AVC-155

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CODING OF MOTION PICTURES AND ASSOCIATED AUDIO

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Introduction

This document describes the Movies of the Future Program's image coding system in its third revision. This is the codec simulation system used for our MPEGII proposal.

The basic structure is a QMF pyramid sub-band coder. The coder operates on *frames* that are created by using two successive source *fields*. Lower resolution sub-bands are coded using scalable motion compensation while the highest resolution sub-bands do not use motion compensation at all. The sub-bands are compressed with a weighted, uniform scalar quantizer and a binary arithmetic coder.

Scalability

The algorithm allows a range over which the sequence can be decoded that is independent of the encoding rate. I.e., a 9Mb/sec sequence can be decoded at rates between approximately 400 Kbits/sec and 9Mbits/sec.

Scalability is provided through the use of sub-bands that can be selectively decoded. At the highest resolution, 6 spatio-temporal sub-bands are "intra-coded" and can be selectively decoded at any time. Information at lower resolutions is motion compensated on a level-by-level basis. Consequently, the first frame of a motion-compensated group of pictures can be decoded at any resolution, while other frames in the group of pictures can be decoded at any resolution less than or equal to the resolution of the preceding frame. One can therefore omit data from the bitstream down to the level of the lowest resolution band and can then interpret that data after decoding an intracoded keyframe. At the highest level, data may be decoded or ignored without restriction.

Complexity

In its present form, the motion compensated subbands are more complex to decode than fullframe motion compensated hybrid coded images. Intermediate bands are interpolated up to quarter size before processing to prevent phase effects and filter artifacts from corrupting the estimate. We are investigating simplifications to this part of the algorithm. Since the upsampling operation is effectively a way to achieve fractional-pel motion compensation accuracy, it may be possible to achieve the fractional-pel accuracy without having to do all the explicit filtering.

The filters used in the subband decomposition are overlapping QMF transforms. This is a more complex transformation than the DCT. There are some optimizations that could be made to decrease the number of calculations.

Color Space

The color space in which MFC operates is the Y-Cb-Cr color space as defined by CCIRR 601. The relationship between this color space and the RGB color space is governed by the following equations. There is no reason why the processing could not occur in a color space different from the color space of the original, but for now it is easiest to use the same color space

$$Yd = 0.299 \times R + 0.587 \times G + 0.144 \times B$$

$$Y = \frac{219 \times Yd}{255} + 16$$

$$Cb = \frac{126 \times (B - Yd)}{255} + 128$$

$$Cr = \frac{160 \times (R - Yd)}{255} + 128$$

Subband Decomposition

A three level spatial sub-band decomposition is used for the luminance. The chrominance is split vertically into two sub-bands, after which the lowpass sub-band is decomposed into a two level pyramid. Subband decomposition is done serially on previously filtered and subsampled bands, resulting in a pyramid, or wavelet-like decomposition. In this discussion, level 1 refers to the highest frequency sub-images, level 2 refers to the midband sub-images, and level 3 refers to the lowest frequency sub-images. The baseband image is the level three sub-image containing the DC component. Note that for luminance, the level 1 images are 352 x 240 and that for chrominance the level 1 images are 176 x 120. The high vertical frequency subband is 352 x 240.

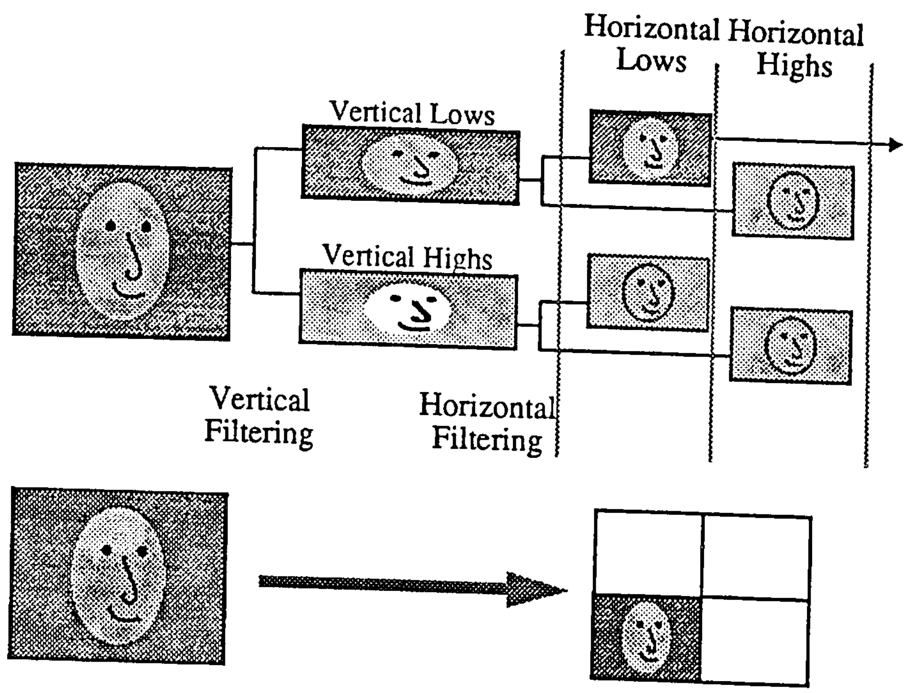
The level 1 luminance bands are further subjected to a 2-frame temporal analysis – sum and difference sub-images are formed.

Lower frequency luminance bands are predicted from previous images using a scaled motion vector field. In the submission tape, every 12 frames is intra-frame coded by omitting the prediction frame. This is, of course, a parameter of encoding.

The level 1 vertically high-passed subbands are subjected to an extra vertical sub-band split. This is done in order to effect a spatiotemporal stepwise approximation to the diagonal region of support (in the vertical/temporal plane) of an interlaced image sequence. This operation need not be performed for sequentially scanned source material.

The highest vertical chrominance band is discarded in the tape submitted for testing, resulting in a 4:2:0 resolution ratio. This is not an essential part of the algorithm, 4:2:2 color can be coded if desired.

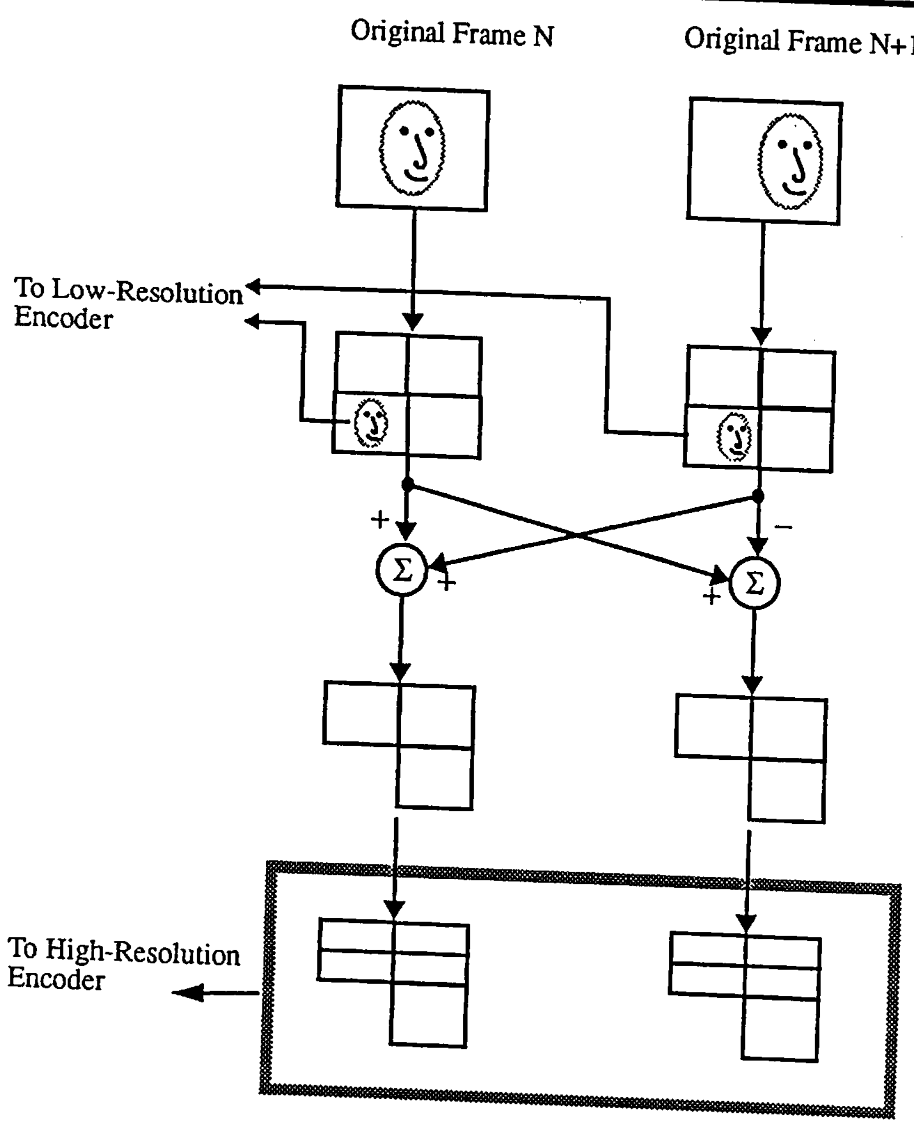
Each filter has a gain of $\sqrt{2}$ associated with it, so that the overall gain of each subband increases by 2 as the pyramid is descended. This has been shown to provide enough precision to allow the pyramids to be stored as short integers.



