Preface

Compression schemes can be divided into two major classes: lossless compression schemes and lossy compression schemes. Data compressed using lossless compression schemes can be recovered exactly, while lossy compression introduces some loss of information in the reconstruction.

While the first modern compression scheme, Huffman coding, was a lossless compression scheme, most of the initial activity in the compression area focused on lossy compression. One reason was that the "data" being considered for compression was analog—primarily samples of speech waveforms. Another reason was that the device which would be used to provide the reconstructed speech to the user, namely, the telephone, introduced so much distortion of its own that it was relatively easy to design compression schemes which introduced less distortion than that to which the user was already being subjected.

In the past two decades the situation has changed dramatically. There is a significant amount of discrete data in the form of text, graphics, images, video, and audio that needs to be stored or transmitted, and display devices are of such quality that very little distortion can be tolerated. This has resulted in a resurgence of interest in lossless compression—hence this handbook. We have tried to put together, in an accessible form, some of the most important aspects of lossless compression. The idea was to have a volume which would allow the reader to get an idea of both the depth and the breadth of the field while at the same time fulfilling the usual function of a handbook—that of being a convenient repository of information about a topic. This combination will, we hope, be useful to both the novice reader who wishes to learn more about the subject, as well as the practitioner who needs an accessible reference book.

This book consists of 21 chapters roughly divided into five sections. Each chapter is relatively self-contained. The first 2 chapters provide the theoretical underpinnings of many lossless compression schemes. These include the classical approach based on information theory and an approach fast gaining in popularity based on the ideas of Kolmogorov complexity. The chapters in the next set are devoted to well-known (and some not so well-known) methods of variable-length coding. These coding techniques are not application specific and thus have been used in a number of application areas. Chapters in the third section are devoted to particular application areas. These include text, audio, and image compression, as well as the new area of delta compression. In these chapters we describe how the various coding techniques have been used in conjunction with models which are specific to the particular application to provide lossless compression. The chapters in the fourth group describe various international standards that involve lossless compression in a variety of applications. These include standards issued by various international bodies as

well as de facto standards. The final chapter examines hardware implementations of compression algorithms.

While, of necessity, we have introduced an ordering in the chapters, there was no pedagogical intent behind the ordering. Readers can delve into any chapter independent of the other chapters. Because these chapters are self-contained, certain topics may be covered more than once. We see this as a feature rather than a bug, as the diversity of writing styles provides the reader with multiple views of these topics.

As I have read through these chapters I have been impressed by both the knowledge of the authors and by the care they have taken to make this knowledge accessible. Among these chapters are some of the best expositions on complex subjects that I have seen. I hope the readers will agree.

I am grateful to the authors for the quality of their work and for giving me the opportunity to be associated with their work. My thanks also to Joel Claypool and Lori Asbury for their help and their support through a period of some turmoil in their corner of the publishing industry.

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