Lossless video codecs comparison

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Altogether tested: **15 codecs!**
Test sequences: **9!**

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CS MSU Graphics&Media Lab

Video Group

http://www.compression.ru/video/

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Overview

Lossless codecs

CODEC	PRODUCER	VERSION
1. Alpary	Alparysoft	2.0 build 951.040602 alpha
2. AVIzlib	Kenji Oshima	2.2.3
3. CamStudio GZIP	RenderSoft	1
4. CorePNG	Jory Stone	0.8.2
5. FFV1	M. Niedermayer	ffdshow 08.08.04
6. GLZW	Gabest	1.01
7. Huffyuv	Ben Rudiak-Gould	2.1.1
8. Lagarith	Ben Greenwood	1.0.0.1
9. Lead JPEG	Lead Technoligies	1.0.0.1
10. LOCO	M. Rezaei	0.2
11. MindVid	MindBend Software	1.0 beta 1 (demo)
12. MSU Lab	MSU Graphics & Media Lab	beta v0.2.4
13. MSU Lab	MSU Graphics & Media Lab	v0.5.2
14. Snow		
15. PICvideo	Pegasus Imaging Corporation	2.10.0.29
16. VBLE	MarcFD	beta version

CODEC	RGB	YUY2	YV12	REGISTRATION NEEDED	NO LOGO
1. Alpary 2.0	✓	✓	✓	-	-
2. AVIzlib 2.2.3	✓	Indirect RGB->YUY2	Indirect RGB->YV12	✓	✓
3. CamStudio GZIP 1.0	✓	-	-	✓	✓
4. CorePNG 0.8.2	✓	✓	✓	✓	✓
5. FFV1 08/08/04	✓	✓	✓	✓	✓
6. GLZW 1.01	Auto RGB->YV12	Auto YUY2->YV12	✓	✓	✓
7. Huffyuv 2.1.1	✓	✓	-	✓	✓
8. Lagarith 1.0.0.1	✓	✓	✓	✓	✓
9. Lead JPEG 1.0.0.1	✓	-	-	✓	✓
10. LOCO 0.2	✓	✓	✓	✓	✓
11. MindVid 1.0 beta	✓	-	-	-	-
12. MSU Lab beta v0.2.4	✓	✓	-	✓	✓
13. MSU Lab v0.5.2	✓	✓	✓	✓	✓
14. PICvideo 2.10	✓	Indirect RGB->YUY2	-	-	-
15. VBLE beta	Auto RGB->YV12	Auto YUY2->YV12	✓	✓	✓

Red color indicate lossy conversions.

Sequences

Sequence	Number of frames	Original size (RGB)	Resolution
1. foreman	300	38481 K	352x288
2. bus	150	20761 K	352x288
3. susidi	374	235618 K	704x576
4. tensdi	373	323308 K	704x576
5. bbc3di	374	263400 K	704x576
6. helicopterdi	113	41112 K	704x352
7. NDDP7di	188	90089 K	720x576
8. battle	1599	351268 K	704x288
9. bankomatdi	376	120286 K	704x352

Comparison rules

- To detect losses after compression in YUV and RGB colorspaces we used VirtualDub 1.6 and VirtualDub 1.5.10 respectively.
- Points related to the sequences that were compressed with losses are omitted from the diagrams. Therefore branches related to the codecs that compressed all the sequences with losses aren't shown on the diagrams.
- Codecs with options that allowed choosing between speed and compression strength were tested using their maximum compression strength settings (special cases are mentioned).
- Compression ratio shown on the diagrams is calculated separately for each colorspace as the ratio between the sizes of the sequence before and after compression.
- Y-axis values on the diagrams where one codec is compared to another (Huffyuv, for example) are calculated as the ratio between the compression ratios of both algorithms.
- Compression ratio in the "Result rating" section is calculated as the ratio between the total size of all the sequences before compression and after compression.

Brief codec description

Codec Instance Support

Many lossless codecs do not allow saving their state and internal parameters (codec instance) using standard system calls. Since codecs of this kind do not usually use interframe compression, this fact doesn't anyhow affect their ordinary use. But it causes difficulties in saving different codec settings (if there are any settings in the codec) for different sequences. In particular such codecs don't work properly in batch-mode processing in VirtualDub.

Codecs with codec instance support:

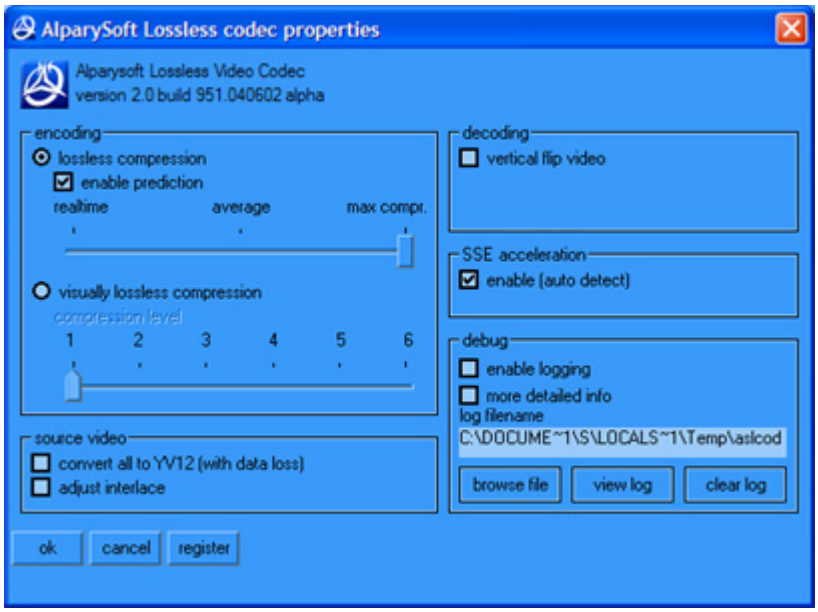
AVIzlib 2.2.3, CorePNG 0.8.2, FFV1 08/08/04, LEAD JPEG 1.0.0.1 (нет параметров), VBLE BETA (нет параметров).

Codecs without codec instance support:

Alpary, CamStudio GZIP 1.0, GLZW 1.01, LOCO 0.2, MindVid 1.0 beta, MSU Lab beta v0.2.4.

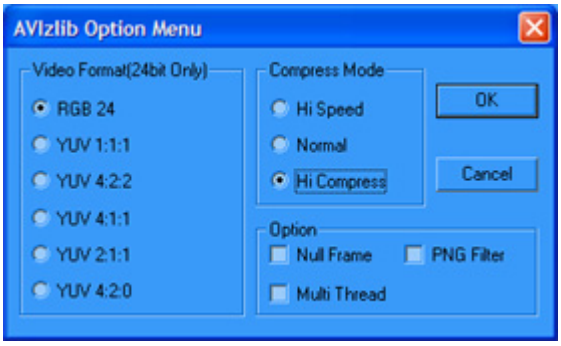
Alpary 2.0

Supports lossless compression in RGB, YUY2 and YV12 colorspaces. Places a small company logo in the right bottom corner of the frame when unregistered. Doesn't support codec instance.



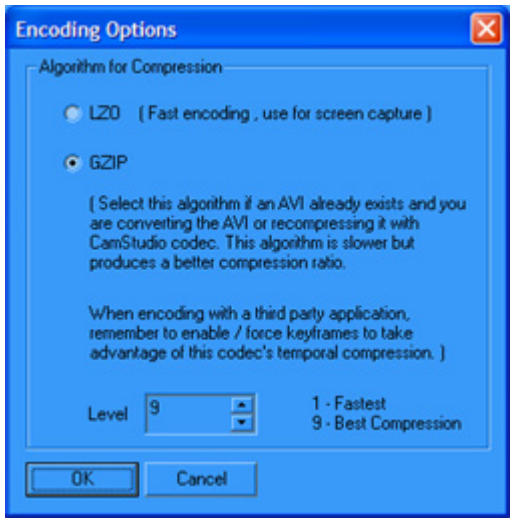
AVIzlib 2.2.3

Only RGB video signal can be used as input signal to this codec. However the codec allows converting it to YUV (for example, YUV2 or YV12). Such conversion causes slight losses invisible by eye.



