Image Compression Using a Modified SPIHT Algorithm and Linear Prediction

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July 29, 1999

Overview

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- Summary

Introduction

- model aircraft
  - length: 2.72 m, wingspan: 3.02 m
  - performance: 2 boxerengines
  - navigation: GPS, inertial, b/w camera

Problem

- JPEG image compression
  - blocking artifacts at low bitrates

- wavelet-based image compression (EZW, SPIHT)
  - coefficients can be accessed by the algorithm at any time
  - entire image is to be located in memory
  - high memory requirements (more than 2 Mbit at 256 x 256 pixels)
  - transmission time delay

Review: SPIHT

- wavelet coefficients represent edges and smooth areas

- much information is contained in the position of coefficients

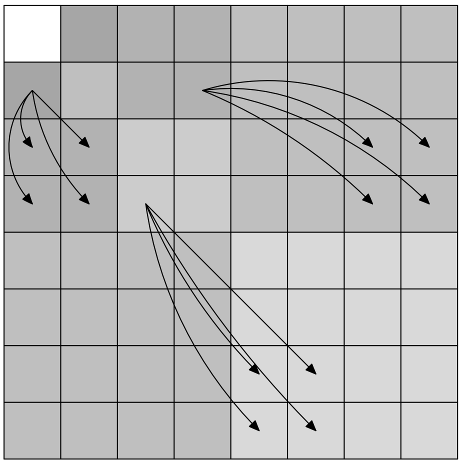
- efficient representation by Said & Pearlman
  - initial partitioning
  - set partitioning rules

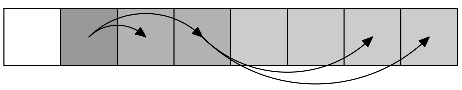
Modified SPIHT algorithm

- different offspring branching rule: two instead of four offspring

- different initial partitioning

2-dim. vs. 1-dim. offspring





Linear prediction

- first attempt
  - prediction of all wavelet coefficients
  - oscillations between successive rows
- better
  - prediction of 32 to 64 low-frequency coefficients
  - no prediction of high-frequency coefficients (adjacent coefficients are nearly independent)

(Numeric) Results

peak signal-to-noise ratio in dB

comp. ratio	8:1	16:1	32:1
#bytes/row	64	32	16
entire image	39.90	36.75	33.63
with prediction	36.09	31.49	26.91
w/o prediction	35.50	30.45	25.60

speedup factor

comp. ratio	16:1	32:1
wavelet transf.	3	
inv. wavelet transf.	2.5	
encoding	7	9
decoding	< 1.5	< 1.25

(Visual) Results

Summary

- 1-dimensional SPIHT algorithm
- linear prediction of wavelet coefficients
- supported features
  - coding of successive rows
  - decreased memory requirements and transmission delay
  - increased compression speed