JPEG_LS

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Introduction

●JPEG-LS is the basis for new lossless/near-lossless compression standard for compressing continuous-tone, greyscale, or colour digital still images

●The standard is based on the LOCO-I algorithm (Low COmplexity LOssless COmpression for Images)

●Developed at Hewlett-Packard Laboratories (Started 1996 ,final draft international standard FDIS14495-1 as of November 1998)

- low complexity projection of the universal context modeling paradigm, matching its modeling unit to a simple coding unit.

- "Enjoys the best of both worlds" By combining simplicity with the compression potential of context models

- The algorithm, LOCO-I, attains compression ratios similar or superior to those obtained with state-of-the-art schemes based on arithmetic coding

- complexity often estimated by measuring running times of software implementations made widely available by the authors of the schemes

- context: Function of samples in the causal template used to condition the coding of the present sample.

- context modelling: Procedure determining probability distribution of prediction error from the context. Each sample value is conditioned on a small number of neighbouring samples

●Jpeg_ls has to modes: Lossless and near-lossless

●Lossless: no information loss

●Near-lossless: every sample value in a reconstructed image component is guaranteed to differ from the corresponding value in the original image by up to a preset (small) amount
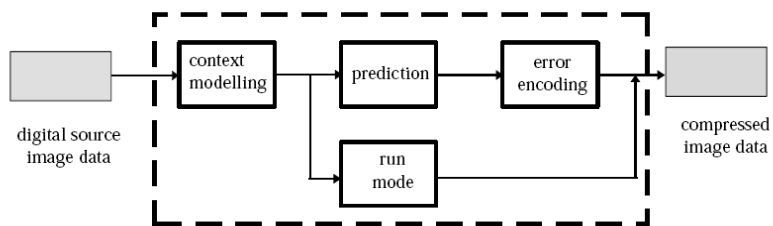
Encoding Process

digital source image data

context modelling

prediction

error encoding

run mode

compressed image data

Figure1 : Lossless encoder simplified diagram
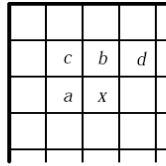
The context modelling

Figure 3: Causal template used for context modelling and prediction

•context is determined from four neighbourhood reconstructed samples at positions a, b, c, and d of the same component

The context modelling cont.

•context determines if the information in the sample x should be encoded in the regular or run mode.

    •run mode: When neighbours are very alike

    •regular mode: Neighbours not very alike

Prediction (regular mode)

- uses a, b, and c to form a prediction of the sample at
  position x.

- prediction error is computed as the difference between the
  actual sample value at position x and its predicted value.

- This prediction error is then corrected by a
  contextdependent
  term to compensate for systematic biases in prediction.

Error encoding (regular mode)

•the corrected prediction error (further quantized for near-
lossless coding) is then encoded using a procedure derived
from Golomb coding

•the Golomb coding procedures depend on the context
determined by the values of the samples at positions a, b, c,
and d as well as prediction errors previously encoded for the
same context.

Run mode

•Selected when reconstructed values of a,b,c and d are identical or within bounds when near-lossless coding.

•skips prediction and error-coding

•the encoder looks, starting at x, for a sequence of consecutive samples with values identical to the reconstructed value of the sample at a.

•The length information is encoded

Decoding process

•encoding and decoding processes are approximately symmetrical

•decoding process is followed by a sample mapping procedure which uses the value of each decoded sample as an index to a look-up table, provided in the compressed image data.

•If no table is provided for a specific component the output of the sample mapping procedure is identical to the input.

Test results

Image	LOCO-I	JPEG-LS	FELICS	Lossless JPEG Huffman	Lossless JPEG arithm.	CALIC arithm.	LOCO-A	PNG
bike	3.59	3.63	4.06	4.34	3.92	3.50	3.54	4.06
cafe	4.80	4.83	5.31	5.74	5.35	4.69	4.75	5.28
woman	4.17	4.20	4.58	4.86	4.47	4.05	4.11	4.68
tools	5.07	5.08	5.42	5.71	5.47	4.95	5.01	5.38
bike3	4.37	4.38	4.67	5.18	4.78	4.23	4.33	4.84
cats	2.59	2.61	3.32	3.73	2.74	2.51	2.54	2.82
water	1.79	1.81	2.36	2.63	1.87	1.74	1.75	1.89
finger	5.63	5.66	6.11	5.95	5.85	5.47	5.50	5.81
us	2.67	2.63	3.28	3.77	2.52	2.34	2.45	2.84
chart	1.33	1.32	2.14	2.41	1.45	1.28	1.18	1.40
chart_s	2.74	2.77	3.44	4.06	3.07	2.66	2.65	3.21
compound1	1.30	1.27	2.39	2.75	1.50	1.24	1.21	1.37
compound2	1.35	1.33	2.40	2.71	1.54	1.24	1.25	1.46
aerial2	4.01	4.11	4.49	5.13	4.14	3.83	3.58	4.44
faxballs	0.97	0.90	1.74	1.73	0.84	0.75	0.64	0.96
gold	3.92	3.91	4.10	4.33	4.13	3.83	3.85	4.15
hotel	3.78	3.80	4.06	4.39	4.15	3.71	3.72	4.22
Average	3.18	3.19	3.76	4.08	3.40	3.06	3.06	3.46

Table 2: Compression results on new image test set (in bits/sample)

Availability

● HP offers some free JPEG-LS software, including a Windows DLL, PhotoShop plugin, and reference executables good on several platforms, including Windows, Linux, Solaris

● Lots of free software out on the net that implements this standard.

References

- http://www.jpeg.org/public/fcd14495p.pdf

- http://www.hpl.hp.com/loco/dcc96copy.pdf