Preface

The support vector machine (SVM) has been developed in the statistical learning theory and later adopted in machine learning, statistics, and signal processing. SVM has been applied to solve a variety of practical problems. Recent advances have seen diverse developments and applications of the SVM. This book would like to summarize these progresses in robotics, computer vision, pattern recognition, computer security, neural and medical image analysis, soft biometrics, etc. The selected studies will present how to formulate their application, use basic SVM algorithm, and extend SVM algorithm for their application. It will motivate the readers to think about their own applications and come up with solutions using related SVM techniques.

Chapter 1 presents an SVM application in robotics. They modified the basic SVM method to an augmented-SVM approach, which combines gradient observations with the standard observations of function values, then applies in robotics for better performance. Chapter 2 proposes a simplified multi-class SVM approach and applies for multi-class pattern recognition problems. Chapter 3 proposes two novel approaches for transfer learning, inductive transfer learning and transductive transfer learning, where a domain adaptation kernelized SVM was developed with two extensions. They evaluate the performance of the proposed method in a biochemical process with real-world datasets. Chapter 4 discusses the SVM for security applications in adversarial environments, e.g., malware detection, intrusion detection, and spam filtering. Chapter 5 presents the application of the SVMs for image categorization, i.e., classifying visual images into different object categories.

Chapter 6 describes an SVM application in neuroimage analysis. Neuroimage analysis is to characterize the group difference captured by the SVMs with anatomically interpretable patterns, providing insights into the unknown mechanism of the brain. The authors introduce the SVM-based methods to the neuroimage analysis. Discriminative patterns are decoded from the SVM through distinctive feature selection, SVM decision boundary interpretation, and discriminative learning of generative models. Chapter 7 studies the SVMs for the imbalanced data problem, where an imbalanced set of samples are used for training the SVMs. They use in two biomedical applications, the abnormal ECG beat annotation and

detection of abnormal regions in colonoscopic images, where the imbalanced data problem exists. Chapter 8 presents the applications of the SVMs for extracting and recognizing soft biometrics, such as human age, gender, and ethnicity from facial images. Soft biometrics is different from the traditional biometrics, such as face recognition or iris, fingerprint recognition. It can be used in business intelligence. The author focuses on the SVMs to learn an estimator or recognizer to extract the soft biometrics. A combination of SVM regression and classifiers has also been developed for age estimation.

We would like to sincerely thank the contributors of each chapter. The book would not be possible to be edited without their great contributions. Hopefully these excellent research works and related reviews give readers a broad and deep representation of recent development of the SVM algorithms and applications.

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