DATA COMPRESSION

TECHNIQUES AND APPLICATIONS

THOMAS J. LYNCH, Ph.D.

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Preface

Data compression is no longer a theoretical curiosity—it is now a practical requirement in many data systems. With the advances in electronic technology, it is now possible to implement in hardware many data compression techniques that formerly were executed only on large-scale general-purpose digital computers.

In the last few years there has been a growing interest in applying data compression techniques to actual data and communication systems in the commercial seetor (compression of newspaper page masters for transmission), in the military (video compression for remotely piloted vehicles), and in many government agencies, such as NASA (image compression from spacecraft). In each potential application there is a need to learn what compression techniques are available, how they operate, and what the implementation considerations are for each technique.

This book is intended to provide this information and serve as a reference source for practicing communication engineers, computer scientists, information scientists, and data systems managers.

No experience in data compression is necessary in order to use this book since each compression technique is described separately and fully, and the necessary theoretical background is developed so that outside references are not needed.

The book is organized into three parts: Theoretical Background, Techniques, and Applications. Under *Theoretical Background*, the necessary theory is presented that allows the reader to understand the concepts and terminology used in later chapters. In addition, the fundamental data compression techniques of quantization and optimum source coding (e.g., the Huffman code) are described. Under *Techniques*, transform coding, predictive coding, nonredundant sample coding, and binary source coding are covered. Included also under *Techniques* are the practical implementation considerations of time coding, buffer control, error control, and system design. Under *Applications*, the use

of data compression in the real world of speech transmission, telemetry, television, pictures, and data bases is described. The examples of specific applications are meant to be typical and illustrative, but certainly not exhaustive.

Examples and exercises have been included under *Theoretical Background* and *Techniques* for study and self-practice by the reader. Annotated references are given at the end of each chapter that guide the reader to more theoretical developments and examples of practical implementations. These references have been carefully chosen so that they reinforce the presentation in the individual chapter, but as such they do not constitute a complete bibliography on data compression.

The material in this book has been used in a course of the same name given by the author as part of the George Washington University Continuing Engineering Education Program.

Thomas J. Lynch

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Contents

PART I THEORETICAL BACKGROUND

CHAPTER 1 Introduction to Data Compression Theory 3

1.1 What Is Data Compression? 3

1.2 Classes of Data Compression 4

1.3 Approach of Part I 7

Suggestions for Further Reading 8

CHAPTER 2 Entropy Reduction 10

2.1 Introduction 10

2.2 Continuous and Discrete Data Sources 11

2.3 The Concept of Information and Entropy 13

2.3.1 Discrete Source Entropy 13

2.3.2 Continuous Source Entropy 15

2.4 The Concept of Rate Distortion 16

2.5 Quantization 21

2.5.1 Zero-Memory Quantization 22

Input-Output Characteristics 22

Uniform Quantizer 25

Nonuniform Quantizers 28

Companding 30

2.5.2 Block Quantization 31
2.5.3 Sequential Quantization 32
2.5.4 Quantizers and Rate Distortion Bounds 35
2.5.5 Quantizer Comparison by SNR for Memoryless Sources 38

2.6 Other Entropy-Reduction Techniques 40

Highlights 40

Suggestions for Further Reading 41

CHAPTER 3 **Redundancy Reduction 44**

3.1 Introduction 44

3.2 The Source Model 45
3.2.1 Statistically Independent Samples 45
3.2.2 Markov-dependent Samples 45

3.3 Information, Entropy, and Redundancy 46
3.3.1 Information and Entropy 46
3.3.2 Redundancy 49

3.4 The Compression Ratio 51
3.4.1 The Upper Bound 51
3.4.2 Approaching the Upper Bound 52

3.5 Optimum Source Encoding 53
3.5.1 Shannon–Fano Code 53
3.5.2 The Huffman Code 55
3.5.3 The Morse Code 57

3.6 Other Redundancy-Reduction Techniques 57
3.6.1 Nonredundant Sample Codes 57
3.6.2 Binary Source Codes 58
3.6.3 Effect of Channel Noise 58

