

# Contents

- 1 Machine Learning and Data Mining ..... 1**
  - 1.1 Introduction ..... 1
  - 1.2 Historical Background ..... 3
  - 1.3 Knowledge Discovery Process and Standardization ..... 4
  - 1.4 Terminology and Categorization of Learning Tasks ..... 6
  - 1.5 Predictive Data Mining: Induction of Models ..... 8
  - 1.6 Descriptive Data Mining: Induction of Patterns ..... 13
  - 1.7 Relational Data Mining ..... 16
  - 1.8 Conclusion ..... 17
  
- 2 Rule Learning in a Nutshell ..... 19**
  - 2.1 Problem Definition ..... 20
  - 2.2 Data Representation ..... 23
  - 2.3 Rule Representation ..... 25
  - 2.4 Rule Learning Process ..... 28
  - 2.5 Learning a Single Rule ..... 29
  - 2.6 Learning a Rule-Based Model ..... 40
  - 2.7 Overfitting Avoidance ..... 42
  - 2.8 Making a Prediction ..... 44
  - 2.9 Estimating the Predictive Accuracy of Rules ..... 45
  - 2.10 A Brief History of Predictive Rule Learning Algorithms ..... 48
  - 2.11 Conclusion ..... 55
  
- 3 Formal Framework for Rule Analysis..... 57**
  - 3.1 Introduction ..... 57
  - 3.2 ROC Space ..... 58
  - 3.3 Coverage Space ..... 60
  - 3.4 Rule Set Learning in Coverage Space ..... 62
  - 3.5 Conclusion ..... 63
  
- 4 Features ..... 65**
  - 4.1 Introduction ..... 66
  - 4.2 Feature Types ..... 68

4.3	Feature Construction .....	71
4.4	Feature Relevancy .....	76
4.5	Handling Missing Attribute Values .....	85
4.6	Handling Imprecise Attribute Values .....	90
4.7	Conclusion .....	93
<b>5</b>	<b>Relational Features .....</b>	<b>95</b>
5.1	Introduction .....	95
5.2	Examples of Relational Learning Tasks .....	97
5.3	Examples of Relational Features .....	99
5.4	Relational Feature Construction .....	101
5.5	Alternative Knowledge Representation Formalisms .....	104
5.6	Conclusion .....	111
<b>6</b>	<b>Learning Single Rules .....</b>	<b>113</b>
6.1	Introduction .....	113
6.2	Single Rule Construction .....	114
6.3	Search Algorithms .....	116
6.4	Search Strategies .....	123
6.5	Relational Rule Construction .....	128
6.6	Conclusion .....	133
<b>7</b>	<b>Rule Evaluation Measures .....</b>	<b>135</b>
7.1	Introduction .....	135
7.2	Basic Properties of Heuristics .....	137
7.3	Heuristics with Linear Isometrics .....	139
7.4	Heuristics with Nonlinear Isometrics .....	152
7.5	Gain Heuristics .....	155
7.6	Complexity-Based Heuristics .....	161
7.7	Composite Heuristics .....	163
7.8	Practical Considerations and Recommendations .....	164
7.9	Conclusion .....	169
<b>8</b>	<b>Learning Rule Sets .....</b>	<b>171</b>
8.1	Disjunctive Rules and Rule Sets .....	171
8.2	The Covering Strategy .....	174
8.3	Weighted Covering .....	178
8.4	Nonreductive Rule Learning Algorithms .....	181
8.5	Combining Rules to Arbitrary Global Models .....	184
8.6	Conclusion .....	185
<b>9</b>	<b>Pruning of Rules and Rule Sets .....</b>	<b>187</b>
9.1	Overfitting and Pruning .....	187
9.2	Prepruning .....	190
9.3	Post-pruning .....	199
9.4	Integrating Pre- and Post-pruning .....	207
9.5	Optimizing Rule Sets .....	212
9.6	Conclusion .....	216

<b>10 Beyond Concept Learning</b> .....	217
10.1 Introduction .....	217
10.2 Binary Classification .....	218
10.3 Prediction with Rule Bases .....	220
10.4 Multiclass Classification .....	223
10.5 Learning in Structured Output Spaces .....	236
10.6 Regression .....	243
10.7 Unsupervised Learning .....	245
10.8 Conclusion .....	246
<b>11 Supervised Descriptive Rule Learning</b> .....	247
11.1 Introduction .....	247
11.2 Subgroup Discovery .....	249
11.3 Contrast Set Mining .....	251
11.4 Emerging Pattern Mining .....	253
11.5 A Unifying View .....	255
11.6 Other Approaches to Supervised Descriptive Rule Learning .....	259
11.7 Subgroup Visualization .....	261
11.8 Conclusion .....	265
<b>12 Selected Applications</b> .....	267
12.1 Introduction .....	267
12.2 Demographic Domain: Dealing with Sequential Data .....	268
12.3 Multiclass Gene Expression Domain: Feature Relevancy for Scientific Discovery Applications .....	274
12.4 Coronary Heart Disease Domain: Expert-Guided Data Analysis .....	281
12.5 Brain Ischaemia Domain: Insightful Data Analysis .....	288
12.6 Conclusion .....	298
<b>References</b> .....	299
<b>Index</b> .....	323



<http://www.springer.com/978-3-540-75196-0>

Foundations of Rule Learning

Fürnkranz, J.; Gamberger, D.; Lavrac, N.

2012, XVIII, 334 p., Hardcover

ISBN: 978-3-540-75196-0