

Contents

1	Introduction	1
	References	4
2	Reinforcement Learning	7
2.1	Applications of Reinforcement Learning	11
2.1.1	Benchmark Problems	11
2.1.2	Games	14
2.1.3	Real-World Applications	14
2.1.4	Generalized Domains	16
2.2	Components of Reinforcement Learning	17
2.2.1	Domains	17
2.2.2	Representations	23
2.2.3	Learning Algorithms	29
2.3	Heuristics and Performance Effectors	38
2.3.1	Heuristics for Reinforcement Learning	38
	References	42
3	Design of Experiments	53
3.1	Classical Design of Experiments	55
3.2	Contemporary Design of Experiments	59
3.3	Design of Experiments for Empirical Algorithm Analysis	63
	References	64
4	Methodology	67
4.1	Sequential CART	67
4.1.1	CART Modeling	68
4.1.2	Sequential CART Modeling	69
4.1.3	Analysis of Sequential CART	75
4.1.4	Empirical Convergence Criteria	76
4.1.5	Example: 2-D 6-hump Camelback Function	78
4.2	Kriging Metamodeling	82
4.2.1	Kriging	83
4.2.2	Deterministic Kriging	84

4.2.3	Stochastic Kriging	85
4.2.4	Covariance Function	86
4.2.5	Implementation.....	88
4.2.6	Analysis of Kriging Metamodels	89
	References	92
5	The Mountain Car Problem	95
5.1	Reinforcement Learning Implementation	95
5.2	Sequential CART.....	97
5.2.1	Convergent Subregions	98
5.3	Response Surface Metamodeling.....	101
5.4	Discussion	107
	References	109
6	The Truck Backer-upper Problem.....	111
6.1	Reinforcement Learning Implementation	112
6.2	Sequential CART.....	114
6.2.1	Convergent Subregions	116
6.3	Response Surface Metamodeling.....	120
6.4	Discussion	122
	References	126
7	The Tandem Truck Backer-Upper Problem	129
7.1	Reinforcement Learning Implementation	131
7.2	Sequential CART.....	133
7.2.1	Convergent Subregions	134
7.3	Discussion	137
	References	139
8	Discussion	141
8.1	Reinforcement Learning	141
8.1.1	Parameter Effects	142
8.1.2	Neural Network	145
8.2	Experimentation	146
8.2.1	Sequential CART	148
8.2.2	Stochastic Kriging	149
8.3	Innovations	150
8.4	Future Work	152
	References	154
	Appendix A Parameter Effects in the Game of Chung Toi	157
A.1	Introduction	157
A.2	Methodology	158
A.2.1	Chung Toi	158
A.2.2	The Reinforcement Learning Method	158

A.2.3 The Environment Model	159
A.2.4 The Agent Model	160
A.2.5 Training and Performance Evaluation Methods	161
A.2.6 Experiments	162
A.3 Results	164
A.3.1 Individual Experiments	164
A.3.2 Optimal Experiments	167
A.4 Discussion	168
A.5 Conclusion	169
References	169
Appendix B Design of Experiments for the Mountain Car Problem	171
B.1 Introduction	171
B.2 Methodology	172
B.2.1 Mountain Car Domain	172
B.2.2 Agent Representation	172
B.2.3 Experimental Design and Analysis	174
B.3 Results	174
B.4 Discussion	176
References	177
Appendix C Supporting Tables	179
Glossary	189