限制码率的视频编码标准比较（包括MPEG-2，H.263， MPEG-4，以及 H.264）

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Thomas Wiegand等人在论文《Rate-Constrained Coder Control and Comparison of Video Coding Standards》中对比了几种编码器的效率，包括MPEG-2，H.263， MPEG-4，以及 H.264/AVC。在此记录一下关键实验数据。

总体结论：

同等码率的前提下，各种标准的视频质量如下所示：

MPEG-2<H.263<MPEG-4<H.264/AVC

流媒体方面的应用的比较

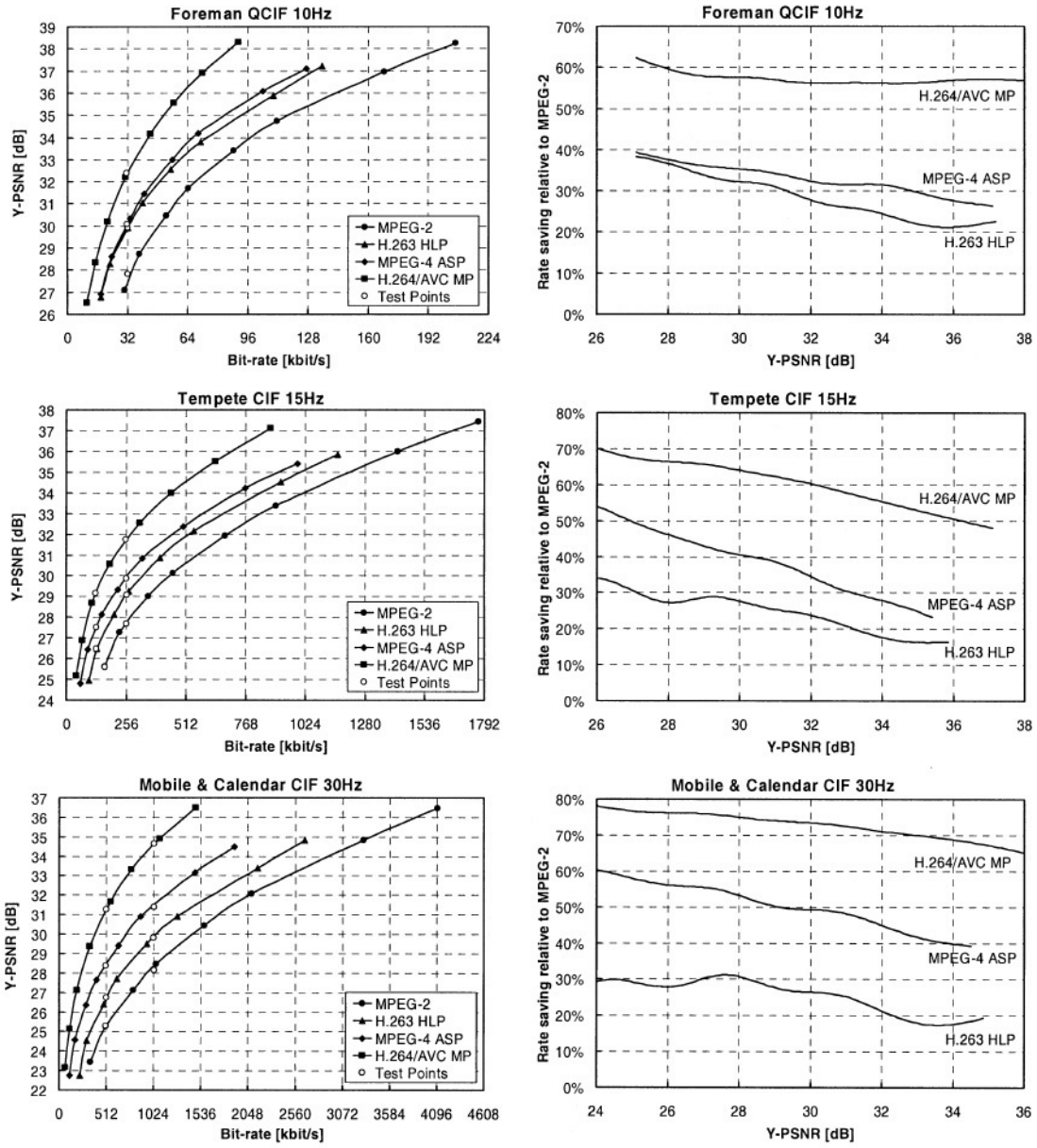
实验数据如表所示（貌似这样看比较抽象...，实验的数据量实在太大了）。一共四种编码标准，每种标准都测了PSNR-Y，PSNR-U，PSNR-V三种参数。

