In the twenty-first century, theory and practical algorithms of machine learning have been studied extensively, and there has been a rapid growth of computing power and the spread of the Internet. These machine learning methods are usually based on the presupposition that the data generation mechanism does not change over time. However, modern real-world applications of machine learning such as image recognition, natural language processing, speech recognition, robot control, bioinformatics, computational chemistry, and brain signal analysis often violate this important presumption, raising a challenge in the machine learning and statistics communities.

To cope with this non-stationarity problem, various approaches have been investigated in machine learning and related research fields. They are called by various names, such as covariate shift adaptation, sample selection bias, semisupervised learning, transfer learning, and domain adaptation. In this book, we consistently use the term covariate shift adaptation, and cover issues including theory and algorithms of function approximation, model selection, active learning, and real-world applications.

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