Error Estimation for Pattern Recognition

Description: This book is the first of its kind to discuss error estimation with a model–based approach. From the basics of classifiers and error estimators to more specialized classifiers, it covers important topics and essential issues pertaining to the scientific validity of pattern classification.

Error Estimation for Pattern Recognition focuses on error estimation, which is a broad and poorly understood topic that reaches all research areas using pattern classification. It includes model–based approaches and discussions of newer error estimators such as bolstered and Bayesian estimators. This book was motivated by the application of pattern recognition to high–throughput data with limited replicates, which is a basic problem now appearing in many areas. The first two chapters cover basic issues in classification error estimation, such as definitions, test–set error estimation, and training–set error estimation. The remaining chapters in this book cover results on the performance and representation of training–set error estimators for various pattern classifiers.

Additional features of the book include:

- The latest results on the accuracy of error estimation
- Performance analysis of resubstitution, cross–validation, and bootstrap error estimators using analytical and simulation approaches
- Highly interactive computer–based exercises and end–of–chapter problems

This is the first book exclusively about error estimation for pattern recognition.

Ulisses M. Braga Neto is an Associate Professor in the Department of Electrical and Computer Engineering at Texas A&M University, USA. He received his PhD in Electrical and Computer Engineering from The Johns Hopkins University. He received an NSF CAREER Award for his work on error estimation for pattern recognition with applications in genomic signal processing. He is an IEEE Senior member.

Edward R. Dougherty is Distinguished Professor, Robert F. Kennedy 26 Chair, and Scientific Director at the Center for Bioinformatics and Genomic Systems Engineering at Texas A&M University, USA. He is a fellow of both IEEE and SPIE, and he has received the SPIE Presidents Award. He has authored several books including Epistemology of the Cell: A Systems Perspective on Biological Knowledge and Random Processes for Image and Signal Processing (Wiley–IEEE Press).

Contents:

PREFACE XIII
ACKNOWLEDGMENTS XIX
LIST OF SYMBOLS XXI
1 CLASSIFICATION 1
1.1 Classifiers 1
1.2 Population–Based Discriminants 3
1.3 Classification Rules 8
1.4 Sample–Based Discriminants 13
1.4.1 Quadratic Discriminants 14
1.4.2 Linear Discriminants 15
5.5.3 Leave–One–Out Error 130
5.5.4 Cross–Validation Error 132
5.5.5 Bootstrap Error 133
5.6 Higher–Order Moments of Error Rates 136
5.6.1 True Error 136
5.6.2 Resubstitution Error 137
5.6.3 Leave–One–Out Error 139
5.7 Sampling Distribution of Error Rates 140
5.7.1 Resubstitution Error 140
5.7.2 Leave–One–Out Error 141
Exercises 142

6 GAUSSIAN DISTRIBUTION THEORY: UNIVARIATE CASE 145
6.1 Historical Remarks 146
6.2 Univariate Discriminant 147
6.3 Expected Error Rates 148
6.3.1 True Error 148
6.3.2 Resubstitution Error 151
6.3.3 Leave–One–Out Error 152
6.3.4 Bootstrap Error 152
6.4 Higher–Order Moments of Error Rates 154
6.4.1 True Error 154
6.4.2 Resubstitution Error 157
6.4.3 Leave–One–Out Error 160
6.4.4 Numerical Example 165
6.5 Sampling Distributions of Error Rates 166
6.5.1 Marginal Distribution of Resubstitution Error 166
6.5.2 Marginal Distribution of Leave–One–Out Error 169
6.5.3 Joint Distribution of Estimated and True Errors 174
Exercises 176

7 GAUSSIAN DISTRIBUTION THEORY: MULTIVARIATE CASE 179
7.1 Multivariate Discriminants 179
B.2 The VC Dimension 278
B.3 VC Theory of Classification 279
B.3.1 Linear Classification Rules 279
B.3.2 kNN Classification Rule 280
B.3.3 Classification Trees 280
B.3.4 Nonlinear SVMs 281
B.3.5 Neural Networks 281
B.3.6 Histogram Rules 281
B.4 Vapnik-Chervonenkis Theorem 282

C DOUBLE ASYMPTOTICS 285

BIBLIOGRAPHY 291

AUTHOR INDEX 301

SUBJECT INDEX 305

Order by Fax - using the form below
Order by Post - print the order form below and send to

Research and Markets,
Guinness Centre,
Taylors Lane,
Dublin 8,
Ireland.
Fax Order Form
To place an order via fax simply print this form, fill in the information below and fax the completed form to 646-607-1907 (from USA) or +353-1-481-1716 (from Rest of World). If you have any questions please visit http://www.researchandmarkets.com/contact/

Order Information
Please verify that the product information is correct.

- Product Name: Error Estimation for Pattern Recognition
- Web Address: http://www.researchandmarkets.com/reports/3110092/
- Office Code: SCDK88QR

Product Format
Please select the product format and quantity you require:

<table>
<thead>
<tr>
<th>Quantity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Copy (Hard Back):</td>
<td>USD 133 + USD 29 Shipping/Handling</td>
</tr>
</tbody>
</table>

* Shipping/Handling is only charged once per order.

Contact Information
Please enter all the information below in BLOCK CAPITALS

- Title: [ ] Mr [ ] Mrs [ ] Dr [ ] Miss [ ] Ms [ ] Prof
- First Name: ____________________________
- Last Name: ____________________________
- Email Address: * ____________________________
- Job Title: ____________________________
- Organisation: ____________________________
- Address: ____________________________
- City: ____________________________
- Postal / Zip Code: ____________________________
- Country: ____________________________
- Phone Number: ____________________________
- Fax Number: ____________________________

* Please refrain from using free email accounts when ordering (e.g. Yahoo, Hotmail, AOL)
Payment Information

Please indicate the payment method you would like to use by selecting the appropriate box.

☐ Pay by credit card: You will receive an email with a link to a secure webpage to enter your credit card details.

☐ Pay by check: Please post the check, accompanied by this form, to:
Research and Markets,
Guinness Center,
Taylors Lane,
Dublin 8,
Ireland.

☐ Pay by wire transfer: Please transfer funds to:
Account number 833 130 83
Sort code 98-53-30
Swift code ULSBIE2D
IBAN number IE78ULSB98533083313083
Bank Address Ulster Bank,
27-35 Main Street,
Blackrock,
Co. Dublin,
Ireland.

If you have a Marketing Code please enter it below:

Marketing Code: ____________________________

Please note that by ordering from Research and Markets you are agreeing to our Terms and Conditions at http://www.researchandmarkets.com/info/terms.asp

Please fax this form to:
(646) 607-1907 or (646) 964-6609 - From USA
+353-1-481-1716 or +353-1-653-1571 - From Rest of World