TABLE I
FIXED BIT-RATE RESULTS FOR VIDEO STREAMING APPLICATIONS

	MPEG-2				H.263 HLP				MPEG-4 ASP				H.264/AVC MP			
Sequence	Rate	PSNR-Y	PSNR-U	PSNR-V	Rate	PSNR-Y	PSNR-U	PSNR-V	Rate	PSNR-Y	PSNR-U	PSNR-V	Rate	PSNR-Y	PSNR-U	PSNR-V
A: QCIF, 10 Hz, 32 kbit/s																
Foreman	32.12	27.81	35.14	34.96	32.18	29.90	37.73	37.70	31.92	30.09	37.33	37.33	31.49	32.40	38.68	38.98
Container	32.22	32.71	39.75	39.04	31.97	35.96	41.38	41.12	31.82	36.42	42.46	42.23	31.89	38.57	43.00	42.98
News	32.44	29.97	35.07	36.75	32.50	34.06	38.68	39.31	32.24	33.30	37.50	38.58	31.96	35.75	39.45	40.05
Tempete	36.91*	24.83	29.38	32.04	32.24	26.62	32.50	34.74	31.68	27.87	31.61	34.21	31.83	29.62	33.58	36.02
B: QCIF, 15 Hz, 64 kbit/s																
Foreman	63.45	30.36	37.07	37.28	65.14	32.38	38.65	38.93	64.38	32.81	38.73	39.15	63.42	35.21	40.00	40.67
Container	63.95	34.34	40.95	40.40	63.97	38.26	43.32	43.22	63.87	38.47	44.21	43.87	63.67	40.67	44.80	44.92
News	63.45	32.61	37.33	38.55	63.80	36.25	39.79	40.43	64.00	35.78	39.37	40.67	63.98	38.80	41.71	42.27
Tempete	65.21	26.36	30.65	33.14	64.39	28.39	33.34	35.57	64.13	29.39	32.59	35.14	63.43	31.78	34.65	36.89
C: CIF, 15Hz, 128 kbit/s																
Foreman	130.37	28.94	35.78	36.30	128.40	30.91	38.35	39.26	127.83	31.30	38.16	38.99	128.70	33.66	39.49	40.87
Container	127.90	32.63	39.94	39.95	129.02	34.99	42.00	41.84	128.62	35.28	42.16	41.91	128.67	36.74	42.40	42.40
News	129.84	32.73	37.92	38.98	129.02	36.68	40.82	41.47	126.97	35.71	39.20	40.58	128.25	38.21	41.21	42.09
Tempete	165.75*	25.60	30.67	33.33	129.07	26.47	33.42	35.66	129.11	27.51	32.03	34.78	126.34	29.16	34.41	36.71
D: CIF, 15 Hz, 256 kbit/s																
Bus	260.78	25.96	35.78	36.25	258.76	26.97	37.60	38.87	256.15	28.31	37.57	39.15	256.14	29.86	38.44	39.96
Mobile	256.01	24.59	29.96	30.17	259.20	25.66	31.97	32.40	258.88	27.07	32.24	32.63	254.87	29.73	34.26	34.69
Flower	261.67	23.93	28.82	32.37	257.85	24.89	31.58	33.56	255.97	26.07	30.89	33.90	257.89	28.08	33.02	35.08
Tempete	257.65	27.68	32.45	34.82	259.28	29.06	34.54	36.75	256.58	29.86	34.09	36.60	254.37	31.74	35.83	37.98
E: CIF, 30 Hz, 512 kbit/s																
Bus	506.29	27.35	36.43	37.62	511.98	28.77	38.16	39.41	511.88	29.75	38.28	39.89	511.85	31.89	39.29	40.85
Mobile	506.26	25.31	30.26	30.47	513.05	26.74	32.40	32.85	505.03	28.36	33.12	33.54	512.58	31.27	35.18	35.65
Flower	518.64	25.71	30.25	33.08	517.90	26.35	31.99	34.14	511.76	27.96	32.16	34.79	514.59	30.16	33.95	35.67
Tempete	521.40	28.43	32.91	35.14	513.73	29.45	34.94	37.11	510.55	30.84	34.74	37.18	515.49	32.79	36.36	38.38
F: CIF, 30 Hz, 1024 kbit/s																
Bus	1022.54	30.72	38.70	40.12	1025.80	31.91	39.55	41.21	1022.54	32.82	39.94	41.60	1025.51	35.24	40.77	42.59
Mobile	1029.58	28.16	33.00	33.27	1024.27	29.82	34.43	34.83	1029.18	31.37	35.29	35.74	1026.00	34.64	37.27	37.74
Flower	1034.33	28.66	32.92	35.10	1033.05	29.77	33.77	35.27	1024.30	31.20	34.58	36.61	1020.08	33.67	36.23	37.32
Tempete	1029.56	31.30	35.17	37.13	1022.81	32.55	36.53	38.50	1025.77	33.34	36.51	38.69	1020.06	35.54	37.90	39.68

