

Contents

A Genetic Programming Approach to Cost-Sensitive Control in Wireless Sensor Networks	1
Afsoon Yousefi Zowj, Josh C. Bongard and Christian Skalka	
1 Introduction	1
1.1 Related Work	3
1.2 Organization of the Chapter	4
2 Methods	5
2.1 Problem Formalization	5
2.2 General Genetic Programming Approach	6
2.3 Non-hierarchical GP	8
2.4 Hierarchical GP	8
3 Results	12
3.1 Synthesized Data	12
3.2 Actual Data	14
4 Adapting to Dynamic Budgets	16
4.1 Problem Formalization	17
4.2 Methods	19
4.3 Results	21
5 Discussion	25
5.1 Basic Results with a Static Budget	25
5.2 Results with a Dynamic Budget	27
6 Conclusion and Future Work	29
References	30
A Study on Performance of Hill Climbing Heuristic Method for Router Placement in Wireless Mesh Networks	33
Evjola Spaho, Alda Xhafa, Donald Elmazi, Fatos Xhafa and Leonard Barolli	
1 Introduction	34
2 Application Scenarios of WMNs	35
2.1 Neighboring Community Networks	35

2.2	Corporate Networks	36
2.3	Metropolitan Area Networks	36
2.4	Other Scenarios	36
3	Mesh Router Nodes Placement Problem in WMNs	36
4	Resolution Methods for Solving Nodes Placement Problem	38
4.1	Exact Algorithms	38
4.2	Local Search Algorithms	38
5	Web Interface for Simulating Mesh Router Nodes Placement	40
5.1	Use Cases	41
6	Simulation Results	42
7	Conclusions	47
	References	47

An Automated Irrigation System Based on a Low-Cost Microcontroller for Tomato Production in South India 49

Prabu Mohandas, Arun Kumar Sangaiah, Ajith Abraham and Jerline Sheebha Anni

1	Introduction	50
2	System Design	53
2.1	Sensing and Control	54
2.2	FLC Based Data Logging and Wireless Controller	55
2.3	Fuzzy Experts and Interference System	56
3	Experimental Setup	59
3.1	Components and Usages	60
3.2	Design and Operation of Sensor Unit	61
3.3	Design and Operation of Server Unit	63
4	Results and Discussion	64
5	Conclusion	70
	References	70

Artificial Neural Network Based Real-Time Urban Road Traffic State Estimation Framework 73

Ayalew Belay Habtie, Ajith Abraham and Dida Midekso

1	Introduction	74
2	Road Traffic State Estimation System	76
2.1	Traffic Data Collection Component	77
2.2	Data Cleaning and Preprocessing	78
2.3	Data Analysis	79
2.4	Model Identification and Optimization	81
2.5	Road Traffic State Estimation	83
2.6	Results and Evaluation	85
3	Framework Application	85
3.1	Test Urban Road Network	86
3.2	Data Preparation	87
3.3	Neural Network Training	90

3.4	Evaluation	91
3.5	Results Based on Simulation Data	92
3.6	Results Based on Real A-GPS Data	92
4	State Estimates of Road Links	93
5	Summary	94
	References	95
	Attack Detection Using Evolutionary Computation	99
	Martin Stehlik, Vashek Matyas and Andriy Stetsko	
1	Introduction	99
2	Related Work	101
2.1	Selective Forwarding and Delay Attacks	101
2.2	Computational Intelligence-Based Solutions	101
3	Intrusion Detection	102
3.1	Selective Forwarding Attack	103
3.2	Delay Attack	103
3.3	Detection Techniques	103
3.4	Non-collaborative Detection of Selective Forwarding Attack	104
3.5	Collaborative Detection of Selective Forwarding Attack	106
3.6	Collaborative Detection of Delay Attack	107
4	Computational Intelligence-Based Optimization	108
4.1	Simulator	108
4.2	Evolutionary Algorithms	109
5	Attacker Strategies	111
5.1	Attacker Behavior	111
5.2	Deployment of Malicious Nodes	113
5.3	Number of Deployed Malicious Nodes	115
5.4	Robustness Evaluation of Optimized Solutions on Different Attacker Strategies	116
6	Experiment Settings	117
6.1	Application	117
6.2	Topology and Routing	117
6.3	IDS Parameters and Sampling	117
6.4	Evaluated Attacker Strategies	119
7	Experiment Results	119
7.1	Selective Forwarding Attack	119
7.2	Delay Attack	123
7.3	Robustness Evaluation	124
8	Conclusion	126
	References	127

Computational Intelligence Based Security in Wireless Sensor Networks: Technologies and Design Challenges		131
Pratik Ranjan and Hari Om		
1	Introduction	131
2	Wireless Sensor Networks	132
2.1	Types of WSNs	133
2.2	Applications of WSNs	133
2.3	Security Issues in WSNs	134
3	Computational Intelligence	135
3.1	Types of Computational Intelligence Techniques	135
3.2	Applications of CI	139
4	CI-Based Secure Schemes for WSNs	140
4.1	Existing CI-Based Secure Schemes for WSNs	141
5	Results and Discussions	147
6	Conclusions and Future Research Directions	147
References		147
Efficient Anomaly Detection System for Video Surveillance Application in WWSN with Particle Swarm Optimization		153
S. Radha, S. Aasha Nandhini and R. Hemalatha		
1	Introduction	154
2	System Model	156
3	Efficient Anomaly Detection System	157
3.1	Background Modelling	157
3.2	Compressed Sensing	158
3.3	Particle Swarm Optimization	159
3.4	Mean Measurement Differencing Approach	160
4	Solar Energy Harvester	162
4.1	PV Panel Modeling	162
4.2	MPPT Converter	163
4.3	Simulation Results of PVEH	165
4.4	Energy Harvested by PVEH	168
5	Performance Evaluation	169
5.1	Detection Accuracy	172
5.2	Energy Analysis	172
5.3	Network Lifetime	173
6	Conclusion and Scope for Future Work	175
References		176
Planning Robust Sensor Relocation Trajectories for a Mobile Robot with Evolutionary Multi-objective Optimization		179
Benjamin Desjardins, Rafael Falcon, Rami Abielmona and Emil Petriu		
1	Introduction	180
2	Related Work	182
2.1	Robot-Assisted Sensor Relocation	182

2.2	Related Optimization Problems	184
2.3	Risk-Driven Detection of Damaged Sensors	185
3	RMF for Sensor Fault Detection	186
3.1	Data Features	186
3.2	Risk Features	187
3.3	Risk Assessment Module	188
4	RRASR: A Multi-objective RASR Formulation	188
5	EMOO Algorithms for RRASR	190
5.1	Solution Encoding	191
5.2	Objective Functions	191
5.3	Population Initialization	191
5.4	Evolutionary Operators	191
5.5	Infeasibility Handling	193
5.6	Stop Criteria	195
6	Experimental Results	195
6.1	Experimental Setup	195
6.2	Experiment 1: Scalability Analysis	198
6.3	Experiment 2: Inflicted Damage Analysis	201
6.4	Experiment 3: Network Density Analysis	204
7	Conclusions	208
	References	208

Computational Intelligence in Wireless Sensor Networks

Recent Advances and Future Challenges

Abraham, A.; Falcon, R.; Koeppen, M. (Eds.)

2017, XV, 210 p. 91 illus., Hardcover

ISBN: 978-3-319-47713-8