving optimization problems with graph-structured data. Additionally, you'll explore self-organizing maps, uncovering their role in optimization tasks. By the end of this chapter, you'll be well-equipped to apply supervised and unsupervised machine learning techniques to handle optimization problems.

Chapter 12 delves into the fascinating realm of reinforcement learning (RL). You'll grasp the fundamental principles underlying RL, understand the concept of a Markov decision process, and delve into the actor-critic architecture and proximal policy optimization algorithms. You'll also become acquainted with multi-armed bandits and contextual bandits and learn how these techniques can be applied to solve optimization problems, where decisions lead to optimal outcomes.

In this part, you'll bridge the gap between machine learning and optimization, gaining insights into how machine learning can be harnessed to find optimal solutions efficiently. This is where the synergy between machine learning and optimization unlocks a new horizon and a shift toward data-driven and intelligent problem-solving.