
Contents

Learning Classifier Systems in Data Mining:

An Introduction

<i>Larry Bull, Ester Bernadó-Mansilla, and John Holmes</i>	1
1 Introduction	1
2 Holland's LCS	2
3 Wilson's ZCS	4
4 Wilson's XCS	6
5 Pittsburgh-Style LCS	7
6 Previous Research on LCS in Data Mining.....	8
7 Learning Classifier Systems in Data Mining: An Overview	10
8 Summary.....	12
References	12

Data Mining in Proteomics with Learning Classifier Systems

<i>Jaume Bacardit, Michael Stout, Jonathan D. Hirst, and Natalio Krasnogor</i>	17
1 Introduction	17
2 Problem Definition	19
2.1 Protein Structure and Coordination Number Prediction	19
2.2 HP Models.....	21
3 The GAssist Learning Classifier System	22
4 Experimental Framework	24
4.1 Experimental Battery I: Primary Sequence and Coordination Number	24
4.2 Experimental Battery II: Assessment of Input Information Sources and Class Partitions for Coordination Number	26
5 Results.....	29
5.1 Experimental Battery I.....	29
5.2 Experimental Battery II	31

VI Contents

6	Discussion	36
6.1	Battery of Experiments I	36
6.2	Battery of Experiments II	39
6.3	Brief Description of Other Related Work	40
7	Conclusions and Further Work	41
	References	42

**Improving Evolutionary Computation Based Data-Mining
for the Process Industry: The Importance of Abstraction**

	<i>William N.L. Browne</i>	47
1	Introduction	47
2	Background	49
2.1	Description of the HSM and Downcoilers of Llanwern Works ..	49
2.2	LCS for Data Mining	49
3	Development of iLCS	50
4	Initial Data-Mining Results	52
4.1	Discovery Training Performance	53
4.2	Discovery Training Results	54
4.3	Advisory Performance	56
4.4	Summary of Industrial LCS	56
5	Abstraction	59
5.1	Abstraction Algorithm Overview	60
6	Results	62
6.1	Q-Learning and Standard XCS	63
6.2	Modified XCS With and Without Abstraction	63
6.3	Effect of Abstraction	64
6.4	Robustness of the Systems	65
7	Conclusions	66
	References	66

Distributed Learning Classifier Systems

	<i>Hai H. Dam, Pornthep Rojanavas, Hussein A. Abbass, and Chris Lokan</i>	69
1	Introduction	69
2	Distributed Data Mining	72
2.1	Overview	72
2.2	Learning in Distributed Environments	73
3	Learning Classifier Systems	75
4	Distributed Learning Classifier Systems (DLCS)	76
4.1	The Framework of DLCS	76
4.2	Knowledge Combination at the Server	77
4.3	Traffic Load	78
5	Experimental Setup	79
6	Combining Local Predictions at the Server	79
6.1	Noise Free Environments	80
6.2	Noisy Environments	81

7	An Effect of the Number of Clients	83
7.1	Noise Free Environments	83
7.2	Noisy Environments	84
8	Investigation of Knowledge Passing in DLCS	85
8.1	Between Clients and Server	85
8.2	Between Clients	87
9	Conclusion	89
	References	90

Knowledge Discovery from Medical Data: An Empirical Study with XCS

	<i>Faten Kharbat, Mohammed Odeh, and Larry Bull</i>	93
1	Introduction	93
2	The Four-Phases Discovery Process	94
3	Phase 1: Understanding the Dataset	95
4	Phase 2: Data Preparation	96
4.1	Data Pre-Processing	96
4.2	Data Formatting and Decoding	97
4.3	The Imbalance Problem	97
4.4	Missing Data Problem	99
5	Phase 3: Data Mining and Knowledge Discovery	100
5.1	Well-Known Classification Techniques Results	100
5.2	XCS Results	101
6	Phase 4: Evaluation of the Discovered Knowledge	110
6.1	Analysis of C4.5 Results	111
6.2	Analysis of XCS Results	113
7	Conclusion	116
	References	116