Luminance High Frequency Decomposition (partial diagram). The boxes indicate filtering/subsampling operations. The lower diagram indicates the spectral region of the horizontal/vertical low frequency band.

Tap #	Low-pass Tap Value	High-pass Tap Value
1	0.019955	0.019955
2	-0.042705	0.042705
3	-0.052242	-0.052242
4	0.292705	-0.292705
5	0.564575	0.564575
6	0.292705	-0.292705
7	-0.052242	-0.052242
8	-0.042705	0.042705
9	0.019955	0.019955

Filter coefficient values of QMF pair used for spatial sub-band decomposition.(Coefficient values should be multiplied by $\sqrt{2}$



Partial diagram of sub-band structure. First, each frame in a pair is spatially decomposed into a one level pyramid. The two basebands are fed into the low-resolution encoder, while the remaining sub-bands are decomposed into temporal subbands. The subbands with vertical detail are further split vertically. This results in ten high resolution sub-bands for each frame pair.

Low Resolution Coder

Motion compensated prediction is used for the lower levels of luminance resolution and all levels of chrominance resolution. Motion vectors are formed using a hierarchical motion estimation method applied to the quarter-sized luminance images that are the inputs to the low resolution coder. Half pixel accuracy is used; a single, full size motion vector field is applied to each sub-image as described below. Motion vector fields are transmitted as in H.261..

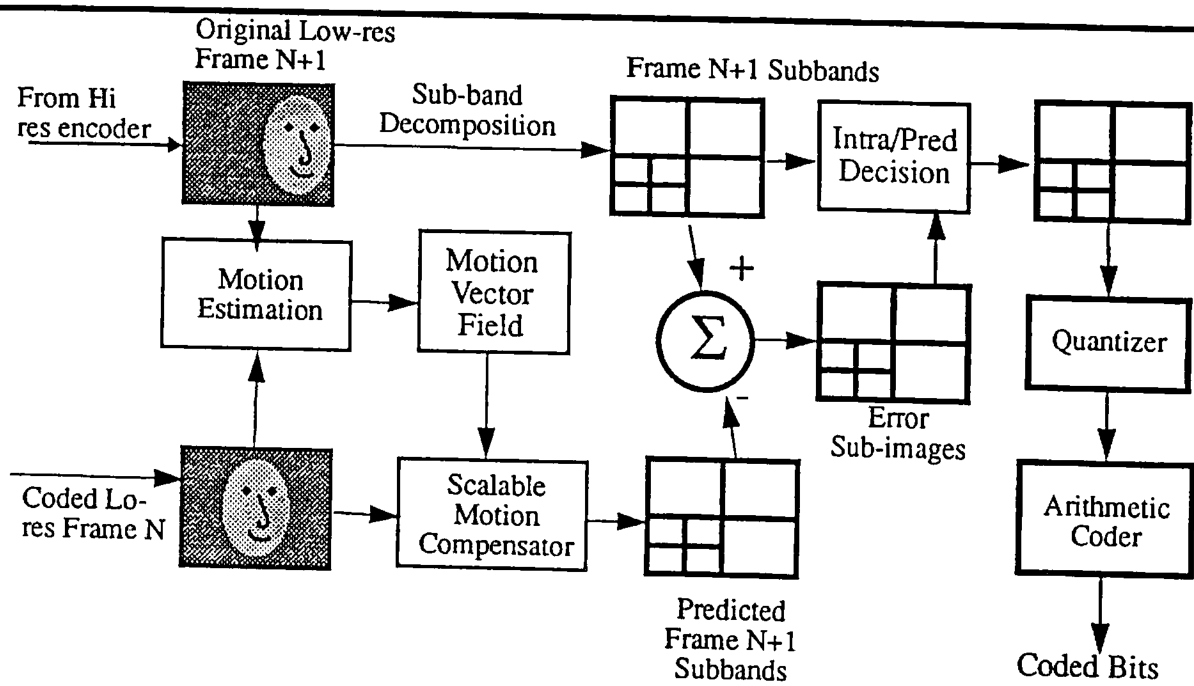


Diagram of low-resolution coder. The previously coded low-resolution image is compared to the low-resolution image being coded inorder to derive a motion vector field. This motion vector field is used to derive predictions for the subbands. For each band, either the original sub-band or the error signal of the prediction is then quantized and compressed using the arithmetic coder in order to obtain the bits that will be transmitted.

First, the previously decoded baseband (DC) image is interpolated up to 352x240 through a repeated application of the synthesis QMF filter set. This image is then warped using the vector field.

Next, this image is reduced back to its original size and used as a predictor for the baseband image in the next frame to be coded.

In decoding, the previous frame baseband image is interpolated up by a factor of two and added to the similarly processed level three subbands. The result of these operations is the reconstruction of a level two DC image.

This intermediate image is then scaled up by a factor of two, the motion vector field is applied to it, and it is then reduced back to its appropriate size and a one-level decomposition is applied to this image. The DC image is discarded, since a baseband predictor already existsand it is independent of all higher level images. This is the essence of the scalable motion compensation. The remaining three sub-images are the predictors for the level three bands in the next frame. This process is repeated for the next level, level two.

Thus, scalable motion compensation provides independant estimates (or predictors) for each level of the pyramid. The main expense of this method is that each image, in order to be predicted well, needs to be motion compensated at as high a resolution as possible. In the current implementation, this means that every motion compensated image is interpolated up to 352 x 240 and then decimated back down to its original size..

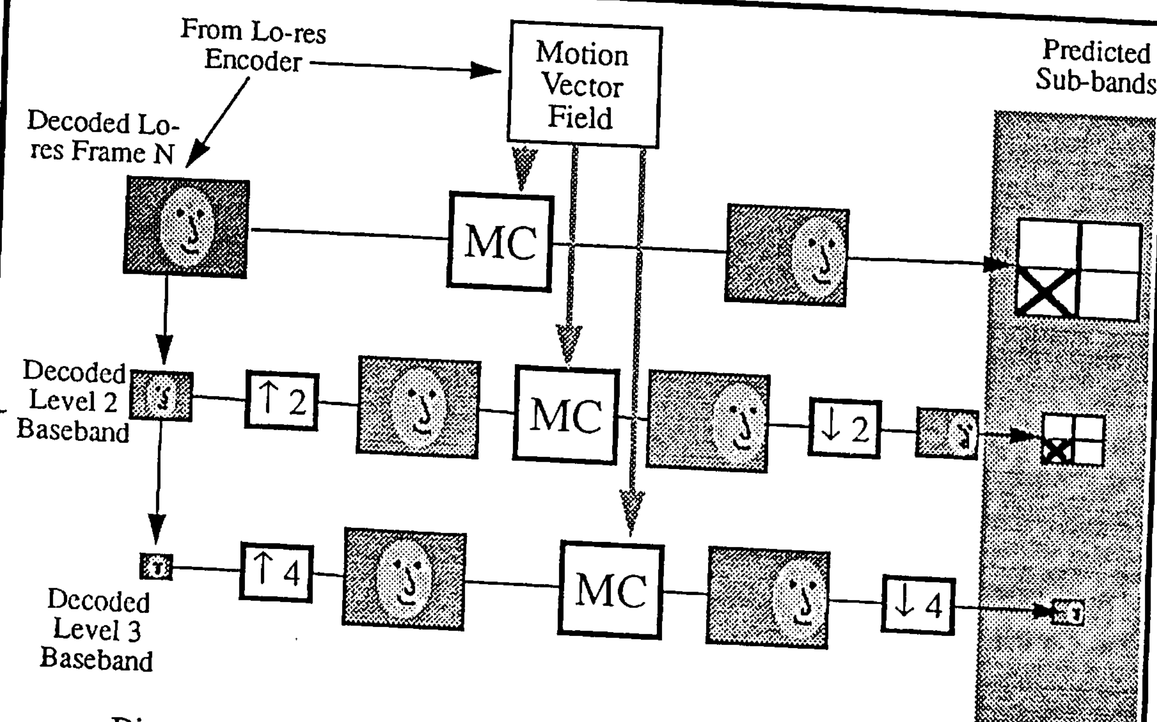


Diagram of Scalable Motion Compensator. The previously decoded frame at each level of resolution is separately warped using the motion vector field in order to obtain a prediction at each level. These predictions are then used to obtain predictions of the detail sub-bands at the level.