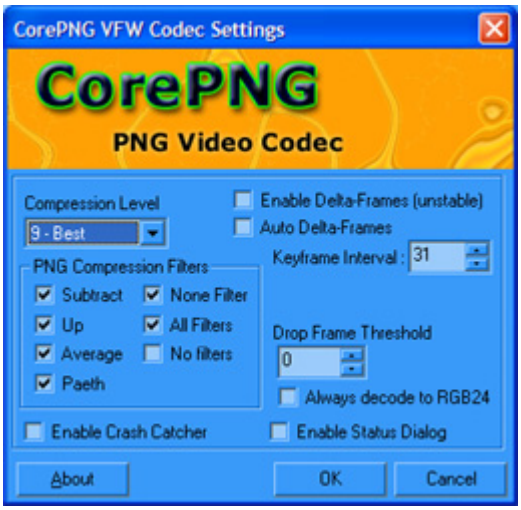
GZIP 1.0

Doesn't support compression in YUY2, YV12 and codec instance.



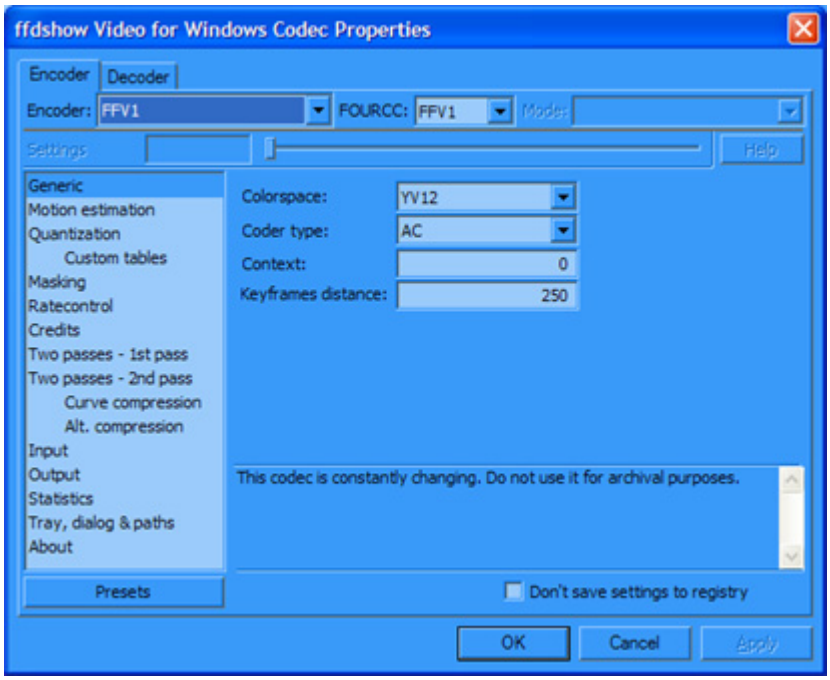
CorePNG 0.8.2

Supports lossless compression in RGB, YUY2 and YV12 colorspaces. For compression in YUV the input video signal should also be in YUV. Supports codec instance.



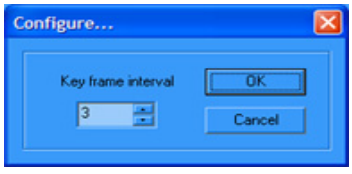
FFV1 08/08/04

Supports lossless compression in all the colorspaces used in this testing. Supports codec instance.



GLZW 1.01

An error occurred during the playback of the compressed (in RGB) “battle” sequence, the playback couldn’t be continued.

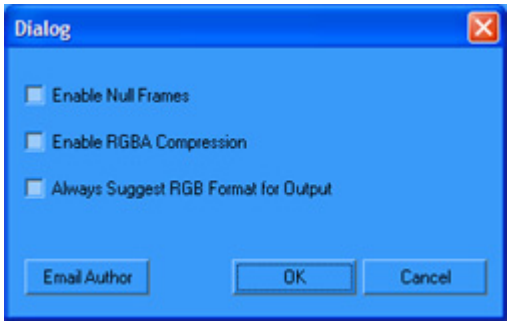


Huffyuv 2.1.1

Supports lossless compression in RGB and YUY2. In order to compress in YUY2 one should provide input signal in YUY2 and specify compression method in the «RGB compression method» field. The codec will automatically detect the right colorspace of the video input and perform lossless compression in this colorspace. Doesn't support codec instance.

Lagarith 1.0.0.1

Supports lossless compression in RGB, YUY2 and YV12 colorspaces. There were no claims regarding performance of this codec.

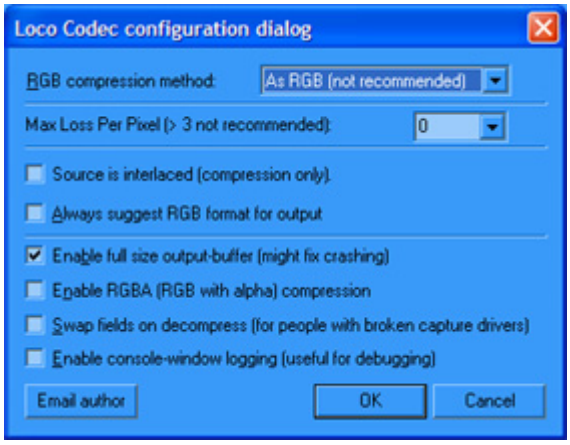


LEAD JPEG 1.0.0.1

Doesn't support YUY2 and YV12. Doesn't provide any options for compression (such as "compression ratio/speed").

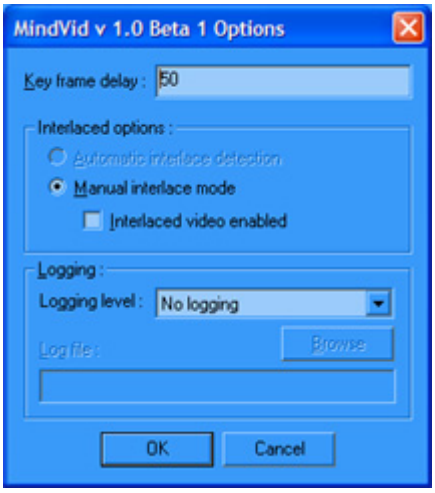
LOCO 0.2

Supports lossless compression in RGB, YUY2 and YV12 colorspaces. To compress in YUY2 and YV12 one should set the «RGB compression method» field to «As RGB» and provide input video signal in these colorspaces.