The achieved bit rates are given in kilobits per second, and the PSNR values for the luminance and the two chrominance components are given in decibels. The symbol "*" marks two cases in which the target bit rate was significantly exceeded in the experiment despite use of the maximum quantization step size.

实验数据如图所示（这样看还是比较形象的）。左边的图是比特率和PSNR关系图。右边的图是其他三种编码标准相对于MPEG2节约的码率的关系图。



Selected rate-distortion curves and bit-rate savings plots for video streaming applications.

平均节约的码率。例如H.264相对于MPEG4-ASP节约了37.44%的码率，相对于H.263-HLP节约了47.58%的码率，相对于MPEG2节约了63.57%的码率。

TABLE II
AVERAGE BIT-RATE SAVINGS FOR VIDEO STREAMING APPLICATIONS

	Average bit-rate savings relative to:		
Coder	MPEG-4 ASP	H.263 HLP	MPEG-2
H.264/AVC MP	37.44%	47.58%	63.57%
MPEG-4 ASP	-	16.65%	42.95%
H.263 HLP	-	-	30.61%

视频会议 方面的 应用的比较

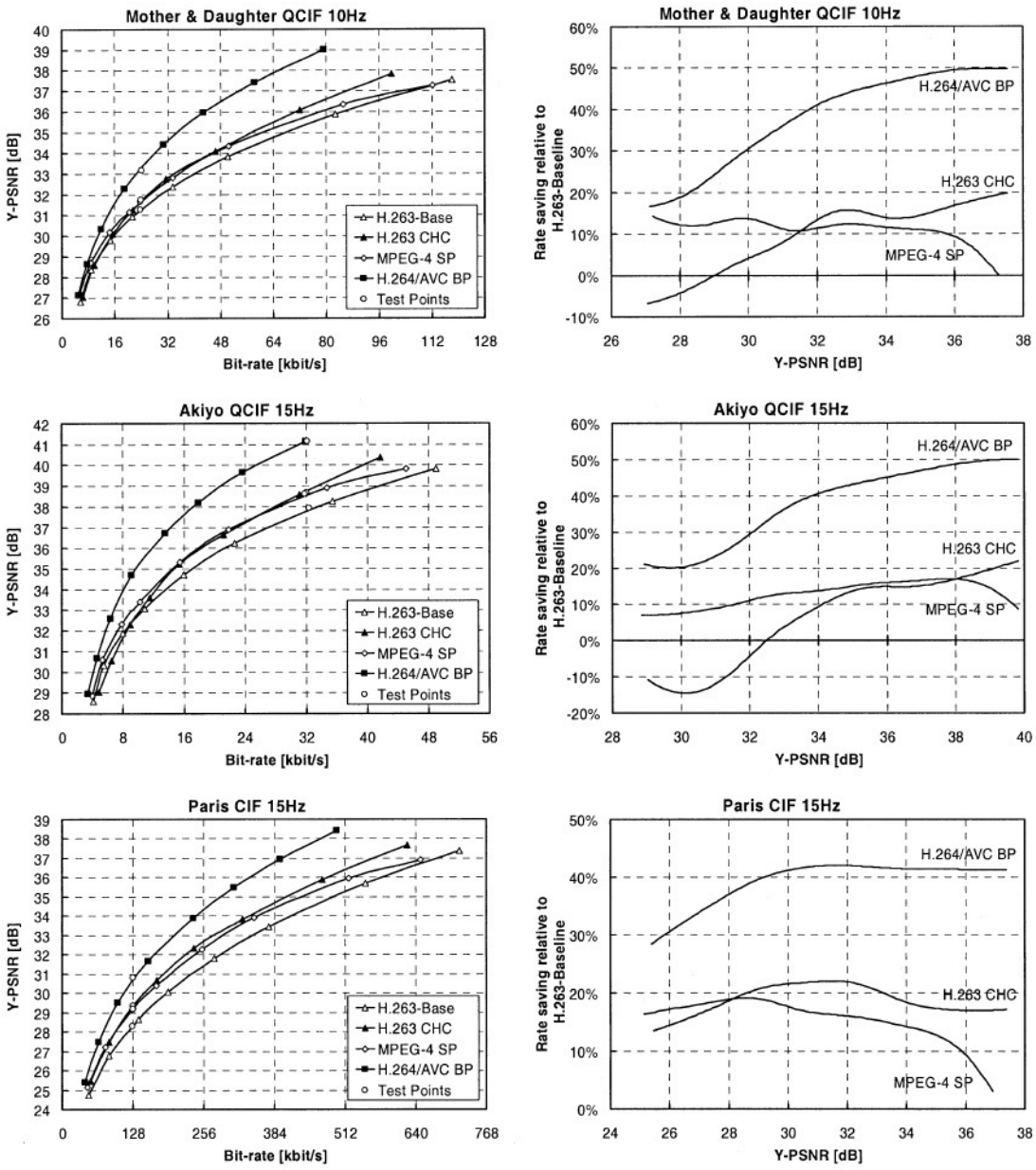
实验数据如表所示。一共四种编码标准，每种标准都测了PSNR-Y，PSNR-U，PSNR-V三种参数。

