

Support Vector Machines

Every mathematical discipline goes through three periods of development: the naive, the formal, and the critical. David Hilbert The goal of this book is to explain the principles that made support vector machines (SVMs) a successful modeling and prediction tool for a variety of applications. We try to achieve this by presenting the basic ideas of SVMs together with the latest developments and current research questions in a unified style. In a nutshell, we identify at least three reasons for the success of SVMs: their ability to learn well with only a very small number of free parameters, their robustness against several types of model violations and outliers, and last but not least their computational efficiency compared with several other methods. Although there are several roots and precursors of SVMs, these methods gained particular momentum during the last 15 years since Vapnik (1995, 1998) published his well-known textbooks on statistical learning theory with a special emphasis on support vector machines. Since then, the field of machine learning has witnessed intense activity in the study of SVMs, which has spread more and more to other disciplines such as statistics and mathematics. Thus it seems fair to say that several communities are currently working on support vector machines and on related kernel-based methods. Although there are many interactions between these communities, we think that there is still room for additional fruitful interaction and would be glad if this textbook were found helpful in stimulating further research. Many of the results presented in this book have previously been scattered in the journal literature or are still under review. As a consequence, these results have been accessible only to a relatively small number of specialists, sometimes probably only to people from one community but not the others.

This book provides a deep but still self-contained introduction to Support Vector Machines (SVMs) and their role in statistical problems.



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