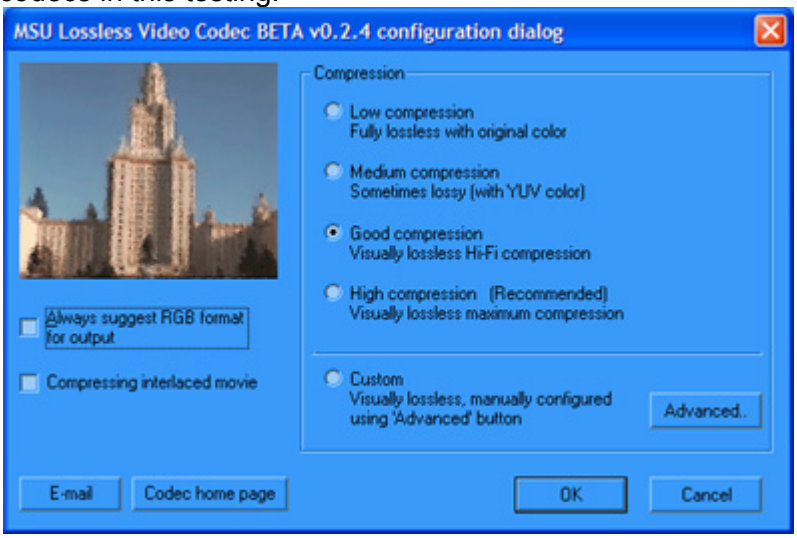
MindVid 1.0 beta

Creates a rather big logo in the upper right corner when unregistered. Default settings of this codec imply log-file creation, which significantly slows down both compression and decompression (a file of 4.5Gb was created in the home VirtualDub directory after compression of all the test sequences). Doesn't support compression in YUY2 and YV12 colorspaces and codec instance.



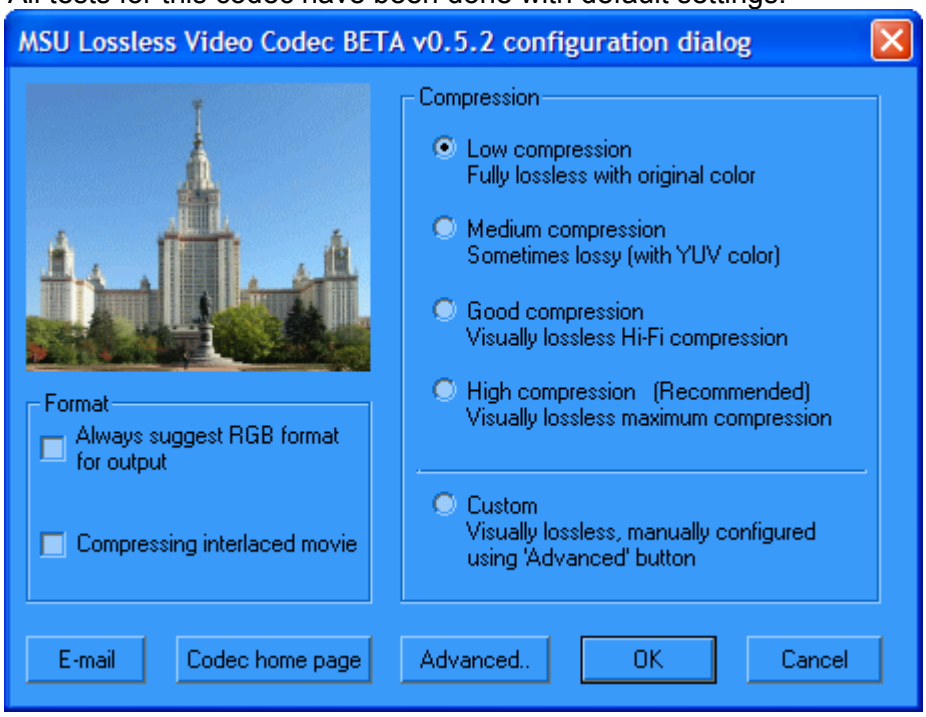
MSU Lab beta v0.2.4

Doesn't support compression in YV12 and state saving. Has the lowest speed among all the other codecs in this testing.



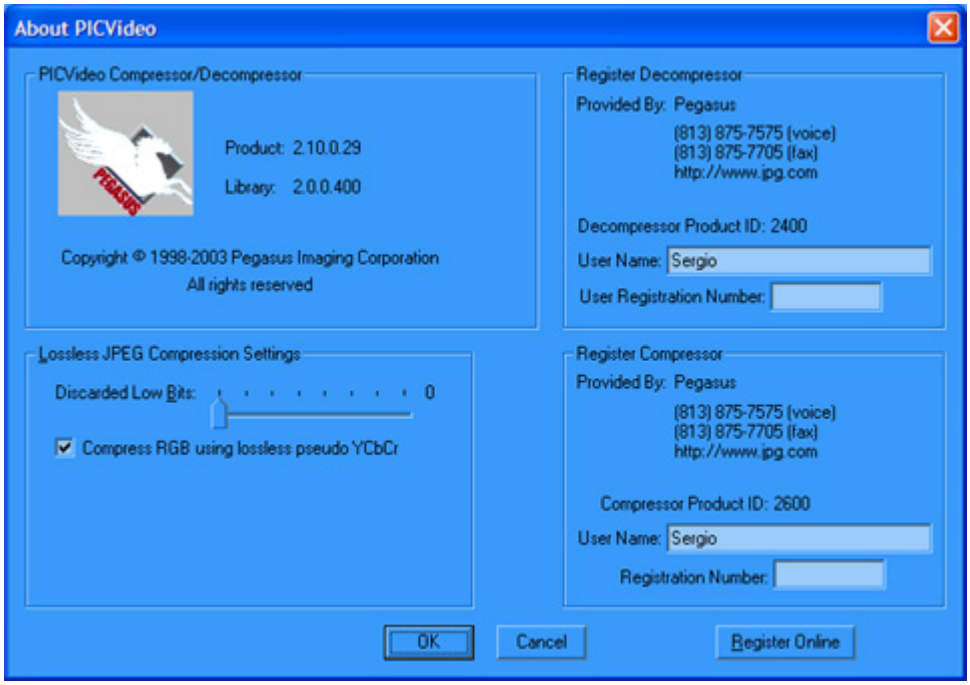
MSU Lab v0.5.2

Supports YUY2, YV12 and Codec Instance. Speed performance significantly improved. All tests for this codec have been done with default settings.



PICvideo 2.10

Places two rather big advertising notes in the top and the bottom of the frame if unregistered. An error occurred during the compression (in RGB) of the “tensdi” sequence; the compression process stopped. Input video signal should be in RGB only; the codec supports conversion to YCbCr (here YUY2).