TABLE IV
FIXED BIT-RATE RESULTS FOR VIDEOCONFERENCING APPLICATIONS

	H.263 Baseline				H.263 CHC				MPEG-4 SP				H.264/AVC Baseline			
Sequence	Rate	PSNR-Y	PSNR-U	PSNR-V	Rate	PSNR-Y	PSNR-U	PSNR-V	Rate	PSNR-Y	PSNR-U	PSNR-V	Rate	PSNR-Y	PSNR-U	PSNR-V
A: QCIF, 10 Hz, 24 kbit/s																
Akiyo	24.14	37.34	39.73	41.31	24.06	38.54	41.89	42.93	24.19	38.01	40.24	41.95	24.00	40.68	42.90	43.58
Foreman	24.21	27.73	35.39	34.95	24.25	28.52	37.39	37.37	24.09	29.10	36.27	35.95	23.87	30.08	37.45	37.58
Mother & Daughter	23.78	31.27	36.49	36.32	23.82	31.68	37.80	37.65	23.97	31.75	36.62	36.37	24.08	33.19	37.96	37.71
Silent	24.08	31.12	35.44	36.93	23.90	32.31	37.28	38.83	24.14	31.68	35.51	37.02	24.09	32.42	36.34	38.07
B: QCIF, 15 Hz, 32 kbit/s																
Akiyo	32.31	37.93	40.53	41.87	32.05	38.68	41.97	42.98	31.76	38.62	41.12	42.60	32.07	41.15	43.22	43.95
Foreman	31.78	28.17	35.38	35.01	32.10	28.66	37.39	37.34	32.13	29.35	36.19	36.13	32.37	30.51	37.58	37.60
Mother & Daughter	31.77	31.56	36.62	36.49	31.74	31.87	37.81	37.61	32.27	31.96	36.73	36.70	32.14	33.66	37.99	37.81
Silent	31.79	31.21	35.46	36.90	31.88	32.58	37.58	38.89	31.97	31.95	35.74	37.39	32.18	32.47	36.45	38.04
C: CIF, 15 Hz, 128 kbit/s																
Carphone	129.71	31.53	35.94	37.03	127.64	32.32	38.02	39.24	127.82	32.50	36.62	37.73	125.64	33.50	37.75	39.23
Foreman	128.32	29.92	36.40	37.00	127.97	30.76	38.50	39.39	128.65	31.52	37.71	38.45	127.24	32.96	38.77	40.06
Paris	127.38	28.30	33.30	33.84	128.29	29.34	35.56	36.32	127.95	29.18	33.59	34.25	128.52	30.81	35.80	36.18
Sean	129.74	36.64	40.56	41.07	128.47	37.91	41.71	42.29	127.37	36.75	40.50	41.31	129.89	39.46	42.22	43.05
D: CIF, 30 Hz, 256 kbit/s																
Carphone	258.89	32.47	36.35	37.54	256.20	33.31	38.20	39.62	256.71	33.34	36.99	38.20	257.42	34.39	37.79	39.21
Foreman	254.66	31.60	37.23	37.86	256.49	32.06	38.96	40.05	258.48	32.39	38.08	39.03	253.62	34.27	39.59	40.85
Paris	257.05	29.55	34.08	34.70	258.19	30.56	36.19	36.65	254.91	30.34	34.44	34.95	256.43	32.24	36.67	36.93
Sean	254.91	37.94	41.42	42.06	258.52	39.53	43.03	43.65	258.09	37.89	41.59	42.45	257.54	40.72	43.26	44.17

The achieved bit rates are given in kilobits per second, and the PSNR values for the luminance and the two chrominance components are given in decibels.

和第一组实验结果图类似。左边的图是比特率和PSNR关系图。右边的图是其他三种编码标准相对于MPEG2节约的码率的关系图。



Selected rate-distortion curves and bit-rate savings plot for videoconferencing applications (neglecting low-delay H.264/AVC MP).

平均节约的码率。例如H.264相对于MPEG4-ASP节约了27.69%的码率，相对于H.263-HLP节约了29.37%的码率，相对于MPEG2节约了40.59%的码率。

