## Contents

Acknowledgments x About the editors xi

	Introduction xiv	
	Part I The state of the practice	
1	An overview of intelligent systems technology Paul E. Lehner	3
2	The development of artificial intelligence V. Daniel Hunt	52
3	Lessons learned building expert systems A. Terry Bahill, Pat N. Harris, and Erich Senn	60
4	Validating expert system performance Robert O'Keefe, Osman Balci and Eric P. Smith	70
	Part II Tools and techniques	
5	Knowledge acquisition for expert systems: Some pitfalls and suggestions Ciana E. Forsythe and Bruce G. Buchanan	85
6	The knowledge acquisition activity matrix: A systems engineering conceptual framework Frederick W. Rook and Joseph W. Croghan	99

7 Knowledge representation in the real world 120 Steven Salzberg

	with	lding knowledge-based systems h procedural languages Butler, E.D. Hodil and G.L. Richardson	127
	9 Con Peter	C. Coffee and Daryll J. Strauss	138
1		v to choose natural language software Rettig and Madeleine Bates	146
		Part III Application areas	
Se	ection A	A. Applications in manufacturing and design	ı
11		ine expert systems in process industries on A. Rowan	165
12	for e	EP: An expert system lectric power plant design Jansen and Hans B. Püttgen	176
13	desig	wledge-based computer-aided on of materials handling systems Gabbert and Donald E. Brown	189
Sec	tion B.	Intelligent computer-assisted instructional systems	
14		igent computer-aided instruction: A y organized around system components Rickel	205
15		apert system for instructional design	235
16	A tuto	gent tutoring systems: orial survey J. Clancey	250

1

## Section C. Defense applications of artificial intelligence

17	Artificial intelligence and simulation: An application to logistics modeling Gerald W. Hopple	283
18	AALPS: A knowledge-based system for aircraft loading Debra Anderson and Charles Oritz	298
19	Expert system technology for the military: Selected examples Jude E. Franklin, Cora Lackey Carmody, Karl Keller, Tod S. Levitt and Brandon L. Buteau	308
20	Artificial intelligence for national defense: Real, imagined and likely applications Stephen J. Andriole	351
Sec	tion D. Financial applications of intelligent systems technology	
21	The Citibank pension expert Jessica Keyes	363
22	INVEST: An expert system for financial investments Stephen Heuer, Ulrich Koch and Colin Cryer	368
Sec	tion E. Applications in robotics	
23	Mobile robots: Real-time intelligent control of mobile robots Louis S. McTamaney	381
24	Ambler: An autonomous rover for planetary exploration John Bares, Martial Hebert, Takeo Kanade, Eric Krotkov, Tom Mitchell, Reid Simmons and William Whittaker	395

S	Section F. Applied natural language	
2	25 The natural language-database connection David Sedlock	407
2	6 KID: Designing a knowledge-based natural language interface H. Ishikawa, Y. Izumida, T. Hoshiai and A. Makinouchi	421
2	7 The intelligent assistant Gary G. Hendrix and Brett A. Walter	441
Se	ection G. Artificial intelligence and the airline indu	ıstry
28	8 Globe-trotter: An intelligent flight itinerary planner Prasanta K. Bose, Gautam Biswas and Adithya M. Rao Padala	455
29	GATES: An airline gate assignment and tracking expert system Robert P. Brazile and Kathleen M. Swigger	470
Se	ction H. Artificial intelligence and the legal syster	n
30		481
31	A case-based approach to modeling legal expertise Kevin D. Ashley and Edwina L. Rissland	486
32	The potential of artificial intelligence to help solve the crisis in the legal system Donald H. Berman and Carole D. Hafner	497
Sect	tion I. Knowledge-based software engineering	
33	KBRA: A new paradigm for requirements engineering Andrew J. Czuchry, Jr. and David R. Harris	519

34	Knowledge-based support for rapid software prototyping <i>Luqi</i>	530
35	<b>Design of knowledge-based systems</b> with a knowledge-based assistant <i>Eric Schoen, Reid G. Smith and Bruce G. Buchanan</i>	539
	Part IV Issues, challenges and new frontiers	
36	Why expert systems do not exhibit expertise Hubert and Stuart Dreyfus	573
37	Artificial intelligence and computable problems Stephen J. Andriole	582
38	Artificial intelligence today Gian-Carlo Rota	594
39	<b>Psychology today and</b> <b>artificial intelligence tomorrow</b> <i>Gerald W. Hopple</i>	601
40	How evaluation guides AI research Paul R. Cohen and Adele E. Howe	621
41	Neurocomputing: Picking the human brain Robert Hecht-Nielson	636
42	Foundations and grand challenges of artificial intelligence Raj Reddy	644
	Index	666