Preface

Machine learning is a subject in computer science, aimed at studying theories, algorithms, and applications of systems that learn like humans. Recent development of computers and sensors allows us to access a huge amount of data in diverse domains such as documents, audio, images, movies, e-commerce, electric power, medicine, and biology. Machine learning plays a central role in analyzing and benefiting from such *big data*.

This textbook is devoted to presenting mathematical backgrounds and practical algorithms of various machine learning techniques, targeting undergraduate and graduate students in computer science and related fields. Engineers who are applying machine learning techniques in their business and scientists who are analyzing their data can also benefit from this book.

A distinctive feature of this book is that each chapter concisely summarizes the main idea and mathematical derivation of particular machine learning techniques, followed by compact MATLAB programs. Thus, readers can study both mathematical concepts and practical values of various machine learning techniques simultaneously. All MATLAB programs are available from

"http://www.ms.k.u-tokyo.ac.jp/software/SMLbook.zip".

This book begins by giving a brief overview of the field of machine learning in Part 1. Then Part 2 introduces fundamental concepts of *probability and statistics*, which form the mathematical basis of statistical machine learning. Part 2 was written based on

Sugiyama, M.
Probability and Statistics for Machine Learning,
Kodansha, Tokyo, Japan, 2015. (in Japanese).

Part 3 and Part 4 present a variety of practical machine learning algorithms in the *generative* and *discriminative* frameworks, respectively. Then Part 5 covers various advanced topics for tackling more challenging machine learning tasks. Part 3 was written based on

Sugiyama, M.
Statistical Pattern Recognition: Pattern Recognition Based on Generative Models,
Ohmsha, Tokyo, Japan, 2009. (in Japanese),

and Part 4 and Part 5 were written based on

Sugiyama, M.
An Illustrated Guide to Machine Learning,
Kodansha, Tokyo, Japan, 2013. (in Japanese).

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