When a predicted sub-band has a prediction error with a variance greater than the variance of the original sub-band, the original sub-band is coded instead. Note that this intra/inter decision is made on a sub-band by sub-band basis and not on a block-by-block basis as in MPEG-I

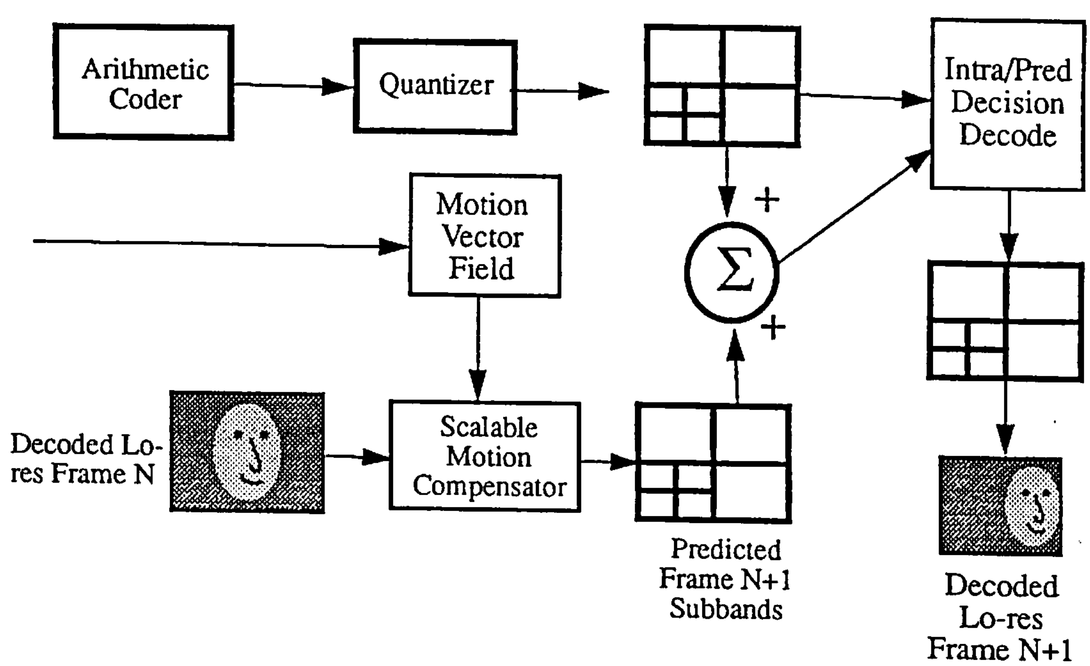


Diagram of low-resolution decoder.Sub-band predictions are formed from the previous reconstructed sub-bands as they were done in the encoder, except that the motion vectors have been received as side information and not calculated. The quantized and arithmetic-coded error signals are selectively added to the predictions (according to the intra/pred decision that was made in the encoder) to form the reconstructed subbands. That pyramid is reconstructed in order to form the reconstructed low-res frame.

Every 12 frames (6 frame pairs), the sub-bands of the first frame in the pair are all encoded using the original. This frame pair is then referred to as an **intra frame pair** while all other frame pairs are referred to as **predicted frame pairs.**

High Resolution Coder

The high resolution coder simply quantizes and arithmetic codes the high-resolution sub-bands.

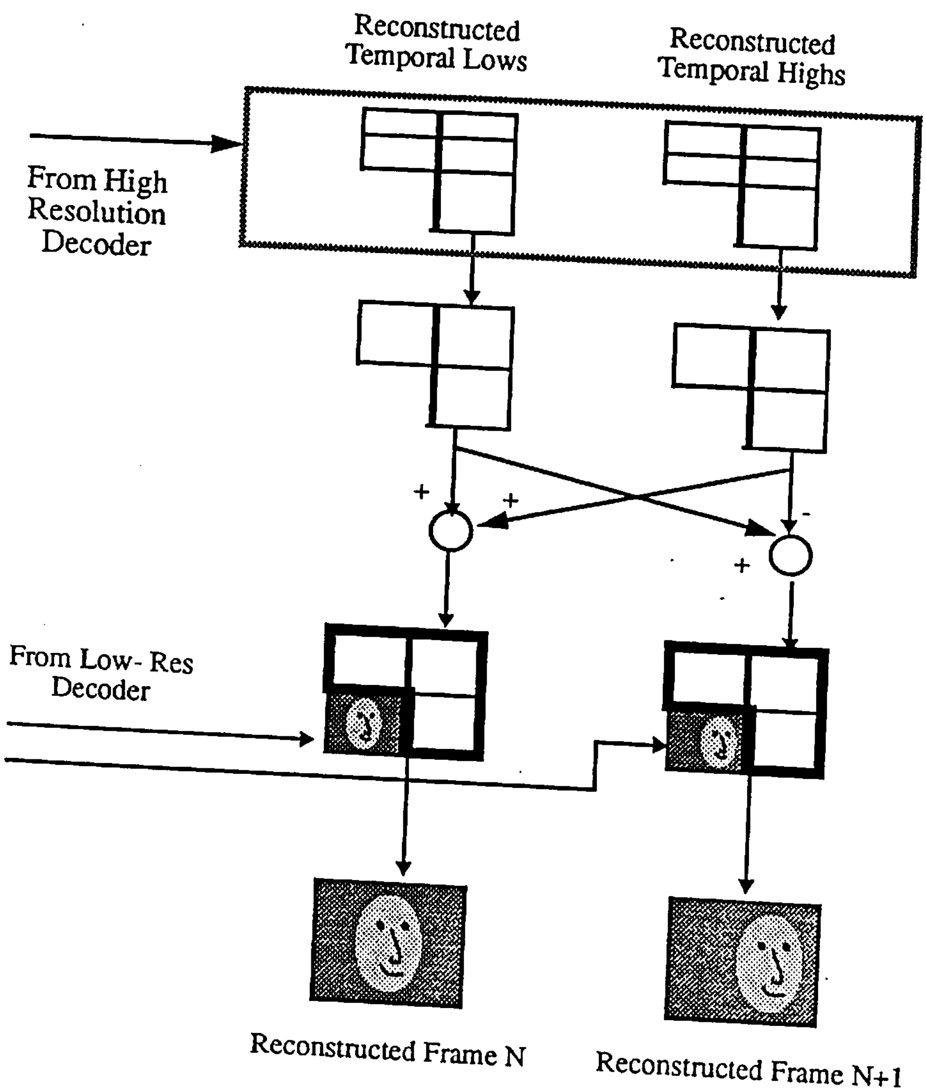


Diagram of Hi-Resolution Decoder. After the high-resolution subbands are decoded, the extra vertical subband decomposition in the vertical highs is reconstructed, and then the temporal subbands are reconstructed. The low-res decoder then supplies the baseband for this final set of pyramid reconstructions which yield the final reconstructed images.

Quantization

The quantizer stepsize is determined by three factors.

We define a **frequency weighting matrix** that will be used to reduce the stepsize for high frequency data, analogous to the visual weighting matrix used in a block coder. This matrix determines the relative weighting of the subbands themselves, and consists of one entry per subband.

In addition, we define a 44x30 point **spatial weighting matrix**, similar to *M-Quant* as used in MPEG-I. This matrix is a created on a 16x16 pixel grid with respect to the full-size 704x480 point source image. This array is space-varying within each subband.

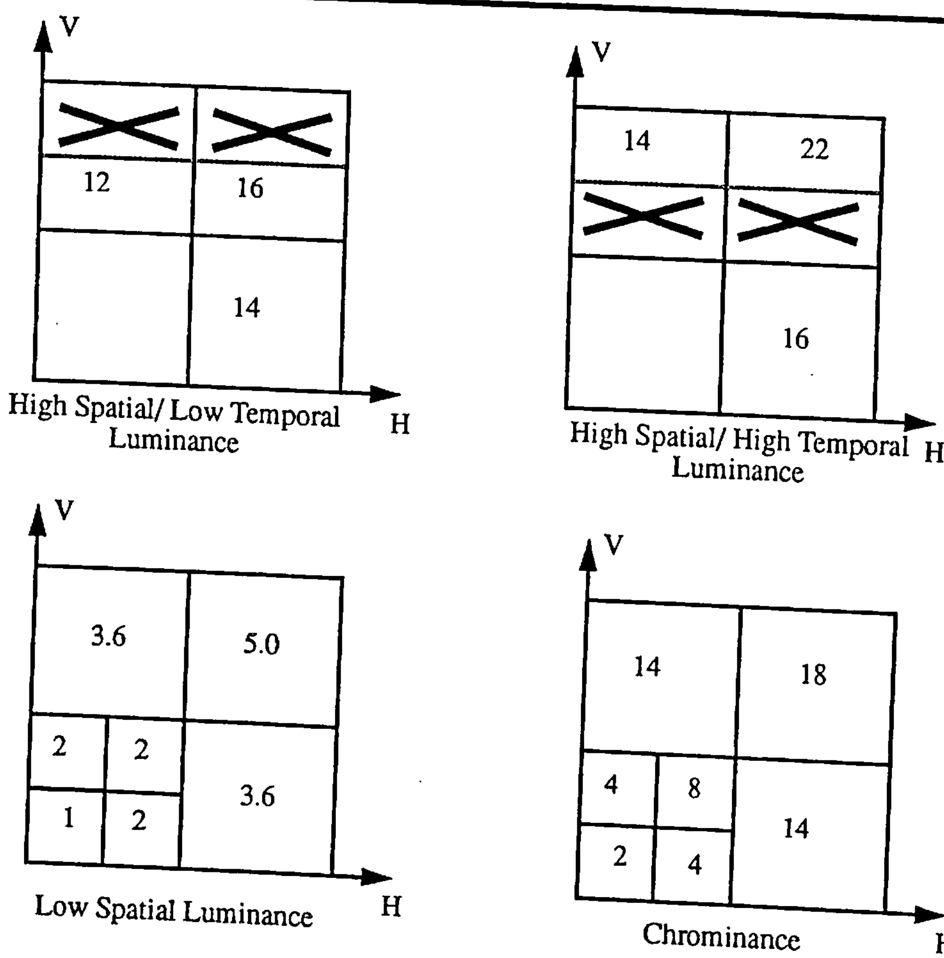
The rate controller reduces or increases all quantization factors by a scalar, the **Quantization Factor**, which is determined by the rate control buffer.

