Kernel methods have long been established as effective techniques in the framework of machine learning and pattern recognition, and have now become the standard approach to many remote sensing applications. With algorithms that combine statistics and geometry, kernel methods have proven successful across many different domains related to the analysis of images of the Earth acquired from airborne and satellite sensors, including natural resource control, detection and monitoring of anthropic infrastructures (e.g. urban areas), agriculture inventorying, disaster prevention and damage assessment, and anomaly and target detection.

Presenting the theoretical foundations of kernel methods (KMs) relevant to the remote sensing domain, this book serves as a practical guide to the design and implementation of these methods. Five distinct parts present state-of-the-art research related to remote sensing based on the recent advances in kernel methods, analysing the related methodological and practical challenges:

- **Part I** introduces the key concepts of machine learning for remote sensing, and the theoretical and practical foundations of kernel methods.

- **Part II** explores supervised image classification including Super Vector Machines (SVMs), kernel discriminant analysis, multi-temporal image classification, target detection with kernels, and Support Vector Data Description (SVDD) algorithms for anomaly detection.

- **Part III** looks at semi-supervised classification with transductive SVM approaches for hyperspectral image classification and kernel mean data classification.
• Part IV examines regression and model inversion, including the concept of a kernel unmixing algorithm for hyperspectral imagery, the theory and methods for quantitative remote sensing inverse problems with kernel-based equations, kernel-based BRDF (Bidirectional Reflectance Distribution Function), and temperature retrieval KMs.

• Part V deals with kernel-based feature extraction and provides a review of the principles of several multivariate analysis methods and their kernel extensions.

This book is aimed at engineers, scientists and researchers involved in remote sensing data processing, and also those working within machine learning and pattern recognition.

ABOUT THE AUTHOR

Gustavo Camps-Valls was born in Valencia, Spain in 1972, and received a B.Sc. degree in Physics (1996), a B.Sc. degree in Electronics Engineering (1998), and a Ph.D. degree in Physics (2002) from the Universitat de Valencia. He is currently an associate professor in the Department of Electronics Engineering at the Universitat de Valencia, where he teaches electronics, advanced time series processing, machine learning for remote sensing and digital signal processing. His research interests are tied to the development of machine learning algorithms for signal and image processing, with special attention to adaptive systems, neural networks and kernel methods. He conducts and supervises research on the application of these methods to remote sensing image analysis and recognition, and image denoising and coding. Dr Camps-Valls is the author (or co-author) of 50 papers in referred international journals, more than 70 international conference papers, 15 book chapters, and is editor of other related books, such as Kernel Methods in Bioengineering, Signal and Image Processing (IGI, 2007). He has served as reviewer to many international journals, and on the Program Committees of SPIE Europe, IGARSS, IWANN and ICIP. Dr Camps-Valls was a member of the European Network on Intelligent Technologies for Smart Adaptive Systems (EUNITE), and the Spanish Thematic Networks on 'Pattern Recognition' and 'Biomedical Engineering'. He is active in the R+D sector through a large number of projects funded by both public and industrial partners, both at national and international levels. He is an Evaluator of project proposals and scientific organizations. Since 2003 he has been a member of the IEEE and SPIE. Since 2009 he has been a member of the machine Learning for Signal Processing (MLSP) Technical Committee of the IEEE Signal Processing Society. Visit http://www.uv.es/gcamps for more information.

Lorenzo Bruzzone received a laurea (M.S.) degree in electronic engineering (summa cum laude) ad a Ph.D. degree in telecommunications from the University of Genoa, Italy, in 1993 and 1998, respectively. From 1998 to 2000 he was a Postdoctoral researcher at the University of Genoa. In 2000 he joined the University of Trento, Italy, where he is currently a Full Professor telecommunications. He teaches remote sensing, pattern recognition, radar and electrical communications. Dr Bruzzone is the Head of the remote Sensing Laboratory in the Department of Information Engineering and Computer Science, University of Trento.
His current research interests are in the area of remote-sensing image processing and recognition (analysis of multitemporal
data, feature extraction and election, classification, regression and estimation, data fusion and machine learning). He conducts
and supervises research on these topics within the frameworks of several national and international projects. He is an Evaluator
of project proposals for many different governments (including the European Commission) and scientific organizations. He
is the author (or co-author) of 74 scientific publication in referred international journals, more than 140 papers in conference
proceedings and 7 book chapters. He is a referee for many international journals and has served on the Scientific Committees
of several international conferences. He is a member of the Managing Committee of the Italian Inter-University Consortium on
Telecommunications and a member of the Scientific Committee of the India-Italy Center for Advanced Research. Since 2009 he
has been a member of the Administrative Committee of the IEEE Geoscience and Remote Sensing Society. Dr Bruzzone gained
first place in the Student Prize Paper Competition of the 1998 IEEE International Geoscience and Remote Sensing Symposium
(Seattle, July 1998). He was a recipient of the Recognition of IEEE Transactions on Geoscience and remote Sensing Best
 reviewers in 1999 and was a Guest Editor of a Special Issue of the IEEE Transactions on Geoscience and Remote Sensing on
the subject of the analysis of multitemporal remote-sensing images (November 2003). He was the General Chair and Co-chair of
the First and Second IEEE International Workshop on the Analysis of Multi-temporal remote-Sensing Images (MultiTemp), and is
currently a member of the Permanent Steering Committee of this series of workshops. Since 2003, he has been the Chair of the
SPIE Conference on Image and Signal Processing for Remote Sensing. From 2004 to 2006 he served as an Associate Editor for
the IEEE Geoscience and Remote Sensing Letters, and currently is an Associate Editor for the IEEE Transactions on Geoscience
and Remote Sensing, and the Canadian Journal of Remote Sensing. He is a Senior member of IEEE, and also a member of the
International Association for Pattern Recognition and of the Italian Association for Remote Sensing (AIT).

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