

Contents

Chapter 1.

Intelligent systems: architectures and perspectives

Ajith Abraham

1	Introduction	1
2	Models of hybrid soft computing architectures	4
2.1	Stand alone intelligent system	4
2.2	Transformational hybrid intelligent system	5
2.3	Hierarchical hybrid intelligent system	5
2.4	Integrated intelligent system	6
3	Neural networks and evolutionary algorithms	6
3.1	Meta learning evolutionary artificial neural networks	8
4	Adaptation of fuzzy inference systems	12
5	Evolutionary fuzzy systems	14
6	Cooperative neuro-fuzzy systems	15
6.1	Fuzzy associative memories	16
6.2	Fuzzy rule extraction using self organizing maps	17
6.3	Systems capable of learning fuzzy set parameters	18
7	Integrated neuro-fuzzy systems	19
7.1	Integrated neuro-fuzzy system (Mamdani FIS)	20
7.2	Integrated neuro-fuzzy system (Takagi-Sugeno FIS)	21
8	Neuro-fuzzy-evolutionary (EvoNF) systems	24
9	Fuzzy evolutionary algorithms	26
10	Soft computing and probabilistic reasoning	27
11	Conclusions	27
	Acknowledgements	28
	References	28

Chapter 2.

Hybrid architecture for autonomous robots, based on representations, perception and intelligent control

Dominique Luzeaux and André Dalgalarondo

1	Introduction	37
1.1	Autonomy in robotic systems	38
1.2	Robot control architectures	39
2	HARPIC	40
2.1	General description	40
2.2	Management of perception resources	42
2.3	Assessment mechanisms within the control architecture	43
2.4	Comparison with other architectures	47
2.5	Implementation and experiments	49
3	Computational intelligence and controlled autonomy	53
4	Computational intelligence and learning	54

5	Conclusion	55
	References	55

Chapter 3.

An intuitionistic fuzzy set based approach to intelligent data analysis: an application to medical diagnosis

Eulalia Szmidt and Janusz Kacprzyk

1	Introduction	57
2	Brief introduction to intuitionistic fuzzy sets	59
2.1	Distances between intuitionistic fuzzy sets.....	61
3	An intuitionistic fuzzy sets approach to medical diagnosis due to De, Biswas and Roy	64
4	Medical diagnosis via distances for intuitionistic fuzzy sets.....	67
5	Conclusions	69
	References	70

Chapter 4.

A fuzzy inference methodology based on the fuzzification of set inclusion

Chris Cornelis and Etienne E. Kerre

1	Introduction	71
2	Classical inference strategies	73
3	Inclusion-based approach	79
3.1	Fuzzification of set inclusion	79
3.2	Inclusion-based reasoning with one fuzzy rule	82
3.3	Inclusion-based reasoning with parallel fuzzy rules.....	83
4	Conclusion	87
5	Acknowledgements	88
	References	88

Chapter 5.

A fuzzy approach to job-shop scheduling problem based on imprecise processing times

Feng-Tse Lin

1	Introduction	91
2	The job-shop scheduling problem.....	93
2.1	Crisp job-shop scheduling problem.....	93
2.2	Fuzzy job processing times	94
3	Preliminaries	95
4	Fuzzy job shop scheduling model based on imprecise processing times...	98
5	Computational results.....	100
6	Concluding remarks	104
	References	105

Chapter 6.

On efficient representation of expert knowledge by fuzzy logic

Hung T. Nguyen and Vladik Kreinovich

1	Introduction: fuzzy logic, granularity, and higher order approaches	107
2	Optimal granularity: case study	111
3	Selecting operations that are in optimal agreement with granularity	116
4	Optimal selection of higher-order approach.....	122
5	Operations which are consistent both with granularity and higher-order logics: preliminary results	126
6	Conclusions	128
	Acknowledgments.....	129
	References	129

Chapter 7.

Discovering efficient learning rules for feedforward neural networks using genetic programming

Amr Radi and Riccardo Poli

1	Introduction	133
2	Standard backpropagation algorithm and recent improvements	135
2.1	Standard backpropagation.....	135
2.2	Improvements to SBP	136
3	Previous work on the evolution of neural network learning rules	138
4	Our approach to evolving learning rules with GP	140
5	Experiments	140
5.1	Stage one: learning rules for output layers	141
5.2	Stage two: learning rules for hidden layers.....	143
6	Discussion.....	151
7	Conclusions	154
	References	156

Chapter 8.