Mining Imbalanced Data with Learning Classifier Systems

	<i>Albert Orriols-Puig and Ester Bernadó-Mansilla</i>	123
1	Introduction	123
2	Description of XCS	125
2.1	Knowledge Representation	125
2.2	Performance Component	125
2.3	Parameter's Update	126
2.4	Discovery Component	126
3	XCS and Class Imbalances	126
3.1	The Imbalanced Multiplexer	126
3.2	XCS on the Imbalanced Multiplexer	127
4	Modeling Parameter's Bounds	128
4.1	Imbalance Bound	128
4.2	Theoretical and Experimental Bounds: Analysis of the Deviation	130
4.3	Learning Rate and Error Estimates	130

VIII Contents

4.4	Occurrence-Based Reproduction	132
4.5	Guidelines for Parameters Configuration	134
5	Online Configuration of XCS to Handle Imbalanced Problems	136
5.1	Online Adaptation Algorithm	136
5.2	Results	138
6	LCS for Mining Imbalanced Datasets	138
6.1	Methodology	139
6.2	Results	139
7	Summary and Conclusions	142
	References	143

XCS for Fusing Multi-Spectral Data in Automatic Target Recognition

Avinash Gandhe, Ssu-Hsin Yu, Raman Mehra, and Robert E. Smith . . . 147

1	Introduction	147
2	Description of Datasets	148
2.1	Datasets Examined	148
2.2	RIT WASP Sensor Data	148
3	Proposed Classification Scheme	150
3.1	Registration of RIT WASP Data	151
3.2	The XCS Classifier	152
4	XCS as a Learning Classifier System	153
5	Feature Representation	154
6	XCS Based Classification Algorithm	155
7	Detection	156
7.1	Spatial Processing	157
7.2	Spectral Processing	158
7.3	Classification	161
8	Final Comments and Future Directions	166
	References	166

Foreign Exchange Trading Using a Learning Classifier System

Christopher Stone and Larry Bull 169

1	Introduction	169
2	Foreign Exchange Trading	171
2.1	Technical Analysis	171
2.2	Foreign Exchange Transactions	171
2.3	Transaction Costs and Slippage	172
2.4	Genetic Programming Approach	172
3	Learning Classifier System Approach	173
3.1	Representation	173
3.2	Excess Return	176
3.3	Transaction Costs	177
4	Experiments	177
4.1	Experimental Setup	177

4.2	Validation Period from 1981 to 1995	180
4.3	Validation Period from 1975 to 1995	182
5	Conclusions	186
	References	187

Towards Clustering with Learning Classifier Systems

	<i>Kreangsak Tamee, Larry Bull, and Owen Pinnigern</i>	191
1	Introduction	191
2	A Simple LCS for Clustering	192
3	Initial Performance	194
4	Rule Compaction	195
5	Modifying XCS for Clustering	197
6	Local Search	198
7	Adaptive Threshold Parameter	199
8	Increased Complexity	201
9	Conclusions	201
	References	203

A Comparative Study of Several Genetic-Based Supervised Learning Systems

	<i>Albert Orriols-Puig, Jorge Casillas, and Ester Bernadó-Mansilla</i>	205
1	Introduction	205
2	Genetic-Based Machine Learning	206
3	Description the GBML Systems Used in the Comparison	208
3.1	UCS	208
3.2	GAssist	209
3.3	SLAVE	210
3.4	Fuzzy AdaBoost	212
3.5	Fuzzy LogitBoost	213
4	Experimentation	214
4.1	Methodology	215
4.2	Results	218
5	Summary and Conclusions	227
	References	227

Learning Classifier Systems in Data Mining

Bull, L.; Bernadó-Mansilla, E.; Holmes, J. (Eds.)

2008, IX, 230 p., Hardcover

ISBN: 978-3-540-78978-9