A single spatial weighting matrix is used for all subbands in the current frame to be quantized. It is (non-interpolatively) scaled to an appropriate size for the band. The matrix reduces the quantizer step size in inactive areas while increasing it in active areas.

At each point in each subband, the final quantizer stepsize that is used is the product of the frequency weighting matrix for that band, the spatial weighting matrix for that block in the subband, and the quantization factor.

The DC quantizer's step size does not vary spatially.

The spatial weighting matrix used for the highest-resolution subbands, those that are not within any motion compensation loop, is formed by taking point by point minima of the matrices for the two input frames that formed the temporal sub-bands.



Frequency weighting matrices for all of the sub-bands.

Computation of spatial weighting matrix

The spatial weighting matrix for each frame is formed on a 16 x 16 block basis on the scale of the704 x 480 luminance image. The activity of each block is measured by summing the absolute values of the sub-band values (except baseband) that correspond to that region. So, the activity of a particular block is formed from the values of three 8 x 8 blocks from the highest spatial subbands, three 4 x 4 blocks from the next lowest sub-bands, and three 2 x 2 blocks from the lowest detail sub-bands. An average of these sum-of-absolutes is then taken. The spatial quantization value for each region is then the measured activity for that region normalized by the average activity of all blocks. Values less that 0.5 are rounded up to 0.5 and values above 2.0 are rounded down to 2.0. Finally, the mask is quantized with a step size of 0.1. The spatial mask is encoded with the same DPCM coder that is used on the basebands.

The mask values for the high-spatial-frequency temporally-split bands are formed for each block by taking the minimum of the two corresponding values in the spatial masks for the frames that were used to form the temporal sub-bands.

Bit allocation is altered by a scene change detector (described below). When a scene change is detected, the high spatial sub-bands are not sent for the frame pair before the scene change and for the 2 frame pairs afterwards. This is a temporal rate allocation based on temporal masking.

Rate Control

Rate control is achieved by controlling the overall quantization factor in response to the state of a simulated buffer. After each frame pair is coded, the simulated buffer state is updated, and then any modification to the overall quantization factor is made. The rate control algorithm is intended to keep image quality as constant as possible while providing the desired bitrate.

We assume that a steady quantization factor will provide steady perceived image quality. We assume that if a steady quantization factor is used to code the images of a sequence, then the number of bits for each frame pair will be steady as long as there is no scene change. We assume that in the absence of a scene change, the ratio between the number of bits needed to code an intra pair and a predicted pair is constant.

With the above assumptions and goals in mind, the rate control operates by repeatedly estimating what the buffer state will be at the end of the current GOP, and regulating the quantization factor so that the buffer state is approaching a cycle in which the average buffer state is one in which the buffer is half full.

Predicting the state of the buffer at the end of the GOP is achieved by knowing the number of frame pairs remaining to be coded in the GOP, the intra-predicted ratio, the number of bits used to code the latest frame pair, and the current buffer state. The condition which causes the quantization factor to be modified is when the projected buffer state is diverging from the desired buffer state. In other words, if the buffer state is approaching the desired buffer state, no modification is made to the quantization factor.

If the projected buffer state is too empty, the quantization factor is decreased by a value linearly related to the amount by which the projected buffer state deviates from half. If the the projected buffer state is too full, the quantization factor is similarly increased.

No modification is made to the quantization factor between coding the first and second frame pairs of a group of pictures. This is done to ensure that the intra-predicted ratio is measured properly.

When a scene change causes high-resolution sub-bands to be discarded, any decrease in the quantization factor is divided by a factor of 10. This is done in order to allocate less bits to the frames surrounding the scene change, and to make more bits available to avoid overflow if the next scene's footage is difficult to code.

Scene Change Detection

Currently, scene changes are detected through examination of the motion vector fields. A sum is taken of the absolute difference between the neighboring vector components for each component of each vector. The idea is that a motion vector field that does not correspond to a scene change will have a significantly lower "difference-sum" than a motion vector field for a scene change.

When a scene change is detected, the previous frame pair, the current frame pair, and the next two frame pairs have their high-resolution sub-bands discarded

Arithmetic Coding

Different coders are used for the basebands and for the non-basebands. Both coders use the same arithmetic coder, based on the JPEG Q-coder.

The fundamental manner in which this compression is being achieved is that the data to be encoded (currently either DPCM data or subband data) is quantized using a JPEG-style uniform scalar quantizer and then the arithmetic coder.

Baseband coding

Basebands for luminance and chrominance channels are coded independently using a JPEG-style DPCM Coder. After applying a DPCM filter to the band and quantizing it, each coefficient is encoded by using Zero/Non-Zero, Positive/Negative, Magnitude, and Coefficient decisions. All decisions are conditioned by the quantized magnitude of the neighboring samples to the left and above.

Non-baseband coding

The only difference between the baseband and non-baseband coders is that there is no DPCM filter applied to the sub-bands. Early attempts to improve the efficiency of the sub-band coder by condition-ing decisions from samples adjacent in frequency have not been successful.

Channel model

An errorless channel is assumed in the test material submitted. however, the scaled motion compensation and temporally filtered high resolution information insures separation of information from each band within the sequence. Thus, this coder insures spatiotemporally limited extent of channel errors. We are preparing a bitstream that allows re-synchronization in the face of channel errors or dropouts.

Sub-band reconstruction

The spatial sub-bands are reconstructed by using the same QMF filters. The temporal sub-bands are reconstructed by inverting the sum-difference operation.

MIT Media Lab MPEG 2 Proposal (#23)

Coded Image Statistics

Because our algorithm coded images in pairs, bit counts are reported on a frame pair by frame pair basis. Signal-to-noise ratios are computed with respect to 255, not to signal peak values.

Statistics for flower_4...

#	Bits	Y-SNR	Cb-SNR	Cr-SNR
0	290240	24.08	32.48	34.73
1		24.21	32.56	34.71
2	214536	24.20	32.40	34.58
3		24.09	32.55	34.72
4	216712	24.00	32.65	34.75
5		24.08	32.53	34.54
6	237544	24.11	32.46	34.46
7		24.10	32.46	34.41
8	242136	24.11	32.53	34.42
9		24.12	32.70	34.43
10	275072	24.24	32.63	34.40
11		24.14	32.68	34.36
12	353216	24.08	32.70	34.43
13		24.12	32.89	34.53
14	256208	24.26	32.78	34.43
15		24.25	32.76	34.47
16	269128	24.23	32.79	34.49
17		24.17	32.87	34.55
18	300480	24.11	32.69	34.40
19		24.24	32.68	34.31
20	257472	24.35	32.50	34.08
21		24.33	32.58	34.14
22	256480	24.30	32.59	34.08
23		24.18	32.77	34.29
24	347504	24.07	32.75	34.22
25		24.14	32.83	34.25
26	247448	23.92	32.85	34.40
27		23.82	33.10	34.63
28	252136	23.81	32.99	34.70
29		23.91	32.92	34.42
30	237624	23.80	33.06	34.57
31		23.82	33.08	34.67
32	263416	23.82	33.05	34.56
33		23.79	32.97	34.49
34	272072	23.76	32.92	34.54
35		23.82	32.93	34.43
36	338768	23.81	32.87	34.38
37		23.85	32.92	34.40
38	259984	23.87	32.68	34.36
39		23.85	32.76	34.29
40	262280	23.78	32.78	34.46
41		23.75	32.85	34.45
42	258528	23.82	32.54	34.24
43		23.73	32.53	34.26
44	277584	23.72	32.43	34.09
45		23.85	32.33	33.91
46	251960	23.75	32.31	33.89
47		23.64	32.54	34.08
48	360376	23.57	32.36	34.00
49		23.55	32.52	34.04
50	258224	23.63	32.46	33.98
51		23.68	32.46	34.01
52	288272	23.52	32.45	34.20
53		23.49	32.35	34.16
54	250664	23.55	32.13	33.95
55		23.67	32.09	33.85
56	251600	23.58	32.13	33.91
57		23.58	32.22	33.91
58	231056	23.48	32.29	33.94
59		23.39	32.43	34.04
60	328504	23.30	32.39	34.04
61		23.36	32.39	34.08
62	260664	23.44	32.25	33.88
63		23.49	32.31	33.96
64	249784	23.42	32.31	33.90
65		23.50	32.26	33.81
66	235872	23.56	32.11	33.66
67		23.60	32.12	33.67
68	239264	23.47	32.17	33.74
69		23.39	32.26	33.75
70	253456	23.39	32.12	33.78
71		23.57	32.01	33.57
72	337840	23.58	31.93	33.40
73		23.54	32.19	33.75
74	258928	23.54	32.03	33.65
75		23.45	32.21	33.81
76	235864	23.47	32.14	33.68
77		23.38	32.27	33.84
78	246320	23.40	32.22	33.82
79		23.42	32.23	33.72
80	227784	23.29	32.39	33.98
81		23.30	32.44	33.88
82	238784	23.31	32.32	33.87
83		23.32	32.22	33.74
84	319880	23.19	32.38	33.80
85		23.16	32.56	33.99
86	233104	23.22	32.39	33.91
87		23.26	32.40	33.85
88	227784	23.23	32.39	33.96
89		23.27	32.33	33.82
90	240472	23.26	32.28	33.76
91		23.21	32.23	33.80
92	250792	23.30	32.10	33.75
93		23.24	32.23	33.68
94	255752	23.21	32.36	33.89
95		23.19	32.36	33.92
96	360368	23.07	32.52	34.07
97		23.02	32.69	34.34
98	283576	23.07	32.61	34.19
99		23.19	32.42	33.97
100	290256	23.20	32.44	33.96
101		23.12	32.40	34.02
102	298760	23.17	32.35	33.87
103		23.39	32.08	33.65
104	300824	23.44	31.86	33.39
105		23.31	31.95	33.43
106	291384	23.34	31.81	33.31
107		23.37	31.85	33.24
108	348224	23.26	31.68	33.18
109		23.19	31.84	33.30
110	266328	23.16	31.79	33.33
111		23.28	31.71	33.27
112	268584	23.15	31.45	33.06
113		23.17	31.50	33.11
114	232592	23.23	31.23	32.93
115		23.11	31.30	33.03
116	240872	23.14	31.23	32.94
117		23.16	31.28	32.90
118	221616	23.18	31.23	32.91
119		23.14	31.37	32.97
120	297568	22.93	31.43	33.09
121		22.90	31.62	33.36
122	228656	22.88	31.64	33.40
123		22.99	31.45	33.20
124	218512	22.99	31.42	33.20
125		23.09	31.39	33.06
126	234384	23.20	31.25	32.95
127		23.18	31.29	32.84
128	246888	23.16	31.21	32.85
129		23.26	31.23	32.84
130	225600	23.30	31.08	32.73
131		23.43	31.03	32.62
132	312128	23.30	30.94	32.59
133		23.32	31.28	32.79
134	234624	23.35	30.99	32.74
135		23.32	30.99	32.72
136	224744	23.32	31.07	32.65
137		23.42	30.97	32.62
138	229264	23.48	31.16	32.57
139		23.48	30.87	32.49
140	228504	23.35	31.17	32.72
141		23.36	31.07	32.69
142	235752	23.26	31.38	32.82
143		23.44	31.15	32.79
144	351176	23.48	31.11	32.64
145		23.61	31.17	32.62
146	270472	23.71	31.02	32.54
147		23.93	30.79	32.38
148	246720	23.95	30.94	32.37
149		23.93	30.87	32.35

