

Arthur K. Kordon



Applying Computational Intelligence

How to Create Value



Springer

Contents

Part I Computational Intelligence in a Nutshell

1.	Artificial vs. Computational Intelligence	3
1.1	Artificial Intelligence: The Pioneer	4
1.2	Computational Intelligence: The Successor	22
1.3	Key Differences Between AI and CI	27
1.4	Summary	29
	Suggested Reading	30
2.	A Roadmap Through the Computational Intelligence Maze	31
2.1	Strengths and Weaknesses of CI Approaches	31
2.2	Key Scientific Principles of Computational Intelligence	42
2.3	Key Application Areas of Computational Intelligence	45
2.4	Summary	50
	Suggested Reading	50
3.	Let's Get Fuzzy	51
3.1	Fuzzy Systems in a Nutshell	51
3.2	Benefits of Fuzzy Systems	60
3.3	Fuzzy Systems Issues	62
3.4	How to Apply Fuzzy Systems	63
3.5	Typical Applications of Fuzzy Systems	65
3.6	Fuzzy Systems Marketing	68
3.7	Available Resources for Fuzzy Systems	70
3.8	Summary	71
	Suggested Reading	72
4.	Machine Learning: The Ghost in the Learning Machine	73
4.1	Neural Networks in a Nutshell	76
4.2	Support Vector Machines in a Nutshell	84
4.3	Benefits of Machine Learning	91

4.4	Machine Learning Issues	96
4.5	How to Apply Machine Learning Systems	97
4.6	Typical Machine Learning Applications	105
4.7	Machine Learning Marketing	108
4.8	Available Resources for Machine Learning	111
4.9	Summary	112
	Suggested Reading	113
5.	Evolutionary Computation: The Profitable Gene	115
5.1	Evolutionary Computation in a Nutshell	116
5.2	Benefits of Evolutionary Computation	128
5.3	Evolutionary Computation Issues	130
5.4	How to Apply Evolutionary Computation	130
5.5	Typical Applications of Evolutionary Computation	136
5.6	Evolutionary Computation Marketing	141
5.7	Available Resources for Evolutionary Computation	142
5.8	Summary	143
	Suggested Reading	144
6.	Swarm Intelligence: The Benefits of Swarms	145
6.1	Swarm Intelligence in a Nutshell	146
6.2	Benefits of Swarm Intelligence	157
6.3	Swarm Intelligence Issues	159
6.4	How to Apply Swarm Intelligence	160
6.5	Typical Swarm Intelligence Applications	166
6.6	Swarm Intelligence Marketing	171
6.7	Available Resources for Swarm Intelligence	173
6.8	Summary	173
	Suggested Reading	174
7.	Intelligent Agents: The Computer Intelligence Agency (CIA)	175
7.1	Intelligent Agents in a Nutshell	176
7.2	Benefits of Intelligent Agents	186
7.3	Intelligent Agents Issues	189
7.4	How to Apply Intelligent Agents	190
7.5	Typical Applications of Intelligent Agents	193
7.6	Intelligent Agents Marketing	196
7.7	Available Resources for Intelligent Agents	199
7.8	Summary	199
	Suggested Reading	200

Part II Computational Intelligence Creates Value

8.	Why We Need Intelligent Solutions	203
8.1	Beat Competition	204

8.2	Accelerate Innovations	207
8.3	Produce Efficiently	210
8.4	Distribute Effectively	212
8.5	Impress Customers	215
8.6	Enhance Creativity	217
8.7	Attract Investors	220
8.8	Improve National Defense	222
8.9	Protect Health	225
8.10	Have Fun	228
8.11	Summary	231
	Suggested Reading	231
9.	Competitive Advantages of Computational Intelligence	233
9.1	Competitive Advantage of a Research Approach	233
9.2	Key Competitive Approaches to Computational Intelligence	237
9.3	How Computational Intelligence Beats the Competition	247
9.4	Summary	255
	Suggested Reading	256
10.	Issues in Applying Computational Intelligence	257
10.1	Technology Risks	257
10.2	Modeling Fatigue	261
10.3	Looks Too Academic	263
10.4	Perception of High Cost	265
10.5	Missing Infrastructure	267
10.6	No Marketing	269
10.7	Wrong Expectations	271
10.8	No Application Methodology	274
10.9	Summary	275
	Suggested Reading	276

Part III Computational Intelligence Application Strategy

11.	Integrate and Conquer	279
11.1	The Nasty Reality of Real-World Applications	280
11.2	Requirements for Successful Real-World Applications	282
11.3	Why Integration Is Critical for Real-World Applications	284
11.4	Integration Opportunities	287
11.5	Integrated Methodology for Robust Empirical Modeling	294
11.6	Integrated Methodology in Action	301
11.7	Summary	309
	Suggested Reading	309
12.	How to Apply Computational Intelligence	311
12.1	When Is Computational Intelligence the Right Solution?	311

12.2	Obstacles in Applying Computational Intelligence	313
12.3	Methodology for Applying CI in a Business	316
12.4	Computational Intelligence Project Management	322
12.5	CI for Six Sigma and Design for Six Sigma	331
12.6	Summary	340
	Suggested Reading	341
13.	Computational Intelligence Marketing	343
13.1	Research Marketing Principles	343
13.2	Techniques – Delivery, Visualization, Humor	348
13.3	Interactions Between Academia and Industry	359
13.4	Marketing CI to a Technical Audience	363
13.5	Marketing to a Nontechnical Audience	369
13.6	Summary	372
	Suggested Reading	373
14.	Industrial Applications of Computational Intelligence	375
14.1	Applications in Manufacturing	375
14.2	Applications in New Product Development	390
14.3	Unsuccessful Computational Intelligence Applications	401
14.4	Acknowledgements	403
14.5	Summary	403
	Suggested Reading	403
Part IV The Future of Computational Intelligence		
15.	Future Directions of Applied Computational Intelligence	407
15.1	Supply–Demand-Driven Applied Research	407
15.2	Next-Generation Applied Computational Intelligence	413
15.3	Projected Industrial Needs	425
15.4	Sustainability of Applied Computational Intelligence	431
15.5	Summary	433
	Suggested Reading	434
	Glossary	435
	Index	447