

3	Neural Networks and Neuro-Fuzzy Systems	69
3.1	Neural Networks	69
3.1.1	Model of an Artificial Neuron	70
3.1.2	Multi-Layer Perceptron	73
3.1.3	Back-Propagation Learning Method	76
3.1.4	RBF Networks	80
3.1.5	Supervised and Unsupervised Learning	84
3.1.6	Competitive Learning	85
3.1.7	Hebbian Learning Rule	88
3.1.8	Kohonen's Self-Organizing Neural Network	89
3.1.9	Learning Vector Quantization	94
3.1.10	Other Types of Neural Networks	97
3.2	Fuzzy Neural Networks	98
3.3	Fuzzy Inference Neural Networks	101
4	Neuro-Fuzzy Architectures	
	Based on the Mamdani Approach	105
4.1	Basic Architectures	105
4.2	General Form of the Architectures	109
4.3	Systems with Inference Based on Bounded Product	114
4.4	Simplified Architectures	116
4.5	Architectures Based on Other Defuzzification Methods	119
4.5.1	COS-Based Architectures	119
4.5.2	Neural Networks as Defuzzifiers	122
4.6	Architectures of Systems with Non-Singleton Fuzzifier	124
5	Neuro-Fuzzy Architectures	
	Based on the Logical Approach	127
5.1	Mathematical Descriptions of Implication-Based Systems	127
5.2	NOCFS Architectures	133
5.3	OCFS Architectures	136
5.4	Performance Analysis	145
5.5	Computer Simulations	157
5.5.1	Function Approximation	157
5.5.2	Control Examples	158
5.5.3	Classification Problems	160
6	Hybrid Learning Methods	165
6.1	Gradient Learning Algorithms	165
6.1.1	Learning of Fuzzy Systems	166
6.1.2	Learning of Neuro-Fuzzy Systems	171
6.1.3	FLiNN - Architecture Based Learning	174
6.2	Genetic Algorithms	175
6.2.1	Basic Genetic Algorithm	175
6.2.2	Evolutionary Algorithms	181

6.3	Clustering Algorithms	185
6.3.1	Cluster Analysis	185
6.3.2	Fuzzy Clustering	189
6.4	Hybrid Learning	191
6.4.1	Combinations of Gradient Methods, GAs, and Clustering Algorithms	192
6.4.2	Hybrid Algorithms for Parameter Tuning	194
6.4.3	Rule Generation	195
6.5	Hybrid Learning Algorithms for Neuro-Fuzzy Systems	198
6.5.1	Examples of Hybrid Learning Neuro-Fuzzy Systems	199
6.5.2	Description of Two Hybrid Learning Algorithms for Rule Generation	201
6.5.3	Medical Diagnosis Applications	204
7	Intelligent Systems	209
7.1	Artificial and Computational Intelligence	209
7.2	Expert Systems	212
7.2.1	Classical Expert Systems	212
7.2.2	Fuzzy and Neural Expert Systems	214
7.3	Intelligent Computational Systems	217
7.4	Perception-Based Intelligent Systems	220
8	Summary	229
	List of Figures	233
	List of Tables	239
	References	241



<http://www.springer.com/978-3-7908-1438-5>

Neuro-Fuzzy Architectures and Hybrid Learning

Rutkowska, D.

2002, XIII, 288 p., Hardcover

ISBN: 978-3-7908-1438-5

A product of Physica-Verlag Heidelberg