Snow

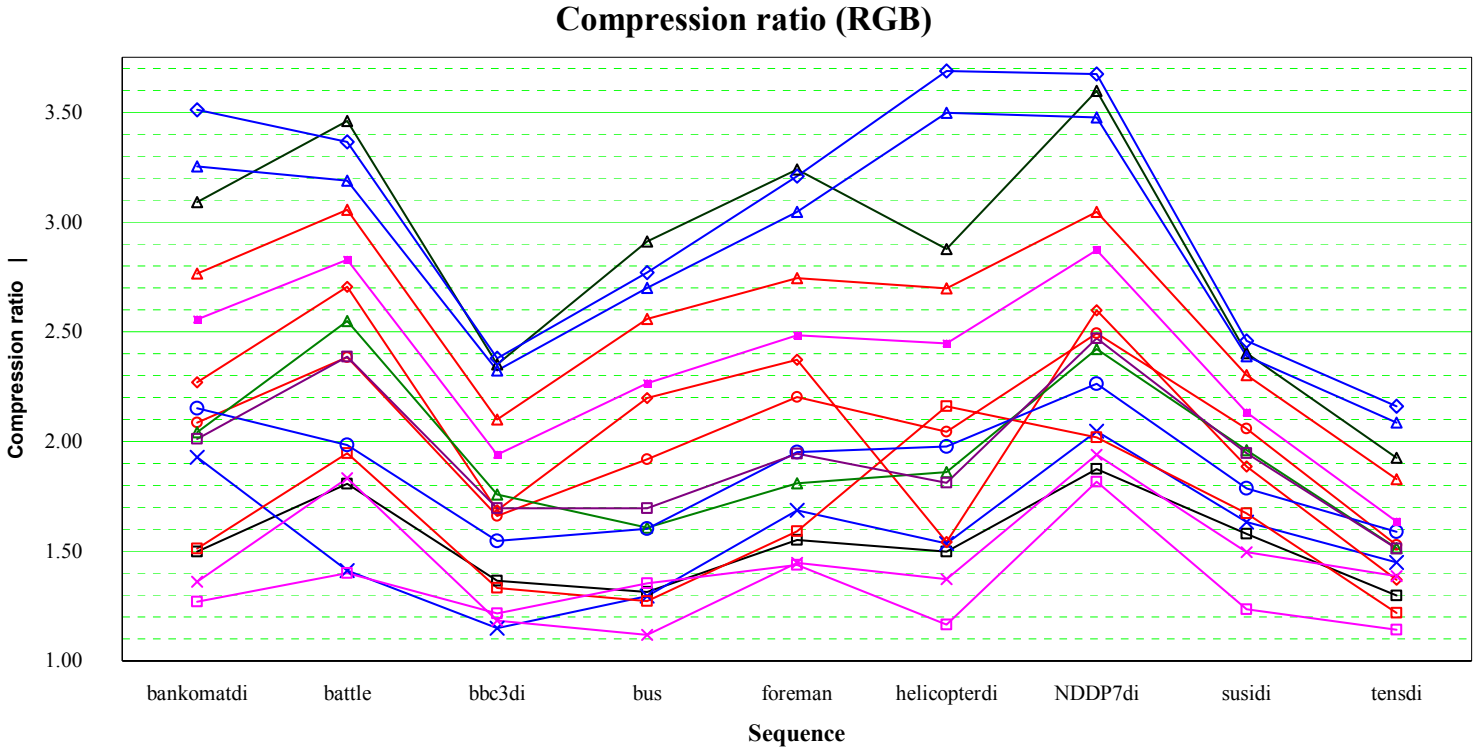
Couldn't be tested. We would appreciate very much a functioning Windows version of this codec.

VBLE BETA

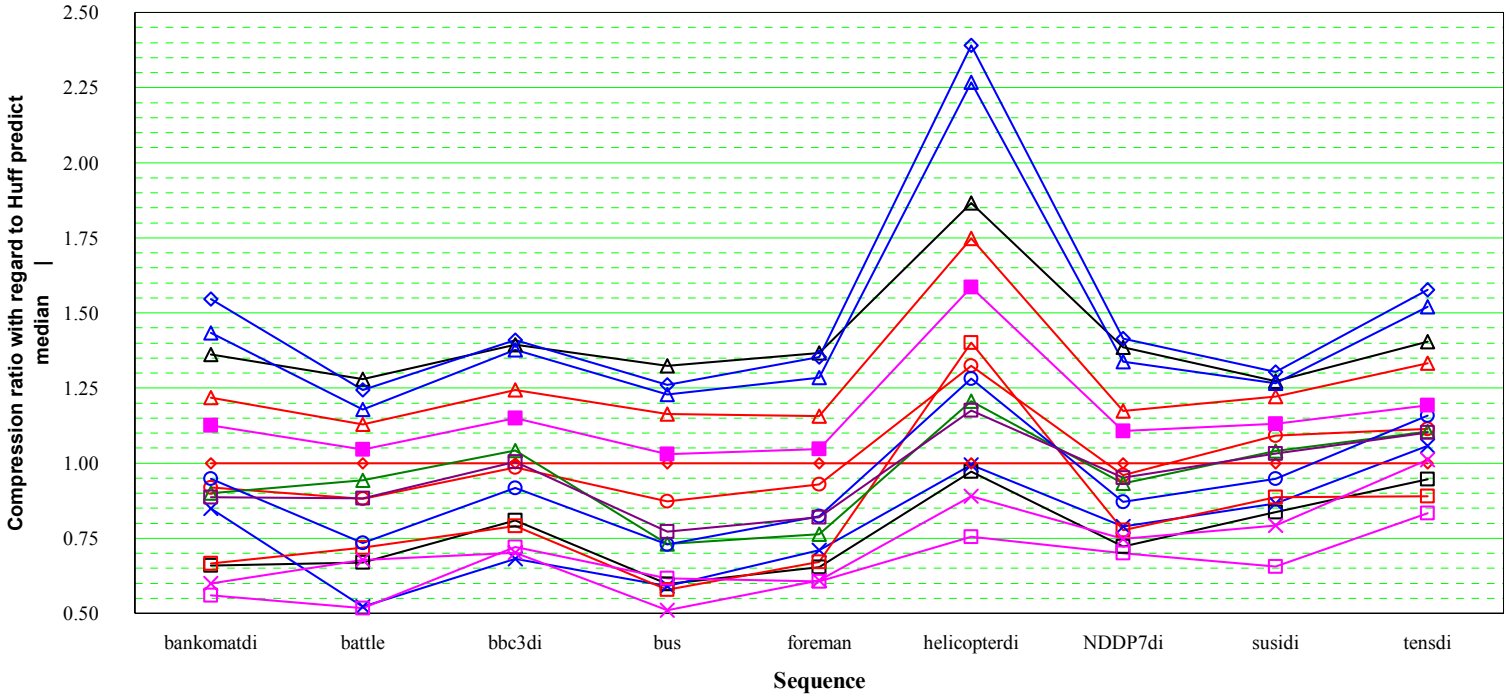
Accepts input video signal in RGB, YUY2 and YV12; compresses only in YV12, therefore losses can completely be avoided only using this colorspace. Doesn't have any interface.