Neuro-fuzzy methods for modeling and identification

Robert Babuska

1	Introduction	161
2	Fuzzy systems and neural networks.....	161
2.1	Nonlinear system identification.....	162
2.2	Fuzzy models.....	162
2.3	Artificial neural networks	166
3	Neuro-fuzzy modeling.....	172
3.1	Constructing neuro-fuzzy networks.....	174
3.2	Structure and parameters.....	174
3.3	Gradient-based learning	175
3.4	Hybrid learning techniques	175
3.5	Initialization of antecedent membership functions.....	179

4	Simulation examples	181
4.1	Static function	181
4.2	pH neutralization process.....	183
5	Concluding remarks	185
	References	186

Chapter 9.

Constrained two dimensional bin packing using a genetic algorithm

Wee Sng Khoo, P. Saratchandran and N. Sundararajan

1	Introduction	187
2	Some industrial applications of 2-dimensional bin packing.....	189
2.1	Floorplan design.....	189
2.2	Cutting	189
2.3	Packing.....	190
3	A brief description of genetic algorithm	191
3.1	Modeling	191
3.2	Objective function	191
3.3	Selection.....	192
3.4	Crossover	193
3.5	Mutation.....	194
3.6	Constraint-handling techniques	194
4	Proposed genetic algorithm for two-dimensional packing.....	195
4.1	Model representation	196
4.2	Objective function	197
4.3	Selection.....	197
4.4	Crossover	197
4.5	Mutation.....	198
4.5.1	Joint	198
4.5.2	Orientation	199
4.5.3	Interchange	199
4.6	Elitism	199
4.7	Constraint handling.....	200
4.7.1	Area constraint.....	200
4.7.2	Penalty function	200
5	Performance evaluation of two-dimensional genetic algorithm	201
5.1	Comparison with heuristic method.....	201
5.2	Comparison with another genetic algorithm	205
6	Conclusion	208
	References	208
	Appendix A: Cargo details	210

Chapter 10.

Sequential and distributed evolutionary algorithms for combinatorial optimization problems

Enrique Alba and Sami Khuri

1	Introduction	211
2	The evolutionary algorithms.....	212
2.1	Sequential evolutionary algorithms	214
2.2	Distributed evolutionary algorithms	215
3	Combinatorial optimization problems.....	216
3.1	The maximum cut problem	217
3.2	The error correcting code design problem	219
3.3	The minimum tardy task problem	221
4	Experimental runs	224
4.1	Results for the maximum cut problem.....	225
4.2	Results for the ECC problem	226
4.3	Results for the minimum tardy task problem	228
5	Conclusion	230
	References	232

Chapter 11.

Embodied emotional agent in intelligent training system

R. Nkambou , Y. Laporte , R. Yatchou and G. Gouradères

1	Introduction	235
2	The problem of emotion generation.....	237
2.1	Emotion as a means of interaction.....	237
2.2	Characterization and modeling of emotions	237
2.3	Models of architecture for emotion generation	239
3	Producing emotions by qualitative reasoning.....	240
3.1	Qualitative reasoning	241
3.2	A qualitative model of emotions	241
3.3	Emotion generation based on a qualitative reasoning system.....	243
4	Emilie: an embodied emotional agent for intelligent tutoring.....	243
4.1	Operational context.....	244
4.2	Architecture overview.....	245
4.3	Choosing and treating the input.....	246
4.4	Generating emotions	248
4.5	Providing visual feedback from emotions	249
5	Discussions and conclusion	250
6	References	251

Chapter 12.		
Optimizing intelligent agent's constraint satisfaction with neural networks		
<i>Arpad Kelemen, Yulan Liang, Robert Kozma, Stan Franklin</i>		
1	Introduction	255
2	Preparing the input for the neural networks	257
3	Design of neural network	259
3.1	FFNN with logistic regression	259
3.2	Neural network selection and criteria	260
3.3	Learning algorithms for FFNN	261
3.4	Support vector machine	261
4	Data analysis and results	262
5	Conclusion	270
	Acknowledgement	270
	References	270