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Acknowledgment

Dank aan mezelf

Dank aan een ander

Abstract

Testabstract. Omschrijf hier je thesis.

The thesis should contain an abstract in Dutch *and* in English. You should aim for anywhere between 500 and 1500 words (per abstract).

Trefwoorden: latex, thesis, stijl

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Acronyms

AEC Adaptive Entropy Coder. 4

CCSDS Consultative Committee for Space Data Systems. 4, 5

DWT discrete wavelet transform. 5

FAPEC Fully Adaptive Prediction Error Coding. 5

FELICS Fast and Efficient Lossless Image Compression. 5

PEC prediction error coding. 5

UDP Unit-Delay Predictor. 4

Chapter 1

Introduction

Chapter 2

Analyse

Chapter 3

State of the art

3.1 CCSDS

The Consultative Committee for Space Data Systems (CCSDS) is an international organisation of space agencies that formulate solutions for common problems in the development and operation of space data systems [1]. These solutions are called "Recommended Standards". The standards most related to this assignment are discussed below.

3.1.1 CCSDS 121.0-b-3

The CCSDS 121.0-b-3 recommended standard from august 2020 [2] is a lossless source coding data compression algorithm. It consists of two stages, the first stage being a preprocessor and the second stage an Adaptive Entropy Coder (AEC).

The preprocessor's role is to convert the data by decorrelating and converting it into nonnegative integers with the preferred probability distribution. For the AEC a probability distribution approaching Laplacian is optimal. The preprocessor presented in this recommended standard is the Unit-Delay Predictor (UDP). This technique predicts the current sample using the one-sample delayed input data signal, this is illustrated in figure 3.1.

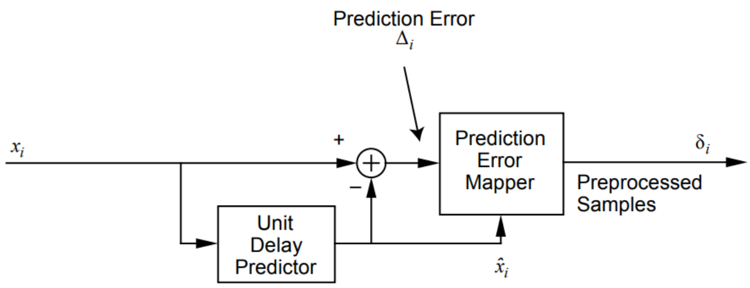

Figure 3.1: Unit-Delay Predictor (UDP) [2]

3.1.2 CCSDS 122.0-b-2

The CCSDS 1212.0-b-2 recommended standard from september 2017 [3] is an image compression algorithm.

3.1.3 Tests

3.2 FAPEC

3.2.1 Algorithm

Fully Adaptive Prediction Error Coding (FAPEC) was developed by Portell, Villafranca and García-Berro [4] as a way to overcome the problems of the CCSDS 121.0 Lossless Data Compression Recommendation. The idea behind FAPEC was designing an algorithm that is capable of dealing with noise and outliers [5]. It was made fully adaptive to automatically calibrate the algorithm to the statistics of the data, thus adapting to changes in the data distribution and becoming an completely autonomous coder.

The algorithm itself consists of a pre-processing (or decorrelation) stage followed by a coding stage [4]. The pre-processing stage is oiften implemented by a data prediction algorithm or a transform such as the discrete wavelet transform (DWT). In general this stage generates one output value for each input value. The FAPEC core performs a statistical analysis on all individual prediction error blocks, identifying the morst effective coding tables and finally calling the prediction error coding (PEC) kernel, which produces a variable-length codefor each of the values to be coded. PEC

A more in-depth description of the algorithm can be found in [4–6].

3.2.2 Tests

3.3 FELICS

3.3.1 Algorithm

Fast and Efficient Lossless Image Compression (FELICS) is a technique presented by Paul G. Howard and Jeffrey Scott Vitter [7]. Each pixel is assigned a code depending on where its intensity (grey-scale value) is located relative to the intensities of its closest neighbours. The distribution of an image's intensity distribution is shown in figure 3.2. L denotes the smaller neighbouring intensity value, H denotes the larger neighbouring intensity value. There are three cases:

1. The pixel's intensity P lies in the range [L, H]. One bit (0) is used to indicate the in-range position. Since the values of P are almost uniformly distributed, P is assigned

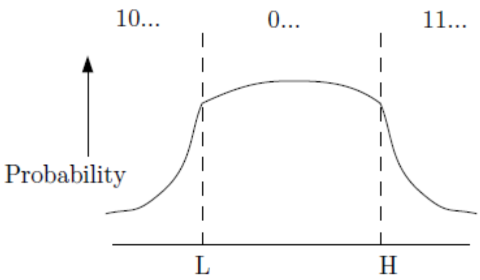

Figure 3.2: Intensity distribution of new pixel [7]

an adjusted binary code that is slightly shorter at the centre of the region [8].

2. The pixel's intensity P is lower than L. Now, one bit (1) is used to indicate the out-of-range position, and one bit (0) is used to indicate the below-range position.

3. The pixel's intensity P is higher than H. Now, one bit (1) is used to indicate the out-of-range position, and one bit (1) is used to indicate the above-range position.

The probability of out-of-range values falls off sharply, making it reasonable to use exponential prefix codes like Golomb or Rice codes [7]. A formal description of the algorithm can be found in [7].

3.3.2 Tests

3.4 mijn eigen ding

3.4.1 Algorithm

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3.5 Hardware versus software-implementation

3.6 Conclusion

Chapter 4

Design

Chapter 5

Realisation

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Evaluation

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