

Contents

	Preface to the Fourth Edition	vii
	Preface to the Third Edition	xi
	Preface to the Second Edition	xv
	Preface to the First Edition	xix
	Introduction	1
1	Basic Techniques	17
1.1	Intuitive Compression	17
1.2	Run-Length Encoding	22
1.3	RLE Text Compression	23
1.4	RLE Image Compression	27
1.5	Move-to-Front Coding	37
1.6	Scalar Quantization	40
1.7	Recursive Range Reduction	42
2	Statistical Methods	47
2.1	Information Theory Concepts	48
2.2	Variable-Size Codes	54
2.3	Prefix Codes	55
2.4	Tunstall Code	61
2.5	The Golomb Code	63
2.6	The Kraft-MacMillan Inequality	71
2.7	Shannon-Fano Coding	72
2.8	Huffman Coding	74
2.9	Adaptive Huffman Coding	89
2.10	MNP5	95
2.11	MNP7	100
2.12	Reliability	101
2.13	Facsimile Compression	104
2.14	Arithmetic Coding	112

2.15	Adaptive Arithmetic Coding	125
2.16	The QM Coder	129
2.17	Text Compression	139
2.18	PPM	139
2.19	Context-Tree Weighting	161
3	Dictionary Methods	171
3.1	String Compression	173
3.2	Simple Dictionary Compression	174
3.3	LZ77 (Sliding Window)	176
3.4	LZSS	179
3.5	Repetition Times	182
3.6	QIC-122	184
3.7	LZX	187
3.8	LZ78	189
3.9	LZFG	192
3.10	LZRW1	195
3.11	LZRW4	198
3.12	LZW	199
3.13	LZMW	209
3.14	LZAP	212
3.15	LZY	213
3.16	LZP	214
3.17	Repetition Finder	221
3.18	UNIX Compression	224
3.19	GIF Images	225
3.20	RAR and WinRAR	226
3.21	The V.42bis Protocol	228
3.22	Various LZ Applications	229
3.23	Deflate: Zip and Gzip	230
3.24	LZMA and 7-Zip	241
3.25	PNG	246
3.26	XML Compression: XMill	251
3.27	EXE Compressors	253
3.28	CRC	254
3.29	Summary	256
3.30	Data Compression Patents	256
3.31	A Unification	259

4	Image Compression	263
4.1	Introduction	265
4.2	Approaches to Image Compression	270
4.3	Intuitive Methods	283
4.4	Image Transforms	284
4.5	Orthogonal Transforms	289
4.6	The Discrete Cosine Transform	298
4.7	Test Images	333
4.8	JPEG	337
4.9	JPEG-LS	354
4.10	Progressive Image Compression	360
4.11	JBIG	369
4.12	JBIG2	378
4.13	Simple Images: EIDAC	389
4.14	Vector Quantization	390
4.15	Adaptive Vector Quantization	398
4.16	Block Matching	403
4.17	Block Truncation Coding	406
4.18	Context-Based Methods	412
4.19	FELICS	415
4.20	Progressive FELICS	417
4.21	MLP	422
4.22	Adaptive Golomb	436
4.23	PPPM	438
4.24	CALIC	439
4.25	Differential Lossless Compression	442
4.26	DPCM	444
4.27	Context-Tree Weighting	449
4.28	Block Decomposition	450
4.29	Binary Tree Predictive Coding	454
4.30	Quadrees	461
4.31	Quadrisection	478
4.32	Space-Filling Curves	485
4.33	Hilbert Scan and VQ	487
4.34	Finite Automata Methods	497
4.35	Iterated Function Systems	513
4.36	Cell Encoding	529

5	Wavelet Methods	531
5.1	Fourier Transform	532
5.2	The Frequency Domain	534
5.3	The Uncertainty Principle	538
5.4	Fourier Image Compression	540
5.5	The CWT and Its Inverse	543
5.6	The Haar Transform	549
5.7	Filter Banks	566
5.8	The DWT	576
5.9	Multiresolution Decomposition	589
5.10	Various Image Decompositions	589
5.11	The Lifting Scheme	596
5.12	The IWT	608
5.13	The Laplacian Pyramid	610
5.14	SPIHT	614
5.15	CREW	626
5.16	EZW	626
5.17	DjVu	630
5.18	WSQ, Fingerprint Compression	633
5.19	JPEG 2000	639
6	Video Compression	653
6.1	Analog Video	653
6.2	Composite and Components Video	658
6.3	Digital Video	660
6.4	Video Compression	664
6.5	MPEG	676
6.6	MPEG-4	698
6.7	H.261	703
6.8	H.264	706
7	Audio Compression	719
7.1	Sound	720
7.2	Digital Audio	724
7.3	The Human Auditory System	727
7.4	WAVE Audio Format	734
7.5	μ -Law and A-Law Companding	737
7.6	ADPCM Audio Compression	742
7.7	MLP Audio	744
7.8	Speech Compression	750
7.9	Shorten	757
7.10	FLAC	762
7.11	WavPack	772
7.12	Monkey's Audio	783
7.13	MPEG-4 Audio Lossless Coding (ALS)	784
7.14	MPEG-1/2 Audio Layers	795
7.15	Advanced Audio Coding (AAC)	821
7.16	Dolby AC-3	847

8	Other Methods		851
8.1	The Burrows-Wheeler Method	853	
8.2	Symbol Ranking	858	
8.3	ACB	862	
8.4	Sort-Based Context Similarity	868	
8.5	Sparse Strings	874	
8.6	Word-Based Text Compression	885	
8.7	Textual Image Compression	888	
8.8	Dynamic Markov Coding	895	
8.9	FHM Curve Compression	903	
8.10	Sequitur	906	
8.11	Triangle Mesh Compression: Edgebreaker	911	
8.12	SCSU: Unicode Compression	922	
8.13	Portable Document Format (PDF)	928	
8.14	File Differencing	930	
8.15	Hyperspectral Data Compression	941	
	Answers to Exercises		953
	Bibliography		1019
	Glossary		1041
	Joining the Data Compression Community		1067
	Index		1069

Each memorable verse of a true poet has
two or three times the written content.

—Alfred de Musset