Highlights 59

Suggestions for Further Reading 59

PART II TECHNIQUES

CHAPTER 4 Introduction to Data Compression Techniques 63

4.1 Introduction 63

4.2 Four Basic Techniques 64

4.2.1 Transform Coding 64

4.2.2 Predictive Coding 65

4.2.3 Nonredundant Sample Coding 65

4.2.4 Binary Source Coding 65

4.3 Implementation Considerations 66

4.4 System Design Considerations 67

CHAPTER 5 Transform Coding 68

5.1 Introduction 68

5.2 Four Transforms 70

5.2.1 Principal Component Transform 70

5.2.2 Fourier Transform 75

5.2.3 Hadamard Transform 79

5.2.4 Haar Transform 82

5.3 Quantization for Transform Coding 85

5.4 Adaptive Transform Coding 87

5.4.1 Adaptive Sampling 87

5.4.2 Adaptive Transforms 87

5.4.3 Adaptive Quantization 88

Highlights 89

Suggestions for Further Reading 90

CHAPTER 6 Predictive Coding 92

6.1 Introduction 92

6.2 Prediction 92

6.3 Delta Modulation 94
6.3.1 Conventional Delta Modulation 95
6.3.2 Adaptive Delta Modulation 97
6.4 Differential Pulse Code Modulation (DPCM) 98
6.4.1 DPCM Operation 100
6.4.2 DPCM Design 101
Design of the DPCM Predictor 102
Design of the DPCM Quantizer 104
6.4.3 Adaptive DPCM 109
Adaptive Prediction 109
Adaptive Quantization 109
6.5 Block-to-Block Compression 112
Highlights 112
Suggestions for Further Reading 113

CHAPTER 7 Nonredundant Sample Coding 115
7.1 Introduction 115
7.2 Polynomial Predictors 116
7.2.1 The Zero-Order Predictor 118
Run-Length Coding 119
7.2.2 The First-Order Predictor 122
7.2.3 Comparison of Polynomial Predictors 124
7.3 Polynomial Interpolators 126
7.4 Statistical Predictors 128
Highlights 129
Suggestions for Further Reading 129

CHAPTER 8 Time and Binary Source Coding 131
8.1 Introduction 131
8.2 Mathematical Models for Time Information 133
8.2.1 Statistically Independent Symbol Model 134
8.2.2 Markov Model 135

8.3 Time Encoding Methods 138

8.3.1 Sequence Time Codes 139
Binary Sequence Codes 139
Lynch–Davisson Code 139

8.3.2 Time of Nonredundant Sample (TNRS) Codes 142
Standard TNRS Code 142
Modified TNRS Code (Cluster Code) 143

8.3.3 Run-Length Codes 144
Fixed-Length Code 144
Huffman Code 145
Binary Nonconsecutive One (BNO) Code 145

8.4 Comparison of Time Coding Methods 148

8.4.1 Statistically Independent Symbol Model 149
Sequence Time Codes 150
Time of Nonredundant Sample (TNRS) Codes 150
Run-Length Codes 151

8.4.2 Markov Symbol Model 153
Sequence Time Codes 153
Time of Nonredundant Sample (TNRS) Codes 153
Run-Length Codes 154

8.4.3 Conclusions 157

8.5 Binary Source Coding 164

8.5.1 Sequence Codes 164

8.5.2 TNRS Codes 167

8.5.3 Run-Length Codes 167

Highlights 168

Suggestions for Further Reading 169

CHAPTER 9 **Buffer Control 171**

9.1 Introduction 171

9.2 Mathematical Buffer Model 172

9.3 Buffer Size Estimation 175

9.4 Buffer Overflow Control 175

9.5 Buffer Underflow Control 178

Highlights 178

Suggestions for Further Reading 179

CHAPTER 10 Effects of Transmission Errors 180

10.1 Introduction 180

10.2 Compression Ratio and Distortion 181

10.2.1 The Uncompressed-Uncoded System 183

10.2.2 The Compressed-Uncoded System 184

10.2.3 The Compressed-Coded System 185

10.2.4 Use of the Performance Measures 186

10.3 Error Control for Transform Coding 187

10.4 Error Control for Predictive Coding 188

10.4.1 Noise Effects in Delta Modulation 188

10.4.2 Noise Effects in DPCM 191

10.4.3 Noise Effects in Block-to-Block Coding 195

10.5 Error Control for Nonredundant Sample Coding 195

10.5.1 General Case 196

10.5.2 An Example 198

Highlights 199

Suggestions for Further Reading 200

CHAPTER 11 System Design 201

11.1 Introduction 201

11.2 Entropy Reduction and Redundancy Reduction 202

Compression Ratio 202

Average Distortion 203

Complexity 204

11.3 Characteristics of Data Compression Techniques 204

11.3.1 Transform Coding 205

1. Timing Requirement 205

2. Buffer Requirement 205

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3. Inherent Distortion 205
4. Error Effects and Error Control 206
5. Actual Compression Ratio 206
11.3.2 Predictive Coding 207
1. Timing Requirement 207
2. Buffer Requirement 207
3. Inherent Distortion 208
4. Error Effects and Error Control 208
5. Actual Compression Ratio 209
11.3.3 Nonredundant Sample Coding 210
1. Timing Requirement 210
2. Buffer Requirement 210
3. Inherent Distortion 211
4. Error Effects and Error Control 211
5. Actual Compression Ratio 211
11.4 Compression Algorithm Selection 212
11.5 Cascaded Encoders 213
Highlights 214