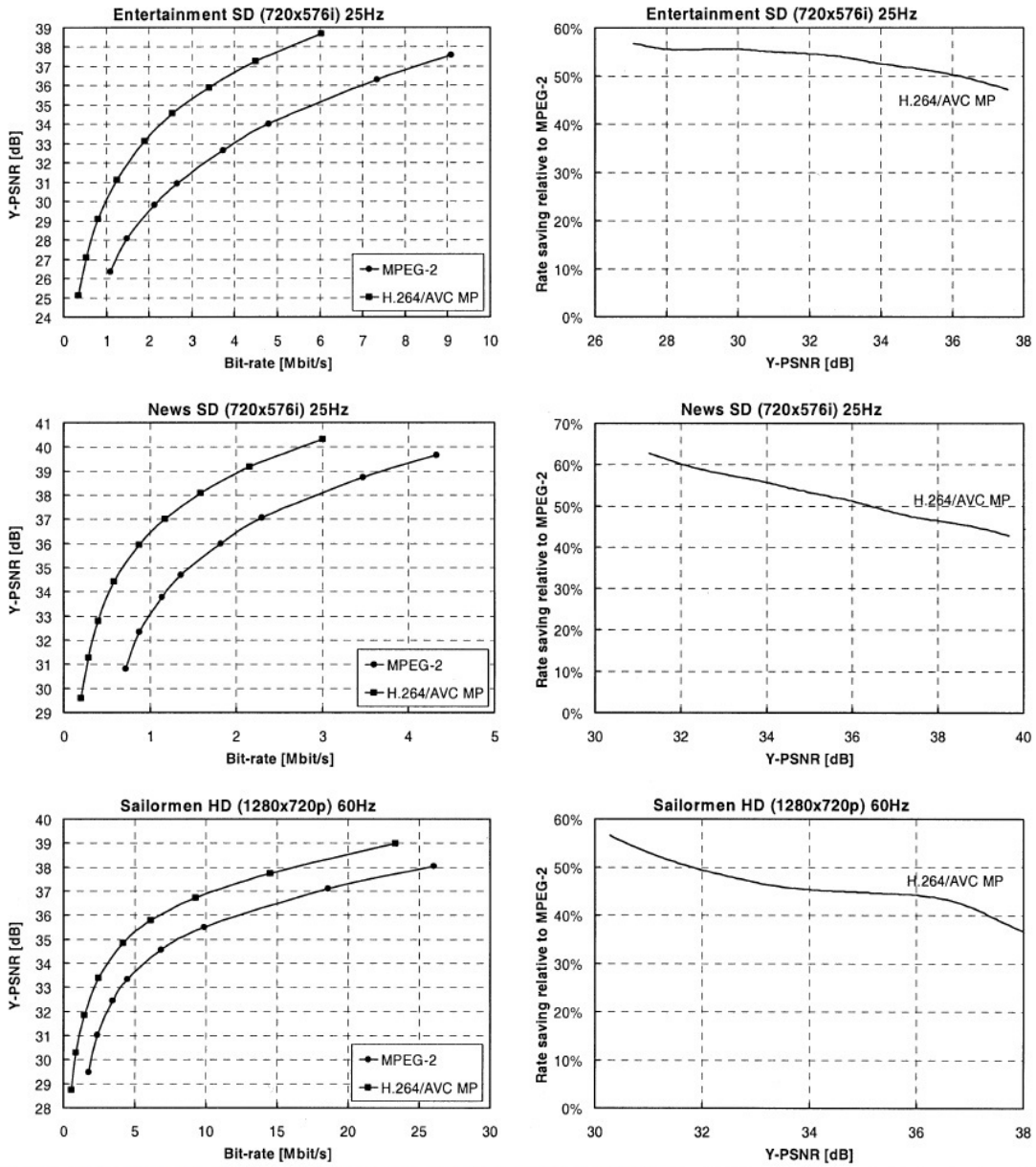
TABLE III
AVERAGE BIT-RATE SAVINGS FOR VIDEOCONFERENCING APPLICATIONS

	Average bit-rate savings relative to:		
Coder	H.263 CHC	MPEG-4 SP	H.263 Base
H.264/AVC BP	27.69%	29.37%	40.59%
H.263 CHC	-	2.04%	17.63%
MPEG-4 SP	-	-	15.69%

(Neglecting low-delay H.264/AVC MP)

娱乐方面的应用的比较

结果如图所示，在这一环节只有两种标准：MPEG2和H.264。



Selected rate-distortion curve and bit-rate savings plot for entertainment-quality applications.

论文地址： http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=1218200

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个人分类： 视频质量评价 视频编码

所属专栏： 视频质量评价