Statistics for flower_9...

#	Bits	Y-SNR	Cb-SNR	Cr-SNR
0	650224	25.88	36.32	37.23
1		25.89	36.17	37.07
2	546856	25.86	36.16	37.03
3		25.84	36.25	37.18
4	556512	25.71	36.29	37.21
5		25.74	36.15	36.92
6	585648	25.80	36.14	36.98
7		25.78	36.16	36.91
8	597928	25.78	36.23	36.93
9		25.78	36.32	36.92
10	634784	25.85	36.25	36.85
11		25.76	36.21	36.94
12	725176	25.71	36.43	36.95
13		25.69	36.45	36.94
14	593152	25.85	36.35	36.75
15		25.79	36.22	36.77
16	596640	25.74	36.04	36.74
17		25.68	36.01	36.79
18	636888	25.62	35.76	36.56
19		25.69	35.70	36.40
20	560144	25.71	35.37	36.21
21		25.70	35.41	36.09
22	558536	25.66	35.43	36.05
23		25.62	35.50	36.29
24	676448	25.54	35.74	36.29
25		25.55	35.70	36.19
26	543568	25.30	35.82	36.41
27		25.27	36.03	36.64
28	556616	25.24	36.07	36.81
29		25.30	35.84	36.53
30	555368	25.24	36.03	36.68
31		25.22	35.98	36.68
32	584264	25.25	35.94	36.66
33		25.23	35.90	36.66
34	600192	25.21	36.17	36.71
35		25.25	36.04	36.55
36	663592	25.29	35.97	36.45
37		25.23	35.95	36.48
38	567424	25.29	35.79	36.33
39		25.27	35.70	36.33
40	574240	25.22	35.79	36.46
41		25.19	35.80	36.46
42	589080	25.28	35.69	36.33
43		25.21	35.67	36.28
44	625592	25.24	35.64	36.34
45		25.26	35.59	36.09
46	590264	25.20	35.55	36.11
47		25.15	35.73	36.21
48	732280	25.09	35.81	36.26
49		25.09	35.84	36.26
50	596416	25.17	35.85	36.23
51		25.17	35.70	36.10
52	618576	25.02	35.62	36.32
53		24.99	35.66	36.27
54	561536	25.05	35.38	36.04
55		25.07	35.23	35.84
56	562688	25.09	35.29	35.96
57		25.05	35.25	36.02
58	534816	24.95	35.32	36.06
59		24.89	35.42	36.24
60	668680	24.85	35.64	36.29
61		24.82	35.59	36.18
62	577048	24.94	35.39	36.03
63		24.93	35.35	36.01
64	563328	24.91	35.41	36.10
65		24.92	35.25	35.95
66	546488	25.06	35.18	35.83
67		25.03	35.16	35.72
68	564576	24.98	35.37	36.00
69		24.98	35.36	36.06
70	611336	25.03	35.49	36.15
71		25.12	35.38	35.96
72	725256	25.22	35.50	35.87
73		25.18	35.65	36.10
74	628624	25.15	35.47	36.06
75		25.10	35.56	36.10
76	562384	25.03	35.43	36.03
77		24.99	35.56	36.15
78	596768	25.00	35.44	36.11
79		25.01	35.44	36.11
80	573608	24.93	35.60	36.22
81		24.93	35.60	36.19
82	588280	24.92	35.32	36.12
83		24.91	35.34	36.04
84	693240	24.83	35.86	36.22
85		24.85	35.98	36.33
86	580792	24.87	35.72	36.21
87		24.88	35.66	36.12
88	568056	24.87	35.65	36.16
89		24.89	35.54	36.15
90	586024	24.86	35.56	36.07
91		24.80	35.51	36.06
92	592096	24.86	35.36	35.97
93		24.82	35.37	35.94
94	594216	24.77	35.46	36.09
95		24.75	35.50	36.09
96	725488	24.61	35.87	36.27
97		24.59	35.97	36.54
98	633672	24.67	35.81	36.43
99		24.66	35.61	36.18
100	609000	24.66	35.27	36.02
101		24.63	35.57	36.10
102	593800	24.63	35.13	35.83
103		24.69	34.84	35.45
104	616520	24.88	34.72	35.33
105		24.79	34.74	35.39
106	593704	24.74	34.61	35.16
107		24.76	34.61	35.19
108	673392	24.73	34.65	35.20
109		24.66	34.75	35.28
110	568328	24.62	34.63	35.33
111		24.68	34.46	35.21
112	600704	24.69	34.39	35.17
113		24.72	34.52	35.19
114	531120	24.71	34.21	35.01
115		24.63	34.23	35.01
116	541096	24.62	34.13	34.97
117		24.64	34.05	35.06
118	507216	24.65	34.02	34.96
119		24.61	34.14	35.05
120	614456	24.44	34.46	35.18
121		24.39	34.63	35.35
122	517592	24.41	34.49	35.45
123		24.43	34.33	35.25
124	512128	24.56	34.33	35.21
125		24.57	34.31	35.11
126	554848	24.79	34.38	35.15
127		24.75	34.39	35.10
128	613928	24.89	34.62	35.29
129		24.91	34.56	35.22
130	585768	25.00	34.46	35.18
131		25.07	34.43	35.02
132	746352	25.19	34.88	35.27
133		25.15	35.04	35.44
134	632016	25.17	34.88	35.34
135		25.15	34.87	35.29
136	616296	25.10	34.83	35.18
137		25.16	34.71	35.32
138	617592	25.26	34.68	35.19
139		25.28	34.58	35.15
140	605400	25.10	34.69	35.24
141		25.05	34.70	35.22
142	603160	24.98	34.76	35.27
143		25.05	34.61	35.18
144	752728	25.19	34.68	35.12
145		25.20	34.62	35.08
146	651848	25.33	34.52	34.93
147		25.52	34.34	34.78
148	578664	25.43	33.94	34.49
149		25.39	33.89	34.33

Statistics for mobile_4...

