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## Preface

Over a period spanning more than a decade, support vector machines (SVMs) have evolved into a leading machine learning technique. SVMs are being applied to a wide range of problems, including bioinformatics, face recognition, text classification and many more. It is fair to say that SVMs are one of the most important methods used for data mining with a wide range of software available to support their application.

A significant barrier to the widespread application of support vector machines is the absence of a capability to explain, in a human comprehensible form, either the process by which an SVM arrives at a specific decision/result, or more general, the totality of knowledge embedded in these systems. This lack of a capacity to provide an explanation is an obstacle to a more general acceptance of “back box” machine learning systems. In safety-critical or medical applications, an explanation capability is an absolute requirement.

This book provides an introduction and overview of methods used for rule extraction from support vector machines. The first part offers an introduction to the topic as well as a summary of current research issues. The second chapter surveys the field of rule extraction from SVMs, reviews areas of current research and introduces an application in the financial field.

Part II describes a range of methods currently being used to extract comprehensible rules from support vector machines. It is very fortunate that practically all authors who published break-through papers on the topic in journals and conference proceedings since 2002 are contributing to this book. One of the first papers with the title “Rule extraction from support vector machines” (if not the first paper) was published in 2002 by Núñez et al. and describes a “decompositional” method to obtain rules from SVMs. Haydemar Núñez, with coauthors, is contributing to the second part of this book. Another decompositional method was published soon afterwards by Glenn Fung who is also contributing a chapter, as is Lisa Torrey and colleagues from the University of Wisconsin in Madison. The research group led by Jude Shavlik has made significant and highly regarded contributions to both rule extraction from neural networks as well as support vector machines.

Publications that truly shaped the field and the authors are establishing the connection between SVMs and reinforcement learning in Part II of this book.

Clearly, the field of rule extraction from support vector machines has grown and is now including methods such as SVM Trees which are being introduced by Shaoning Pang and Nik Kasabov in Part II of this volume. The use of prototypes for explanatory purposes has a history in the area of rule extraction from neural networks. Prototypes are now being applied to SVMs by Marcin Blachnik and Wlodzislaw Duch in this book.

Rule extraction from neural networks is an established data mining method. This was made possible by authors who applied these emerging methods to real world data sets and compared the results with other machine learning techniques. Fortunately, researchers in the field of rule extraction from support vector machines have tackled real world problems early on and one of the first attempts by Rolf Mitsdorffer is included in Part III of this book. Part III is entirely devoted to real world applications of rule extraction from support vector machines. Mitsdorffer investigates the problem of forecasting the success of initial public offering in the US stock market by use of rule extraction and other methods.

Support vector machines are performing particularly well for high dimensional data, i.e. sample sets with input vectors that have a significant number of elements (tens of thousands and more) and relatively few nonzero values. Problems such as text, speech and image classification often include data sets of this nature. An application to speech recognition, and in particular accent classification, by Carol Pedersen has been included in the third part of this book. This chapter is also investigating novel testing and evaluation methods for rule extraction from SVMs.

As mentioned earlier, bioinformatics and in particular protein structure prediction is a core application area for support vector machines. Jieyue He and coworkers have developed rule extraction methods for these applications and the work is included in this book.

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