

Contents

1	Introduction	1
1.1	Background of Rule Based Systems	1
1.2	Categorization of Rule Based Systems	5
1.3	Ensemble Learning	6
1.4	Chapters Overview	7
	References	8
2	Theoretical Preliminaries	11
2.1	Discrete Mathematics	11
2.2	Probability Theory	16
2.3	If-then Rules	17
2.4	Algorithms	18
2.5	Logic	19
2.6	Statistical Measures	21
2.7	Single Rule Based Classification Systems	23
2.8	Ensemble Rule Based Classification Systems	24
	References	26
3	Generation of Classification Rules	29
3.1	Divide and Conquer	29
3.2	Separate and Conquer	29
3.3	Illustrative Example	33
3.4	Discussion	38
	References	41
4	Simplification of Classification Rules	43
4.1	Pruning of Decision Trees	43
4.2	Pruning of If-Then Rules	46
4.3	Illustrative Examples	47
4.4	Discussion	48
	References	50

5	Representation of Classification Rules	51
5.1	Decision Trees	51
5.2	Linear Lists	52
5.3	Rule Based Networks	53
5.4	Discussion	60
	References	62
6	Ensemble Learning Approaches	63
6.1	Parallel Learning	63
6.2	Sequential Learning	67
6.3	Hybrid Learning	68
6.4	Discussion	71
	References	72
7	Interpretability Analysis	75
7.1	Learning Strategy	75
7.2	Data Size	76
7.3	Model Representation	77
7.4	Human Characteristics	78
7.5	Discussion	78
	References	80
8	Case Studies	81
8.1	Overview of Big Data	81
8.2	Impact on Machine Learning	82
8.3	Case Study I-Rule Generation	85
8.4	Case Study II-Rule Simplification	89
8.5	Case Study III-Ensemble Learning	92
	References	94
9	Conclusion	97
9.1	Theoretical Significance	97
9.2	Practical Importance	98
9.3	Methodological Impact	100
9.4	Philosophical Aspects	102
9.5	Further Directions	108
	References	113

Contents	xiii
Appendix 1: List of Acronyms	115
Appendix 2: Glossary	117
Appendix 3: UML Diagrams	119
Appendix 4: Data Flow Diagram	121