#	Bits	Y-SNR	Cb-SNR	Cr-SNR
0	334104	22.58	31.57	31.95
1		22.68	31.60	32.06
2	261464	22.63	31.63	32.07
3		22.67	31.59	32.02
4	262912	22.66	31.60	31.95
5		22.65	31.49	31.85
6	261024	22.67	31.47	31.79
7		22.63	31.34	31.69
8	256040	22.74	31.41	31.67
9		22.75	31.29	31.66
10	245512	22.75	31.32	31.64
11		22.80	31.35	31.70
12	325704	22.71	31.33	31.65
13		22.79	31.44	31.76
14	244552	22.80	31.37	31.80
15		22.86	31.42	31.77
16	242808	22.92	31.40	31.75
17		22.91	31.35	31.75
18	243600	22.92	31.37	31.65
19		22.87	31.24	31.57
20	240536	22.88	31.24	31.57
21		22.91	31.19	31.51
22	242016	22.94	31.18	31.57
23		22.87	31.27	31.51
24	327984	22.85	31.18	31.49
25		22.94	31.24	31.65
26	236544	22.97	31.35	31.68
27		22.96	31.28	31.63
28	234560	22.92	31.31	31.65
29		22.98	31.28	31.57
30	233704	22.99	31.15	31.46
31		22.99	31.16	31.37
32	238112	23.04	31.11	31.34
33		23.09	31.16	31.31
34	244032	23.11	31.27	31.39
35		23.08	31.23	31.38
36	350032	23.10	31.24	31.55
37		23.11	31.34	31.60
38	258368	23.13	31.33	31.62
39		23.10	31.32	31.61
40	265208	23.08	31.40	31.64
41		23.05	31.32	31.51
42	255800	23.07	31.22	31.47
43		23.08	31.30	31.51
44	263232	23.14	31.34	31.51
45		23.13	31.29	31.55
46	264600	23.16	31.31	31.50
47		23.18	31.17	31.50
48	358424	23.11	31.29	31.61
49		23.22	31.42	31.62
50	267224	23.21	31.42	31.63
51		23.20	31.40	31.68
52	269984	23.20	31.42	31.65
53		23.16	31.34	31.56
54	265824	23.15	31.31	31.56
55		23.17	31.21	31.49
56	259440	23.16	31.16	31.41
57		23.04	31.16	31.33
58	260480	23.11	31.07	31.29
59		23.12	31.07	31.27
60	355992	23.08	31.20	31.40
61		23.10	31.27	31.49
62	257824	23.12	31.29	31.52
63		23.10	31.31	31.54
64	255784	23.15	31.27	31.54
65		23.17	31.19	31.40
66	260808	23.14	31.23	31.36
67		23.19	31.17	31.42
68	257520	23.12	31.14	31.30
69		23.17	31.09	31.26
70	259464	23.14	31.03	31.26
71		23.16	30.99	31.19
72	360200	23.00	31.07	31.24
73		23.12	31.08	31.25
74	269640	23.12	31.10	31.24
75		23.09	31.09	31.20
76	252880	23.00	30.99	31.05
77		22.96	30.96	31.01
78	246048	23.14	30.90	31.02
79		23.13	30.84	31.00
80	241264	23.13	30.81	30.95
81		23.16	30.80	30.97
82	237400	23.15	30.80	30.95
83		23.21	30.80	30.94
84	336752	23.09	30.92	31.04
85		23.18	30.92	31.08
86	244864	23.17	30.90	31.12
87		23.13	30.93	31.05
88	242504	23.12	30.91	31.05
89		23.12	30.90	31.04
90	242776	23.09	30.93	31.02
91		23.09	30.87	30.96
92	245640	23.00	30.78	30.87
93		23.06	30.74	30.83
94	244528	23.14	30.74	30.89
95		23.11	30.70	30.85
96	334408	23.08	30.84	31.02
97		23.13	30.89	31.08
98	230624	23.14	30.92	31.03
99		23.15	30.89	31.04
100	233096	23.20	30.88	31.05
101		23.23	30.91	30.98
102	230664	23.23	30.87	30.98
103		23.22	30.86	30.97
104	232120	23.21	30.92	30.97
105		23.25	30.92	30.95
106	238584	23.27	30.91	30.89
107		23.33	30.84	30.89
108	348328	23.21	30.91	30.95
109		23.34	30.96	30.96
110	247080	23.26	30.95	30.89
111		23.20	30.98	30.92
112	246720	23.31	31.05	30.93
113		23.35	30.96	30.90
114	252992	23.36	30.89	30.94
115		23.37	30.90	30.97
116	258296	23.38	30.94	31.00
117		23.40	30.92	30.93
118	257240	23.44	31.02	31.05
119		23.43	31.04	31.05
120	355528	23.39	31.01	31.05
121		23.42	31.13	31.23
122	250384	23.40	31.20	31.25
123		23.35	31.20	31.28
124	252672	23.37	31.16	31.25
125		23.35	31.09	31.22
126	247920	23.14	31.15	31.18
127		23.23	31.07	31.14
128	240000	23.28	31.17	31.21
129		23.31	31.08	31.24
130	243232	23.27	31.22	31.33
131		23.25	31.23	31.32
132	349488	23.16	31.25	31.29
133		23.19	31.36	31.43
134	250616	23.16	31.48	31.54
135		23.17	31.43	31.53
136	245536	23.19	31.29	31.42
137		23.15	31.31	31.36
138	251296	23.19	31.33	31.38
139		23.21	31.24	31.32
140	250056	23.32	31.22	31.33
141		23.39	31.25	31.28
142	273200	23.46	31.24	31.23
143		23.46	31.18	31.18
144	380248	23.32	31.05	31.10
145		23.37	31.11	31.13
146	276568	23.40	31.23	31.24
147		23.47	31.18	31.28
148	263472	23.53	31.13	31.16
149		23.57	31.06	31.06

Statistics for tennis_9...

#	Bits	Y-SNR	Cb-SNR	Cr-SNR
0	690232	25.83	39.76	41.07
1		25.75	39.80	41.09
2	553024	25.68	39.83	41.18
3		25.86	39.86	41.28
4	554800	25.97	39.87	41.27
5		25.86	39.86	41.23
6	542872	25.76	39.71	41.07
7		25.89	39.68	40.92
8	607592	25.70	39.75	40.94
9		25.84	39.79	41.10
10	602840	25.56	39.79	41.09
11		25.54	39.69	40.99
12	778224	25.35	39.82	41.22
13		25.55	39.88	41.15
14	585624	26.02	39.83	40.98
15		25.76	39.81	41.08
16	574944	25.44	39.82	41.08
17		25.40	39.74	41.08
18	585152	25.68	39.70	41.01
19		25.81	39.71	40.94
20	579224	25.86	39.69	40.82
21		25.77	39.56	40.71
22	685680	25.37	39.47	40.61
23		25.84	39.49	40.73
24	781600	26.34	39.73	41.21
25		27.06	39.80	41.34
26	635952	27.46	40.04	41.51
27		27.85	40.17	41.90
28	508688	28.02	40.22	41.80
29		28.24	40.23	41.75
30	466568	28.33	40.22	41.83
31		28.73	40.52	42.12
32	431208	28.79	40.69	42.36
33		29.16	40.89	42.51
34	385760	29.03	40.96	42.41
35		29.40	41.37	42.48
36	437824	29.60	41.50	42.78
37		29.69	41.55	42.90
38	362376	29.75	41.53	42.67
39		29.81	41.69	42.58
40	451672	30.39	42.09	42.98
41		30.52	42.05	43.06
42	658896	30.73	42.72	43.89
43		30.78	42.64	43.90
44	651496	30.39	42.67	43.82
45		30.40	42.72	43.97
46	651032	30.38	42.75	43.90
47		30.41	42.64	43.80
48	696152	30.29	42.56	43.78
49		30.35	42.53	43.60
50	651664	30.17	42.38	43.48
51		30.17	42.27	43.43
52	657240	29.89	42.20	43.16
53		29.85	42.18	43.13
54	662968	29.66	42.10	42.98
55		29.67	42.10	42.77
56	675952	29.35	42.05	42.78
57		29.37	41.97	42.72
58	696400	29.11	41.86	42.62
59		29.16	41.78	42.50
60	757672	28.80	41.90	42.52
61		28.85	41.79	42.50
62	708840	28.62	41.69	42.32
63		28.74	41.60	42.25
64	418064	26.07	41.52	42.02
65		26.08	41.41	41.92
66	568424	25.94	41.42	41.67
67		25.58	39.89	39.88
68	285536	25.52	39.82	39.78
69		25.43	39.73	39.72
70	300632	25.37	39.66	39.68
71		25.28	39.60	39.63
72	817176	28.90	40.04	39.99
73		28.91	39.93	39.93
74	646880	29.27	39.86	39.88
75		29.26	39.79	39.84
76	641392	29.30	39.75	39.75
77		29.30	39.65	39.71
78	627424	29.37	39.53	39.61
79		29.38	39.47	39.61
80	642272	29.23	39.46	39.60
81		29.21	39.45	39.59
82	642408	29.21	39.48	39.62
83		29.20	39.45	39.65
84	806480	29.28	39.88	39.83
85		29.30	39.86	39.86
86	631720	29.35	39.84	39.76
87		29.37	39.74	39.79
88	566608	29.40	39.61	39.65
89		29.39	39.57	39.64
90	615208	29.44	39.63	39.69
91		29.43	39.59	39.65
92	623080	29.45	39.55	39.72
93		29.45	39.53	39.66
94	280864	25.80	39.40	39.57
95		25.80	39.44	39.53
96	720224	25.60	39.81	39.83
97		24.31	40.30	40.45
98	318096	24.31	40.22	40.30
99		24.31	40.12	40.28
100	344232	24.31	40.18	40.26
101		24.32	40.11	40.38
102	748400	28.89	40.14	40.36
103		28.89	40.10	40.47
104	736024	28.93	40.05	40.48
105		28.95	40.03	40.45
106	737968	28.97	40.01	40.35
107		28.96	40.00	40.34
108	934032	28.98	40.43	40.66
109		28.98	40.42	40.65
110	717240	28.98	40.37	40.63
111		28.98	40.34	40.58
112	707744	28.96	40.24	40.48
113		28.95	40.21	40.48
114	653328	28.92	40.05	40.32
115		28.91	40.02	40.26
116	603736	28.78	39.94	40.13
117		28.79	39.84	40.10
118	554640	28.68	39.68	39.92
119		28.68	39.66	39.91
120	774056	28.64	39.78	39.89
121		28.64	39.72	39.82
122	622512	28.61	39.69	39.77
123		28.55	39.67	39.70
124	665104	28.28	39.53	39.49
125		27.99	39.52	39.40
126	557600	27.09	39.23	39.25
127		26.80	39.26	39.14
128	562496	26.32	39.42	39.24
129		26.26	39.30	39.32
130	554072	26.14	39.41	39.29
131		26.10	39.25	39.29
132	656096	25.99	39.49	39.39
133		25.90	39.47	39.44
134	531928	25.76	39.57	39.38
135		25.70	39.51	39.61
136	499376	25.58	39.52	39.47
137		25.51	39.52	39.52
138	504480	25.49	39.76	39.74
139		25.50	39.66	39.75
140	563632	25.48	39.67	39.57
141		25.51	39.56	39.71
142	598504	25.57	39.46	39.68
143		25.57	39.37	39.61
144	707640	25.59	39.41	39.60
145		25.55	39.43	39.63
146	605488	25.51	39.47	39.66
147		25.51	39.42	39.61
148	556728	25.37	39.31	39.57
149		25.33	39.27	39.55

Statistics for mobile_9...

