

CISM COURSES AND LECTURES

Series Editors:

The Rectors of CISM

Sandor Kaliszky - Budapest

Mahir Sayir - Zurich

Wilhelm Schneider - Wien

The Secretary General of CISM

Giovanni Bianchi - Milan

Executive Editor

Carlo Tasso - Udine

The series presents lecture notes, monographs, edited works and proceedings in the field of Mechanics, Engineering, Computer Science and Applied Mathematics.

Purpose of the series is to make known in the international scientific and technical community results obtained in some of the activities organized by CISM, the International Centre for Mechanical Sciences.

INTERNATIONAL CENTRE FOR MECHANICAL SCIENCES

COURSES AND LECTURES - No. 382



LEARNING, NETWORKS AND STATISTICS

EDITED BY

G. DELLA RICCIA
UNIVERSITY OF UDINE

H.-J. LENZ
FREE UNIVERSITY OF BERLIN

R. KRUSE
UNIVERSITY OF MAGDEBURG



Springer-Verlag Wien GmbH

Le spese di stampa di questo volume sono in parte coperte da
contributi del Consiglio Nazionale delle Ricerche.

This volume contains 53 illustrations

This work is subject to copyright.

All rights are reserved,

whether the whole or part of the material is concerned
specifically those of translation, reprinting, re-use of illustrations,
broadcasting, reproduction by photocopying machine
or similar means, and storage in data banks.

© 1997 by Springer-Verlag Wien

Originally published by Springer-Verlag Wien New York in 1997

SPIN 10639259

In order to make this volume available as economically and as
rapidly as possible the authors' typescripts have been
reproduced in their original forms. This method unfortunately
has its typographical limitations but it is hoped that they in no
way distract the reader.

ISBN 978-3-211-82910-3

ISBN 978-3-7091-2668-4 (eBook)

DOI 10.1007/978-3-7091-2668-4

PREFACE

This volume contains the papers accepted for presentation at the invitational ISSEK96 workshop on 'Learning, Networks and Statistics' organized by the International School for the Synthesis of Expert Knowledge (ISSEK) and held at the Centre International des Sciences Mécaniques (CISM) in Udine from 19 to 21 September, 1996.

*The first workshop on "Mathematical and Statistical Methods in Artificial Intelligence" organised by the International School for the Synthesis of Expert Knowledge (ISSEK) was held in 1994. This brought together a group of scientists with international reputation in the field of Mathematics, Statistics and Computer Science and it was a great success since all the participants had a strong interest in interdisciplinary work and collaboration. Instead of a call for papers the participants were recruited according to their scientific standings and by individual invitation. For further information on this event we refer to the book: *Mathematical and Statistical Methods in Artificial Intelligence*, G. Della Riccia, R. Kruse and R. Viertl (eds.); CISM Courses and Lecture No. 363, International Centre for Mechanical Sciences (Springer-Verlag Wien New York).*

In a joint venture of the Free University of Berlin (Prof. Lenz), the Otto-von-Guericke University of Magdeburg (Prof. Kruse) and the University of Udine (Prof. Della Riccia), a second international workshop on 'Learning, Networks and Statistics' was held. According to the overwhelming success of the first workshop the same fundamental principles were followed up, in particular, the organisers invited a rather limited but distinguished group of speakers with superb methodological backgrounds and with an expressed interest in overcoming the traditional frontiers of Computer Science, Mathematics and Applied Statistics.

*Motivated by a recent book published by D. Michie, D. J. Spiegelhalter and C. C. Taylor (*Machine Learning, Neural and Statistical Classification*, Ellis Horwood, 1994), the workshop was organised in 4 sessions reflecting the main areas of interest: *Neural Nets, Statistics and Networks, Classification and Data Mining and (Machine) Learning.**

As it was intended not to have a pure academic discussion, but to inspect and unwrap practical problems too, the organisers as well as the editors were glad

to have a lot of stimulating contributions from the 'shop-floor'. The various fields of interest of the participants and the stimulating atmosphere of the lecture hall at Palazzo del Torso of CISM at Udine made it possible to analyse some important topics with stepwise refinement and on a uniform terminology basis. The editors believe that those discussions helped to clarify several of our ideas and helped to polish the papers accepted for final publication and collected in this volume.

The organisers and the editors of this volume would like to thank the following organisations which sponsored this event and made a meeting of such calibre possible:

- The International School for the Synthesis of Expert Knowledge (ISSEK) for promoting the workshop.*
- The Free University of Berlin and the University of Udine for their administrative support.*
- The Centre International des Sciences Mécaniques (CISM) for hosting again the workshop in their beautiful Palazzo del Torso and for providing technical support.*

On behalf of all participants we express our gratitude to the Fondazione Cassa di Risparmio di Udine e Pordenone, to the Cassa di Risparmio di Udine and Pordenone and to EuroStat (Statistical Office of the European Communities at Luxembourg) for granting the necessary financial support.

Finally, we would like to thank very warmly Mrs. Angelika Wnuk from the Free University of Berlin for her superb secretarial work throughout the planning period and the time after.

The editors are happy and proud to announce a third event of this kind to be held in 1998 and are looking forward to meeting again most members of this scientific community.

*H.-J. Lenz
R. Kruse
G. Della Riccia*

CONTENTS

	Page
Preface	
PART 1: NEURAL NETS	
Overtraining in Single-Layer Perceptrons <i>by S. Raudys</i>	3
Neural Networks for Rapid Learning in Computer Vision and Robotics <i>by H. Ritter</i>	2 5
PART 2: STATISTICS AND NETWORKS	
Adaptive Market Simulation and Risk Assessment <i>by R.A. Müller</i>	4 3
Processing of Prior-Information in Statistics by Projections on Convex Cones <i>by E. Rödel</i>	5 5
PART 3: CLASSIFICATION AND DATA MINING	
Simultaneous Visualization and Clustering Methods as an Alternative to Kohonen Maps <i>by H.H. Bock</i>	6 7
Data analysis in Industry - A Practical Guideline <i>by H. Hellendoorn</i>	8 7
Fuzzy Shell Cluster Analysis <i>by F. Klawonn, R. Kruse and H. Timm</i>	1 0 5
Automatic Construction of Decision Trees and Neural Nets for Classification Using Statistical Considerations <i>by F. Wysotzki, W. Müller and B. Schulmeister</i>	1 2 1

From the Art of KDD to the Science of KDD by <i>Y. Kodratoff</i>	135
---	-----

PART 4: MACHINE LEARNING

Machine Learning: Between Accuracy and Interpretability by <i>I. Bratko</i>	163
--	-----

Preprocessing by a Cost-Sensitive Literal Reduction Algorithm: REDUCE by <i>N. Lavrac, D. Gamberger and P. Turney</i>	179
---	-----

A General Framework for Supporting Relational Concept Learning by <i>L. Saitta</i>	197
---	-----

Machine Learning and Case-Based Reasoning: Their Potential Role in Preventing the Outbreak of Wars or in Ending Them by <i>R. Trappl, J. Fürnkranz, J. Petrak and J. Bercovitch</i>	209
---	-----

List of Participants	227
----------------------------	-----