

Data Compression

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August 6, 2002

1 Abstract

The course details various data compression techniques used on various environments. It explores different data compression methods, explaining the theory behind each and showing how compression algorithms significantly increase the storage capacity of their system. Each technique is fully illustrated and discussed.

2 Topics

2.1 Introduction

- Statistic codes and dictionary codes.
- Static codes and adaptive codes.
- Lossless codes and lossy codes.
- Run-length coding.
- The prefix property.
- Shannon-Fano coding.

2.2 Huffman code

- The Huffman coder's algorithm.
- Implementation.
- Optimality of Huffman code.
- Static Huffman and Adaptive Huffman.
- Canonical Huffman Trees.

- Errors in Huffman codes.
- Markov chain of Huffman trees (Bookstein-Klein's method).

2.3 Arithmetic coding

- The Arithmetic coder's algorithm.
- The scaling procedure.
- Optimality of Arithmetic coding.
- Evaluation of Arithmetic coding.
- Quasi Arithmetic coding
- Errors in Arithmetic coding.

2.4 Lempel & Ziv's methods

- LZ77.
- LZSS.
- LZR.
- LZH.
- ZIP, GZIP.
- LZ78.
- LZW.
- The "compress" command in UNIX.

2.5 Burrows-Wheeler Transform

- Burrows-Wheeler's algorithm.
- Burrows-Wheeler's decoding.
- "Move to front" algorithm.
- How does Burrows-Wheeler use Run-length coding.
- Burrows-Wheeler Transform - pro & con.
- Comparison of lossless methods.

2.6 JPEG

- Introduction to lossy methods.
- DCT.
- Quantization.
- JPEG's entropy encoder.
- Errors in JPEG.
- Color Images.
- Progressive Modes.
- Quality.

3 Bibliography

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