#	Bits	Y-SNR	Cb-SNR	Cr-SNR
0	681984	24.25	34.27	34.76
1		24.33	34.24	34.75
2	581016	24.40	34.18	34.74
3		24.41	34.15	34.66
4	582336	24.42	34.10	34.75
5		24.46	34.04	34.64
6	586608	24.54	33.92	34.56
7		24.49	34.07	34.42
8	569208	24.51	34.04	34.33
9		24.54	34.06	34.41
10	543936	24.47	34.09	34.38
11		24.52	34.02	34.50
12	666592	24.46	34.14	34.60
13		24.49	34.19	34.67
14	536992	24.55	34.08	34.70
15		24.67	34.16	34.59
16	554504	24.73	34.08	34.60
17		24.72	34.11	34.58
18	557064	24.75	34.17	34.64
19		24.71	34.21	34.68
20	575008	24.79	34.23	34.72
21		24.83	34.20	34.77
22	606768	24.91	34.21	34.76
23		24.91	34.31	34.73
24	730952	24.92	34.32	34.88
25		24.96	34.61	35.04
26	599344	24.99	34.46	34.99
27		24.98	34.37	34.94
28	594184	24.95	34.35	34.88
29		24.96	34.30	34.84
30	593800	25.01	34.16	34.65
31		25.06	34.05	34.55
32	586920	25.10	33.94	34.44
33		25.07	33.91	34.40
34	602536	25.10	33.98	34.42
35		25.11	33.92	34.37
36	729752	25.04	34.19	34.67
37		25.02	34.18	34.67
38	603768	25.04	34.15	34.59
39		24.98	34.17	34.52
40	591152	24.80	34.14	34.50
41		24.87	34.02	34.50
42	590728	24.95	34.00	34.39
43		24.87	33.93	34.34
44	591240	24.92	33.89	34.28
45		24.93	33.93	34.34
46	594400	24.97	33.88	34.30
47		24.95	33.79	34.23
48	712848	24.90	34.01	34.45
49		24.96	34.04	34.49
50	587016	25.00	34.04	34.48
51		24.94	34.08	34.56
52	597456	24.96	34.03	34.52
53		24.97	33.93	34.41
54	574760	24.94	33.72	34.16
55		24.95	33.59	34.14
56	572896	24.94	33.60	34.04
57		24.90	33.54	33.97
58	575048	24.97	33.47	33.85
59		24.92	33.46	33.81
60	701544	24.91	33.82	34.21
61		24.91	33.84	34.20
62	564888	24.91	33.89	34.20
63		24.83	33.87	34.23
64	559992	24.95	33.80	34.26
65		24.98	33.74	34.08
66	574632	24.98	33.66	34.00
67		25.03	33.59	34.04
68	579464	25.05	33.60	33.88
69		25.07	33.55	33.85
70	579272	25.07	33.44	33.86
71		25.07	33.47	33.78
72	720784	25.03	33.74	34.11
73		25.12	33.73	34.06
74	602552	25.13	33.69	34.03
75		25.19	33.66	33.92
76	569536	25.07	33.48	33.73
77		24.91	33.48	33.60
78	549256	25.03	33.38	33.68
79		25.04	33.29	33.65
80	545920	25.09	33.27	33.57
81		25.10	33.24	33.56
82	535472	25.08	33.21	33.60
83		25.09	33.22	33.57
84	675576	25.04	33.59	33.90
85		25.02	33.55	33.90
86	547288	25.03	33.49	33.83
87		25.00	33.48	33.80
88	550952	25.02	33.45	33.75
89		25.05	33.44	33.67
90	558040	25.02	33.51	33.70
91		25.01	33.43	33.70
92	577736	25.00	33.46	33.73
93		25.06	33.48	33.70
94	598816	25.21	33.54	33.87
95		25.22	33.52	33.91
96	724704	25.32	33.79	34.18
97		25.31	33.85	34.18
98	572592	25.27	33.80	34.14
99		25.28	33.76	34.09
100	578216	25.35	33.71	34.06
101		25.36	33.68	34.01
102	584128	25.40	33.65	34.04
103		25.40	33.68	34.00
104	595912	25.37	33.84	34.02
105		25.45	33.85	34.00
106	602704	25.45	33.81	33.94
107		25.43	33.72	33.95
108	750168	25.45	33.87	34.20
109		25.45	33.83	34.18
110	605808	25.33	33.80	34.11
111		25.37	33.79	34.04
112	594704	25.33	33.76	33.99
113		25.34	33.72	33.98
114	584560	25.31	33.55	33.88
115		25.28	33.53	33.84
116	585744	25.22	33.54	33.89
117		25.24	33.56	33.87
118	570376	25.19	33.63	33.91
119		25.16	33.68	33.98
120	693952	25.16	33.71	34.05
121		25.14	33.97	34.35
122	535592	25.07	33.92	34.28
123		25.00	33.90	34.38
124	533136	24.96	33.82	34.22
125		24.94	33.88	34.11
126	525320	24.74	33.78	34.04
127		24.77	33.76	34.03
128	527760	24.84	33.88	34.17
129		24.80	33.86	34.18
130	562952	24.81	34.02	34.44
131		24.74	34.04	34.42
132	754840	24.85	34.45	34.85
133		24.84	34.50	34.98
134	619328	24.79	34.49	34.97
135		24.77	34.54	34.97
136	597880	24.74	34.42	34.79
137		24.70	34.34	34.74
138	581592	24.78	34.38	34.58
139		24.79	34.18	34.50
140	585512	25.04	34.24	34.64
141		25.12	34.21	34.72
142	641440	25.39	34.33	34.61
143		25.40	34.16	34.58
144	803584	25.31	34.13	34.49
145		25.33	34.34	34.62
146	655816	25.35	34.27	34.67
147		25.42	34.28	34.72
148	614408	25.42	33.94	34.33
149		25.53	33.71	34.12

Statistics for popple_9...