Compression ratio

RGB

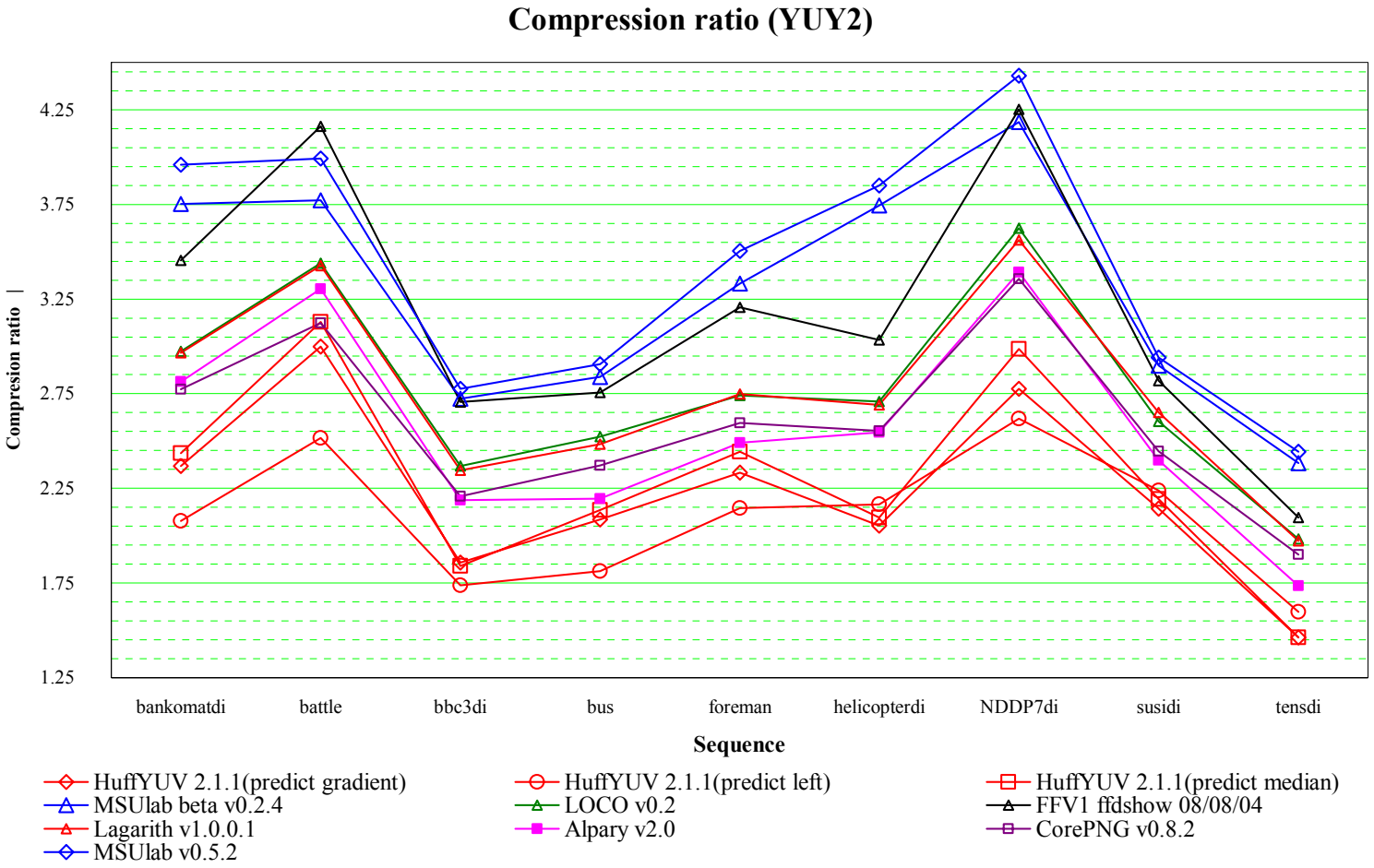


Comparison with Huff predict gradient (RGB)

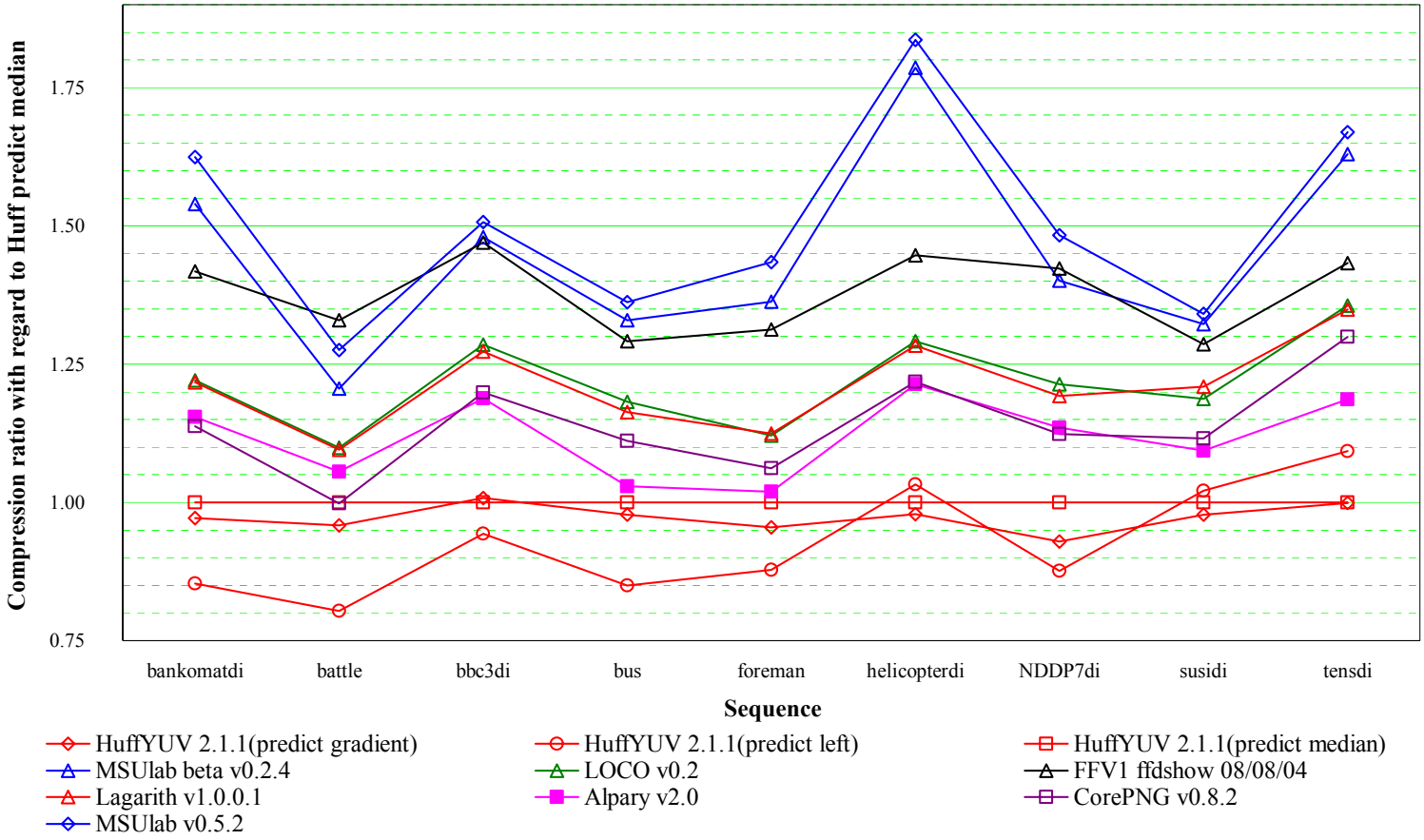


- LEAD JPEG v1.0.0.1
- CamStudio GZIP(9) v1.0
- HuffYUV 2.1.1(predict left/no decorr.)
- HuffYUV 2.1.1(predict left)
- HuffYUV 2.1.1(predict gradient)
- Pegasus PicVideo JPEG v.2.10.0.29
- AVIzlib(hi compression) v2.2.3
- Lagarith v1.0.0.1
- LOCO v0.2
- MindVid v1.0 beta 1
- FFV1 ffdshow 08/08/04
- MSUlab beta v0.2.4
- Alpary v2.0
- CorePNG v0.8.2
- MSUlab v0.5.2

