

Hybrid Fractal Video Coding with Neighbourhood Vector Quantisation

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A volume-based hybrid video coding scheme which combines fractal coding with neighbourhood vector quantisation, which is essentially a form of predictive VQ, is reported. The algorithm works as follows: the neighbourhood blocks (the virtual code-book) of a range block r_i are causally selected from the connected neighbourhood, 9 in the previous time slice, and 4 are within the same time slice. Unlike the conventional motion compensation, where block matching is only done with a previous frame, neighbourhood VQ can exploit both temporal and spatial redundancy hence the local signal coherence can be well captured. For each $r_i \in R$, the range pool, we look for its best approximation r_y in the *previously encoded, connected space neighbourhood* and their isometric transformed versions where $e(r_i, T_x(r_y))$ is minimum. If $e(r_i, T_x(r_y))$ is below a threshold σ , which suggests that r_i and r_y are similar, then r_i is quantised as $T_x(r_y)$. If $e(r_i, T_x(r_y)) > \sigma$, then r_i is encoded using a conventional fractal contractive mapping. In the implementation, instead of having the neighbourhood blocks collected from the original frames, we compare the range block with the blocks that were actually transmitted, ie. the previously quantised blocks, \hat{r}_y . This prevents quantisation errors from accumulating and gives better rate-distortion performance. The error metric function $e(\cdot, \cdot)$ we used is the conventional squared-error measure.

The experimental results suggests that the coder's compression performance beats most of the fractal-based video coders published so far and is comparable with MPEG-2 standard with lower complexity. Results on *missa* is presented below.

Table 1: Results from the hybrid volume coder

σ (dB)	$ T $	Interpolated	Rate (bpp)	PSNR (dB)
24	16	No	0.090	31.451
38	16	No	0.142	35.490
24	8	No	0.074	31.210
38	8	No	0.128	35.704
24	16	Yes	0.042	31.755
38	16	Yes	0.068	34.449
24	8	Yes	0.040	30.960
38	8	Yes	0.070	34.444

A full version of the manuscript is available on:

<http://www.dcs.warwick.ac.uk/~yao/pub.html>