#	Bits	Y-SNR	Cb-SNR	Cr-SNR
0	601648	29.57	38.69	39.17
1		29.53	38.44	39.04
2	532480	29.39	38.31	38.84
3		29.42	38.34	38.96
4	551376	29.48	38.34	38.88
5		29.50	38.24	38.88
6	599512	29.81	38.50	39.17
7		29.87	38.51	39.08
8	604944	29.84	38.55	39.05
9		29.86	38.44	38.98
10	609880	29.86	38.42	38.90
11		29.83	38.40	38.95
12	678440	29.92	38.77	39.39
13		29.99	38.58	39.05
14	607856	29.82	38.53	38.98
15		29.78	38.47	39.05
16	604744	29.75	38.52	39.00
17		29.79	38.49	39.07
18	601176	29.85	38.46	39.05
19		29.90	38.50	39.04
20	598304	29.68	38.55	39.03
21		29.72	38.53	39.03
22	600976	29.72	38.56	39.18
23		29.70	38.59	39.11
24	657688	29.65	39.06	39.66
25		29.54	38.89	39.36
26	591472	29.50	38.95	39.39
27		29.60	38.89	39.24
28	594872	29.64	38.83	39.25
29		29.71	38.89	39.35
30	586152	29.65	38.84	39.33
31		29.65	38.72	39.39
32	589744	29.80	38.73	39.35
33		29.83	38.72	39.23
34	588352	29.81	38.66	39.34
35		29.78	38.75	39.28
36	659768	29.81	39.05	39.64
37		29.86	38.94	39.45
38	590592	29.98	38.78	39.46
39		29.97	38.76	39.37
40	591344	30.01	38.64	39.24
41		30.05	38.59	39.13
42	592840	30.08	38.60	39.30
43		30.10	38.58	39.20
44	601112	30.04	38.58	39.16
45		30.03	38.57	39.10
46	595336	30.09	38.32	38.94
47		30.02	38.45	39.00
48	665552	29.89	38.82	39.44
49		29.89	38.67	39.34
50	589464	29.88	38.66	39.30
51		29.90	38.54	39.08
52	594616	29.79	38.51	39.19
53		29.84	38.51	39.08
54	602288	29.75	38.44	39.45
55		29.78	38.69	39.33
56	558448	29.59	38.52	39.01
57		29.57	38.59	39.41
58	549776	29.65	38.57	39.31
59		29.61	38.55	39.57
60	609552	29.59	38.97	39.71
61		29.62	38.85	39.64
62	568160	29.59	38.86	39.55
63		29.50	38.88	40.00
64	580680	29.71	38.94	40.12
65		29.78	39.16	40.01
66	611808	30.17	39.36	40.17
67		30.13	39.27	40.26
68	575976	29.67	39.40	40.38
69		29.66	39.41	40.42
70	599008	29.07	39.71	40.57
71		29.16	39.98	40.81
72	612200	28.86	40.19	40.94
73		28.99	40.19	40.89
74	543944	29.09	40.28	41.02
75		29.28	40.42	41.17
76	545152	29.55	40.90	41.45
77		29.73	40.87	41.52
78	571008	30.18	41.52	42.01
79		30.25	41.55	41.96
80	685328	30.62	42.10	42.40
81		30.78	42.31	42.53
82	602528	31.05	42.01	42.44
83		31.19	42.06	42.21
84	619624	31.52	42.27	42.35
85		31.52	42.24	42.46
86	590704	31.87	42.24	42.55
87		31.91	42.16	42.51
88	641360	31.65	42.45	42.74
89		31.72	42.41	42.78
90	631032	31.19	42.18	42.57
91		31.19	42.36	42.87
92	649936	30.71	42.11	42.66
93		30.63	42.17	42.54
94	703600	30.11	42.05	42.48
95		30.23	41.88	42.28
96	712528	30.06	41.30	41.80
97		29.84	41.33	41.47
98	712392	29.56	41.33	41.57
99		29.46	41.42	41.67
100	635256	28.75	40.72	40.86
101		28.90	40.49	40.94
102	564704	28.56	39.91	40.45
103		28.62	39.89	39.99
104	588736	28.07	39.87	40.28
105		28.23	39.90	40.26
106	596096	27.99	40.02	40.11
107		28.04	39.99	40.35
108	610368	28.05	39.90	40.49
109		28.06	40.00	40.43
110	607656	27.79	39.94	40.71
111		27.79	39.98	40.52
112	534264	27.44	39.56	40.09
113		27.67	39.54	40.32
114	528376	27.83	39.60	40.09
115		27.81	39.70	40.44
116	528848	27.38	39.72	40.58
117		27.41	39.64	39.95
118	558320	27.10	39.57	39.79
119		27.08	39.41	40.13
120	582696	26.88	39.26	39.62
121		26.79	39.14	39.58
122	579880	27.16	39.39	39.71
123		27.16	39.06	39.49
124	600832	27.15	39.23	39.52
125		27.37	39.09	40.10
126	581720	26.94	39.04	39.34
127		26.86	39.28	39.75
128	583040	27.23	39.08	39.92
129		27.15	39.03	39.32
130	578856	27.14	39.13	39.20
131		27.23	39.18	39.81
132	592720	26.83	39.17	39.45
133		27.03	38.98	39.46
134	594520	27.45	38.80	39.38
135		27.27	39.07	39.14
136	607856	26.85	38.89	39.16
137		27.14	38.52	39.47
138	595048	26.61	39.11	39.23
139		26.60	38.96	39.41
140	589416	27.34	38.66	39.63
141		27.06	39.16	39.17
142	597296	26.85	38.89	39.22
143		27.21	38.83	39.50
144	598112	26.59	38.97	39.23
145		26.60	38.93	39.25
146	585656	27.00	38.75	39.45
147		26.89	39.07	39.34
148	607848	26.28	38.76	39.11
149		26.47	38.75	39.46

Statistics for tennis_4...

#	Bits	Y-SNR	Cb-SNR	Cr-SNR
0	299088	23.46	38.33	38.85
1		23.36	38.35	38.92
2	223568	23.37	38.39	38.99
3		23.62	38.47	39.07
4	220864	23.62	38.46	39.05
5		23.52	38.49	39.01
6	215064	23.47	38.39	38.92
7		23.59	38.38	38.82
8	249480	23.61	38.55	38.88
9		23.70	38.55	39.08
10	258768	23.59	38.57	39.00
11		23.56	38.49	39.12
12	362592	23.42	38.59	39.48
13		23.67	38.61	39.40
14	275336	24.10	38.61	39.26
15		23.85	38.60	39.35
16	270992	23.69	38.59	39.34
17		23.63	38.56	39.38
18	255456	23.72	38.61	39.26
19		23.87	38.62	39.28
20	267376	23.93	38.55	39.11
21		23.81	38.47	39.06
22	281728	23.36	38.36	38.97
23		23.81	38.39	39.04
24	352040	24.28	38.42	39.30
25		25.01	38.67	39.77
26	267776	25.40	38.77	39.88
27		25.83	38.87	40.15
28	224096	26.19	39.03	40.13
29		26.35	39.04	40.09
30	200768	26.56	39.15	40.31
31		26.82	39.32	40.42
32	179240	27.06	39.51	40.40
33		27.32	39.66	40.55
34	174416	27.59	39.80	40.65
35		27.76	39.97	40.68
36	216808	28.22	40.00	40.67
37		28.20	40.31	40.87
38	163568	28.42	40.23	40.84
39		28.45	40.34	40.65
40	191416	28.98	40.66	41.00
41		29.11	40.56	41.07
42	237560	29.33	40.91	41.68
43		29.42	40.83	41.53
44	336536	29.63	41.56	42.20
45		29.62	41.51	42.13
46	330880	29.61	41.49	42.20
47		29.70	41.38	42.18
48	373152	29.59	41.25	41.90
49		29.59	41.20	41.65
50	336384	29.46	41.06	41.68
51		29.43	40.91	41.55
52	298448	29.05	40.62	41.10
53		28.96	40.66	41.05
54	301856	28.85	40.62	40.79
55		28.81	40.61	40.67
56	306072	28.55	40.42	40.64
57		28.55	40.29	40.43
58	321320	28.33	40.18	40.39
59		28.39	40.18	40.29
60	372504	28.05	40.14	40.35
61		28.11	40.08	40.39
62	326856	27.93	40.09	40.30
63		28.01	39.95	40.17
64	231384	25.92	39.65	39.81
65		25.92	39.51	39.69
66	357824	25.80	39.48	39.45
67		25.39	38.16	38.13
68	121248	25.31	38.13	38.03
69		25.23	38.09	38.02
70	138296	25.17	38.08	37.99
71		25.08	38.05	37.93
72	369016	27.91	37.94	37.82
73		27.92	37.90	37.78
74	244840	28.21	37.83	37.73
75		28.23	37.82	37.67
76	240632	28.27	37.79	37.60
77		28.25	37.74	37.59
78	232816	28.32	37.68	37.53
79		28.33	37.71	37.50
80	239832	28.23	37.74	37.56
81		28.18	37.72	37.54
82	252624	28.22	37.76	37.58
83		28.22	37.77	37.58
84	387224	28.36	37.99	37.75
85		28.39	37.98	37.74
86	250216	28.44	38.00	37.80
87		28.46	37.99	37.71
88	245648	28.54	37.99	37.71
89		28.52	38.00	37.72
90	237640	28.55	37.98	37.67
91		28.53	37.95	37.66
92	262568	28.56	37.97	37.72
93		28.54	37.93	37.77
94	145816	25.59	37.96	37.72
95		25.60	37.90	37.71
96	474344	25.41	38.01	37.88
97		24.15	38.69	38.53
98	175848	24.15	38.70	38.51
99		24.15	38.66	38.49
100	174064	24.15	38.62	38.51
101		24.15	38.57	38.43
102	347240	27.90	38.58	38.33
103		27.91	38.53	38.33
104	319888	27.93	38.49	38.36
105		27.93	38.46	38.28
106	320232	27.95	38.44	38.29
107		27.94	38.46	38.30
108	466528	27.89	38.49	38.31
109		27.90	38.47	38.31
110	314432	27.90	38.44	38.32
111		27.92	38.42	38.31
112	250472	27.71	38.36	38.17
113		27.69	38.32	38.17
114	259120	27.67	38.31	38.12
115		27.66	38.29	38.15
116	218728	27.41	38.27	38.08
117		27.40	38.19	38.06
118	234064	27.35	38.18	38.07
119		27.30	38.14	38.01
120	378904	27.21	38.04	37.86
121		27.23	38.06	37.92
122	266288	27.08	38.09	37.89
123		27.01	38.12	37.83
124	250864	26.42	38.08	37.66
125		25.98	38.11	37.54
126	247960	25.57	38.04	37.51
127		25.24	38.05	37.48
128	255240	24.90	38.07	37.58
129		24.82	38.06	37.65
130	252256	24.74	38.14	37.65
131		24.69	38.08	37.62
132	333672	24.55	37.96	37.40
133		24.50	37.97	37.63
134	246160	24.36	38.16	37.70
135		24.30	38.14	37.90
136	219232	24.28	38.09	37.94
137		24.21	38.23	38.00
138	204160	24.17	38.26	38.06
139		24.12	38.18	38.11
140	221032	24.07	38.18	37.98
141		24.01	38.02	37.98
142	245408	24.06	37.93	37.96
143		24.06	37.93	37.93
144	333856	24.04	37.71	37.55
145		24.06	37.80	37.73
146	260040	24.02	37.95	37.80
147		23.96	37.87	37.86
148	255808	23.94	37.88	37.88
149		23.89	37.93	37.92