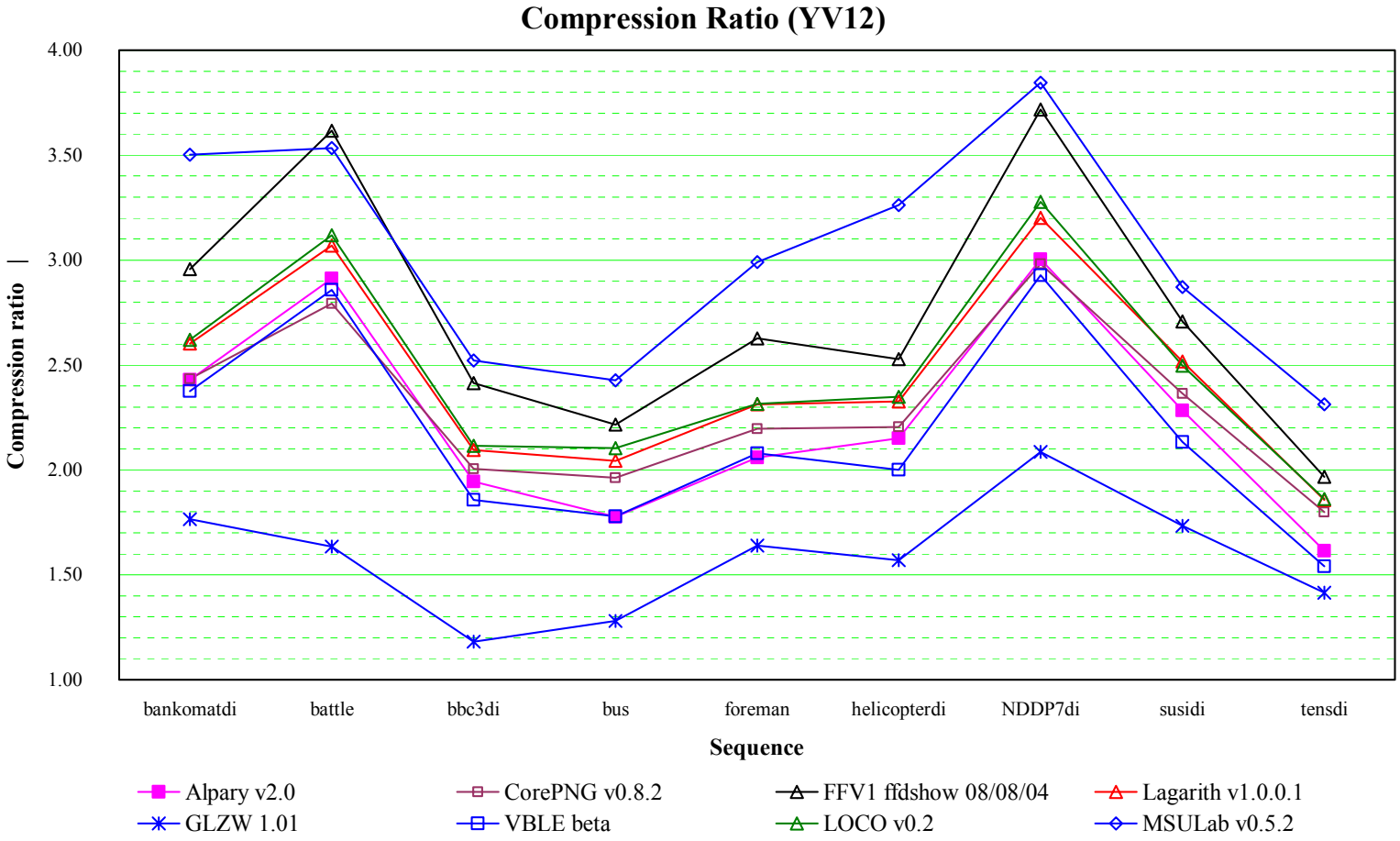
YUY2

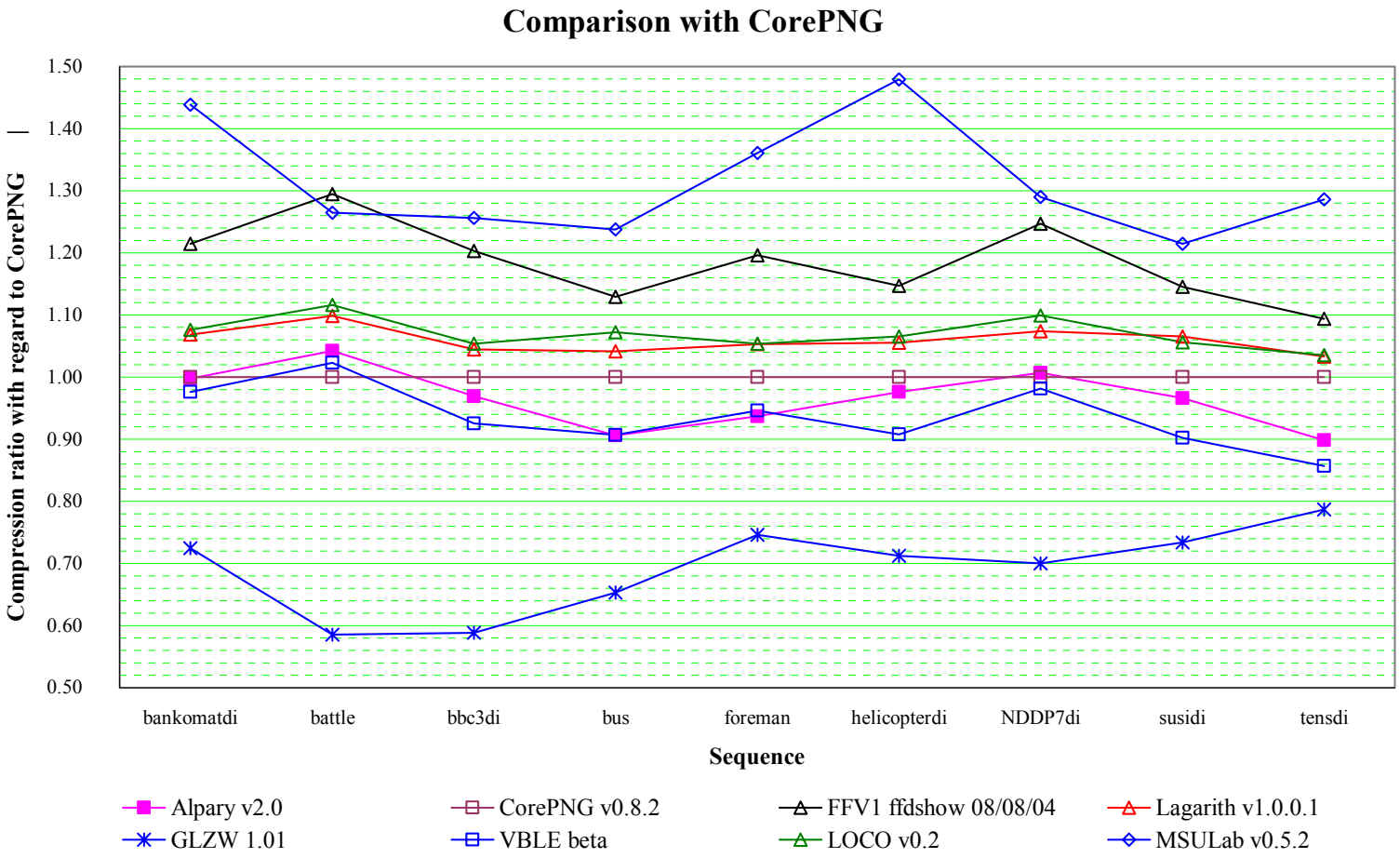

Compression ratio (YUY2)
Compression ratio
4.25
3.75
3.25
2.75
2.25
1.75
1.25
bankomatdi
battle
bbc3di
bus
foreman
helicopterdi
NDDP7di
susidi
tensdi
Sequence
HuffYUV 2.1.1(predict gradient)
HuffYUV 2.1.1(predict left)
HuffYUV 2.1.1(predict median)
MSUlab beta v0.2.4
LOCO v0.2
FFV1 ffdshow 08/08/04
Lagarith v1.0.0.1
Alpary v2.0
CorePNG v0.8.2
MSUlab v0.5.2

Comparison with Huff predict median (YUY2)