PART III **APPLICATIONS**

CHAPTER 12 **Introduction to Data Compression Applications 217**
12.1 Introduction 217
12.2 Brief History of Data Compression Techniques 217
12.3 What to Compress and Why 218
12.4 The Approach and Contents of Part III 219
12.4.1 Speech Compression 220
12.4.2 Telemetry Compression 220
12.4.3 Television Compression 221
12.4.4 Picture Compression 221
12.4.5 Data Base Compression 221

CHAPTER 13 **Speech Compression 222**
13.1 Introduction 222
13.2 Speech As a Data Source 223

13.3 Waveform Coding 225

13.3.1 Time Domain Waveform Coding 225
Pulse Code Modulation (PCM) 226
Differential Pulse Code Modulation (DPCM) 226
Delta Modulation (DM) 227
A Comparison of PCM, Adaptive DPCM, and Adaptive DM 228
Adaptive Predictive Coding (APC) 229
Variable Speech Control (VSC) 230

13.3.2 Frequency Domain Waveform Coding 231
Subband Coding (SBC) 231
Adaptive Transform Coding (ATC) 232

13.4 Voice Coding 235

13.4.1 VOCODERS 235

13.4.2 Linear Predictive Coders (LPC) 239
LPC Parameters 241
Quantizing the LPC Parameters 242
Effect of Channel Errors on LPC Performance 243
Concatenation of Waveform Coders with LPC 243

13.5 Hardware Implementation of Speech Compression Techniques 243

Highlights 244

Suggestions for Further Reading 245

CHAPTER 14 **Telemetry Compression 249**

14.1 Introduction 249

14.2 Telemetry Characteristics 250

14.2.1 Channel Bandwidth 250

14.2.2 Time Dependence 250

14.2.3 Multiplexing vs. Packetizing 251

14.2.4 Error Control 251

14.3 Space Data Compression 252

14.3.1 Missile/Rocket Telemetry 252

14.3.2 Satellite Telemetry 252

14.4 Seismic Data Compression 254

14.5 Electrocardiogram Compression 256

Highlights 258

Suggestions for Further Reading 259

CHAPTER 15 Television Compression 262

15.1 Introduction 262

15.2 Television As an Information Source 263

15.3 Monochrome Video Compression 264

15.3.1 Transform Coding Techniques 265
Two-Dimensional Transforms 265
Three-Dimensional Transforms 265

15.3.2 Predictive Coding Techniques 266
Delta Modulation 267
DPCM 267
Two-Dimensional DPCM 268
Interframe Coding 268

15.3.3 Hybrid Coding 269

15.3.4 Slant Transform 270

15.3.5 Pseudorandom Techniques 271
Dithering 273
Pseudorandom Scanning 273

15.3.6 Slow-Scan Techniques 273

15.4 Color Video Compression 274

15.5 Remotely Piloted Vehicle (RPV) TV Compression 277

15.6 Teleconferencing TV Compression 278

15.7 Videotex/Teletext Compression 279

15.8 High-definition TV Compression 280

Highlights 281

Suggestions for Further Reading 281

CHAPTER 16 Picture Compression 285

16.1 Introduction 285

16.2 Two-Level Picture Compression 286

16.2.1 Two-Level Facsimile Compression 286

16.2.2 Newspaper Compression 288

16.3 Multilevel Picture Compression 289
16.3.1 Multispectral Image Compression 289
16.3.2 X-Ray Image Compression 291
16.3.3 Multilevel Facsimile 294
Highlights 294
Suggestions for Further Reading 294

CHAPTER 17 Data Base Compression 297
17.1 Introduction 297
17.2 What Is a Data Base? 298
17.2.1 Data Files 298
17.2.2 Indices and Directories 300
17.3 File Compression 301
17.3.1 Nonalphanumeric File Compression 301
17.3.2 Alphanumeric File Compression 302
17.4 Index Compression 305
Highlights 308
Suggestions for Further Reading 309

APPENDIX A An Introduction to Error-Control Coding 311
A.1 Error-Control Coding and Data Compression 311
A.2 Types of Error-Control Codes 312
A.3 Block Codes 313
A.4 Convolutional Codes 316
APPENDIX B Solutions to Problems 320
Glossary of Terms 324
Index 335

PART I

Theoretical Background

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