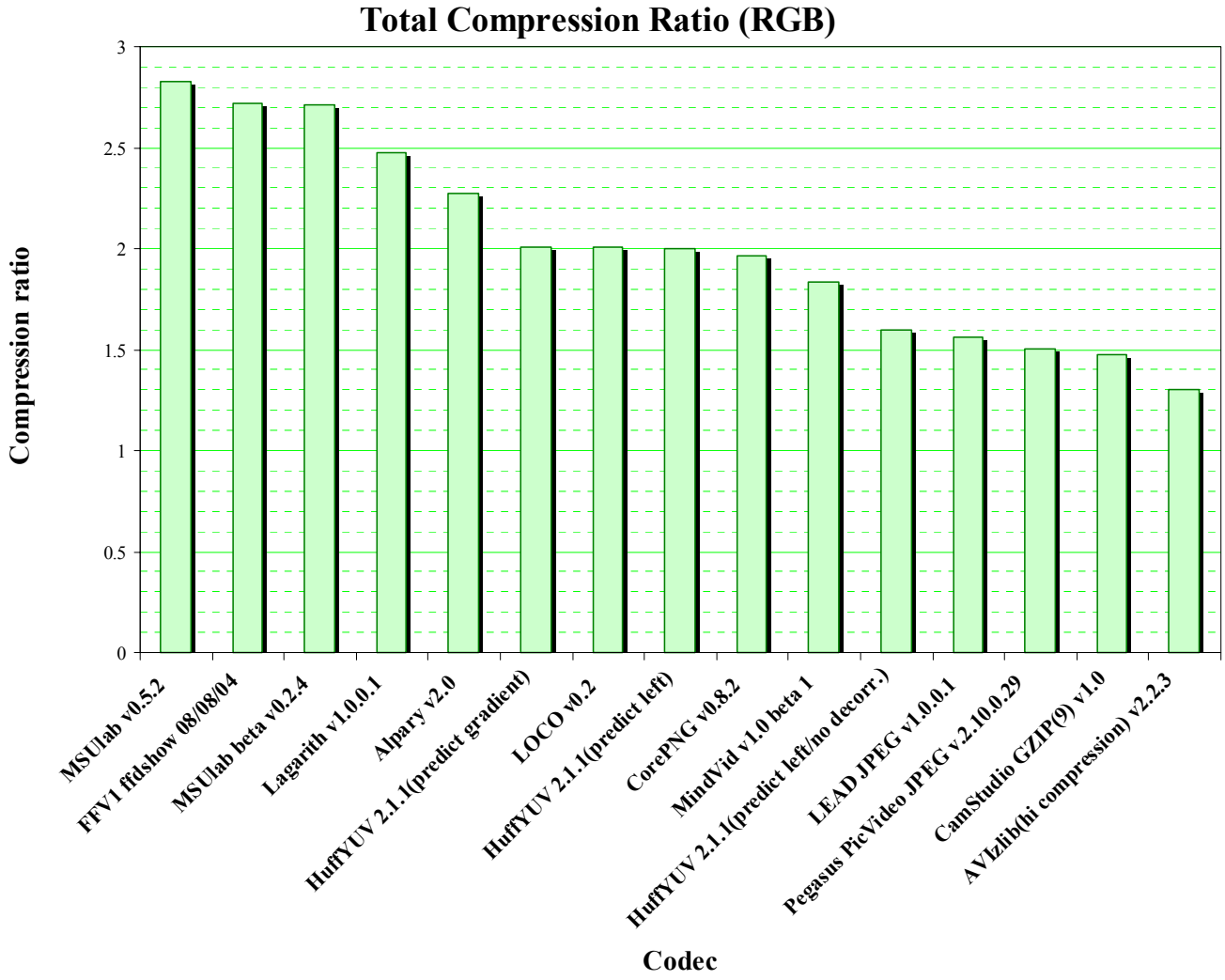
YV12


Compression Ratio (YV12)
Compression ratio
4.00
3.50
3.00
2.50
2.00
1.50
1.00
bankomatdi
battle
bbc3di
bus
foreman
helicopterdi
NDDP7di
susidi
tensdi
Sequence
Alpary v2.0
CorePNG v0.8.2
FFV1 ffdshow 08/08/04
Lagarith v1.0.0.1
GLZW 1.01
VBLE beta
LOCO v0.2
MSULab v0.5.2


Comparison with CorePNG
Compression ratio with regard to CorePNG
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
bankomatdi
battle
bbc3di
bus
foreman
helicopterdi
NDDP7di
susidi
tensdi
Sequence
Alpary v2.0
CorePNG v0.8.2
FFV1 ffdshow 08/08/04
Lagarith v1.0.0.1
GLZW 1.01
VBLE beta
LOCO v0.2
MSULab v0.5.2

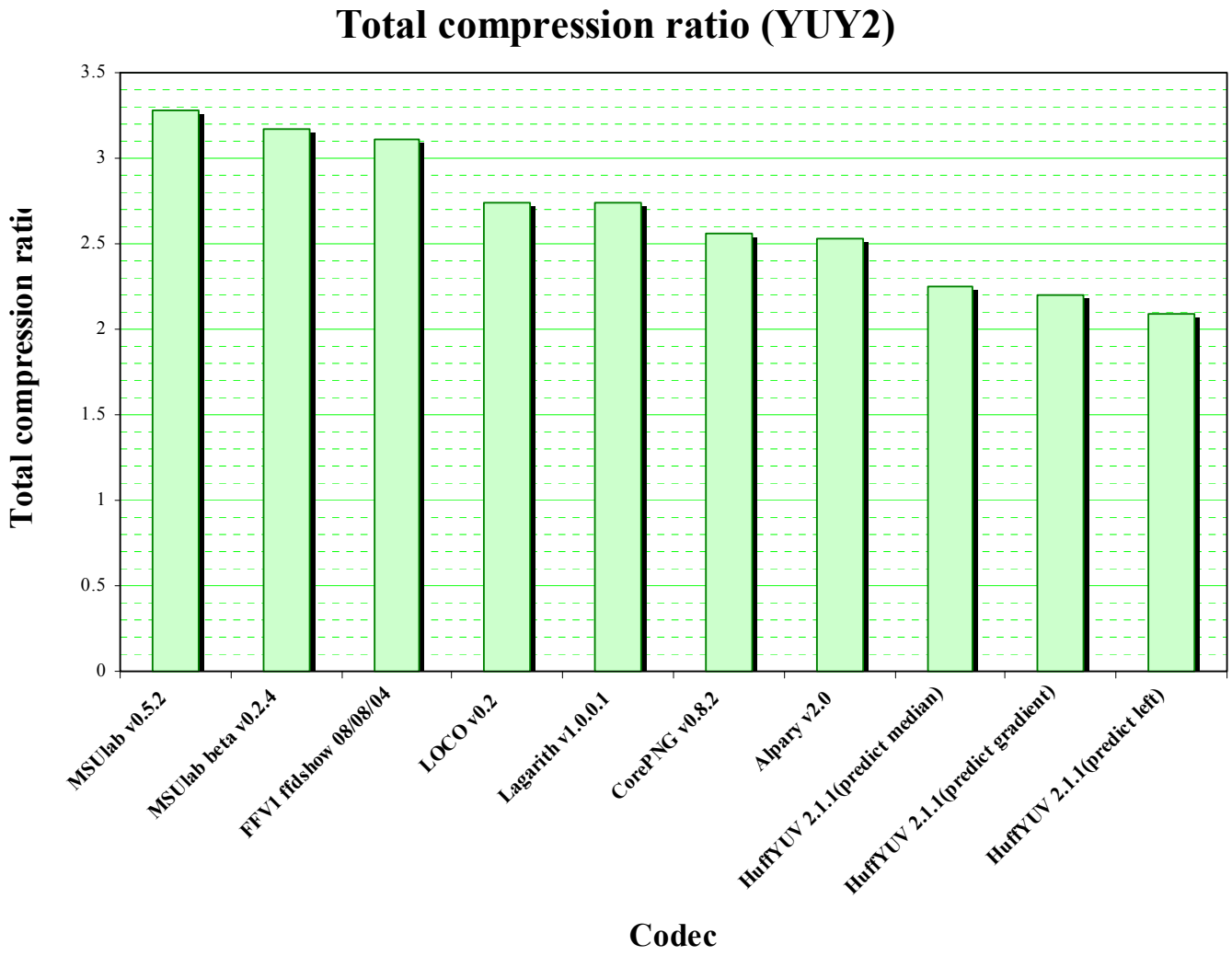
Result rating

RGB



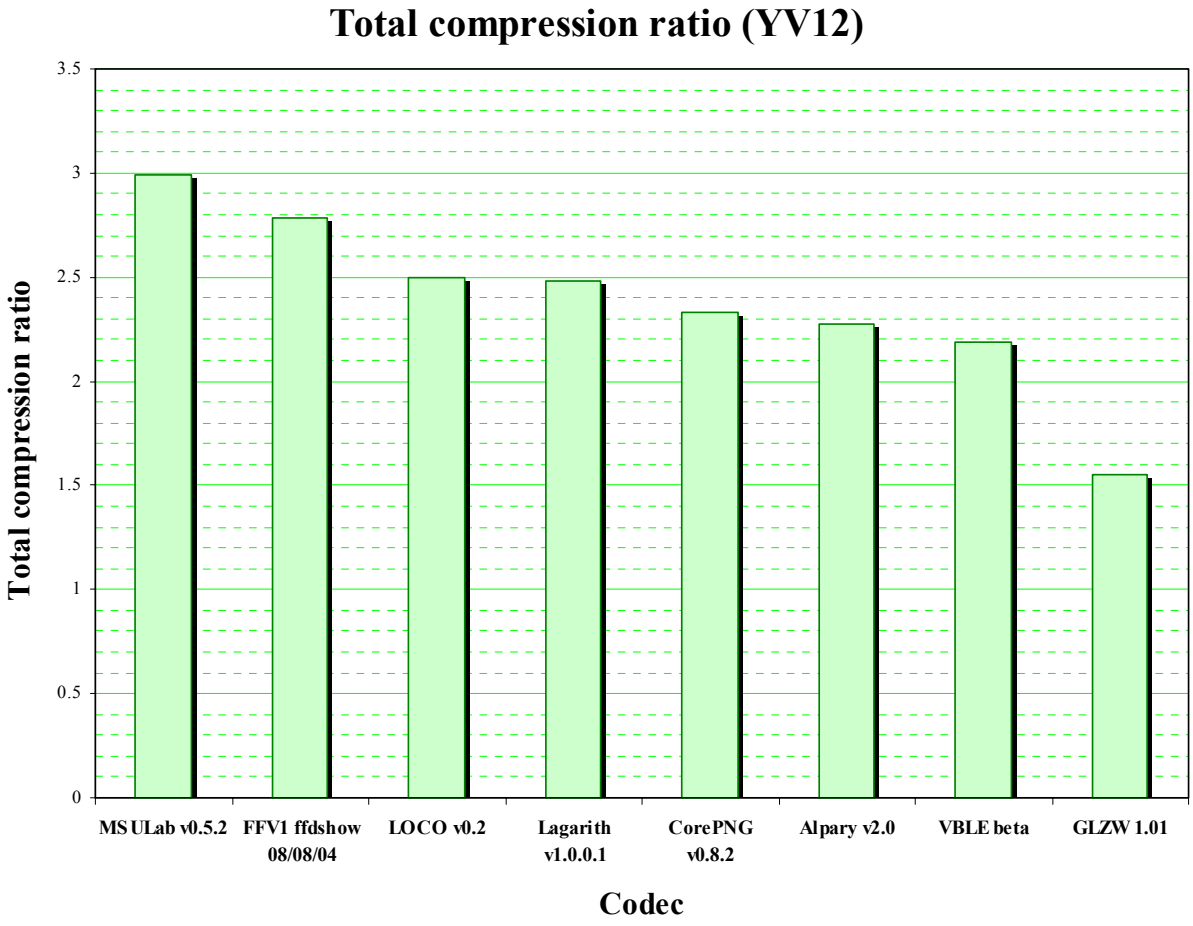
	CODEC	COMPRESSION RATIO
1.	MSUlab v0.5.2	2.826201525
2.	FFV1 ffdshow 08/08/04	2.721049078
3.	MSUlab beta v0.2.4	2.709258918
4.	Lagarith v1.0.0.1	2.473789541
5.	Alpary v2.0	2.271791469
6.	HuffYUV 2.1.1(predict gradient)	2.008705889
7.	LOCO v0.2	2.007392859
8.	HuffYUV 2.1.1(predict left)	2.001257296
9.	CorePNG v0.8.2	1.96321033
10.	MindVid v1.0 beta 1	1.832238639
11.	HuffYUV 2.1.1(predict left/no decorr.)	1.600243335
12.	LEAD JPEG v1.0.0.1	1.558307827
13.	Pegasus PicVideo JPEG v.2.10.0.29	1.506064676
14.	CamStudio GZIP(9) v1.0	1.476062405
15.	AVIzlib(hi compression) v2.2.3	1.305269756

YUY2



	CODEC	COMPRESSION RATIO
1.	MSUlab v0.5.2	3.283708552
2.	MSUlab beta v0.2.4	3.170732603
3.	FFV1 ffdshow 08/08/04	3.106822399
4.	LOCO v0.2	2.74279946
5.	Lagarith v1.0.0.1	2.736678484
6.	CorePNG v0.8.2	2.559016651
7.	Alpary v2.0	2.532755985
8.	HuffYUV 2.1.1(predict median)	2.245646695
9.	HuffYUV 2.1.1(predict gradient)	2.199336806
10.	HuffYUV 2.1.1(predict left)	2.094569835

YV2



	CODEC	COMPRESSION RATIO
1.	MSULab v0.5.2	2.992108122
2.	FFV1 ffdshow 08/08/04	2.785669737
3.	LOCO v0.2	2.500607416
4.	Lagarith v1.0.0.1	2.481259762
5.	CorePNG v0.8.2	2.333204262
6.	Alpary v2.0	2.274389563
7.	VBLE beta	2.189955765
8.	GLZW 1.01	1.552307011

About us (Graphics & Media Lab Video Group)

Graphics & Media Lab Video Group is a part of Graphics & Media Lab of Computer Science Department in Moscow State University. The history of Graphics Group began at the end of 1980's. Graphics & Media Lab was officially founded in 1998. Main research directions of the lab lie in different areas of Computer Graphics, Computer Vision and Media Processing (audio, image and video processing). Some of research results were patented, other results were presented in a number of publications.

Main research directions of Graphics & Media Lab Video Group are video processing (pre-, post- and video analysis filters) and video compression (codecs' testing and tuning, quality metrics research, development of codecs).

Our main achievements in **video processing:**

- High quality industrial filters for format conversion including high quality deinterlacing, high quality frame rate conversion, new fast practical super resolution, etc.
- Methods for modern TV-sets: big family of up-sampling methods, smart brightness and contrast control, smart sharpening, etc.
- Artifacts' removal methods: family of denoising methods, flicking removal, video stabilization with frame edges restoration, scratches, spots, drop-outs removal, etc.
- Specific methods like: subtitles removal, construction of panorama image from video, video to high quality photo, video watermarking, video segmentation, practical fast video deblur, etc.

Our main achievements in **video compression:**

- Well-known public comparisons of JPEG, JPEG-2000, MPEG-2 decoders, MPEG-4 and annual H.264 codec's testing; also we provide tests for "weak and strong points of codec X" for companies with bugreports and codec tuning recommendations.
- Our own video quality metrics research, public part is MSU Video Quality Measurement Tool and MSU Perceptual Video Quality Tool.
- We have internal research and contracts on modern video compression and publish our MSU Lossless Video Codec and MSU Screen Capture Video Codec – codecs with ones of the highest compression ratios.

We are really glad to work many years with companies like Intel, Samsung, RealNetworks and others.

A mutual collaboration in areas of video processing and video compression is always interesting for us.
E-mail: video@graphics.cs.msu.ru