

Quality Assessment of Gaming Videos Compressed via AV1

Darkhan Ashimov, Maria Martini and Nabajeet Barman

School of Computer Science and Mathematics,
Kingston University, London

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Introduction

Video Codec Comparison

- H.264 – one of the most widely used video codecs nowadays
- HEVC – successor of H.264, superior codec compression efficiency as compared to H.264
- AV1 – very recently developed royalty free codec

Motivation

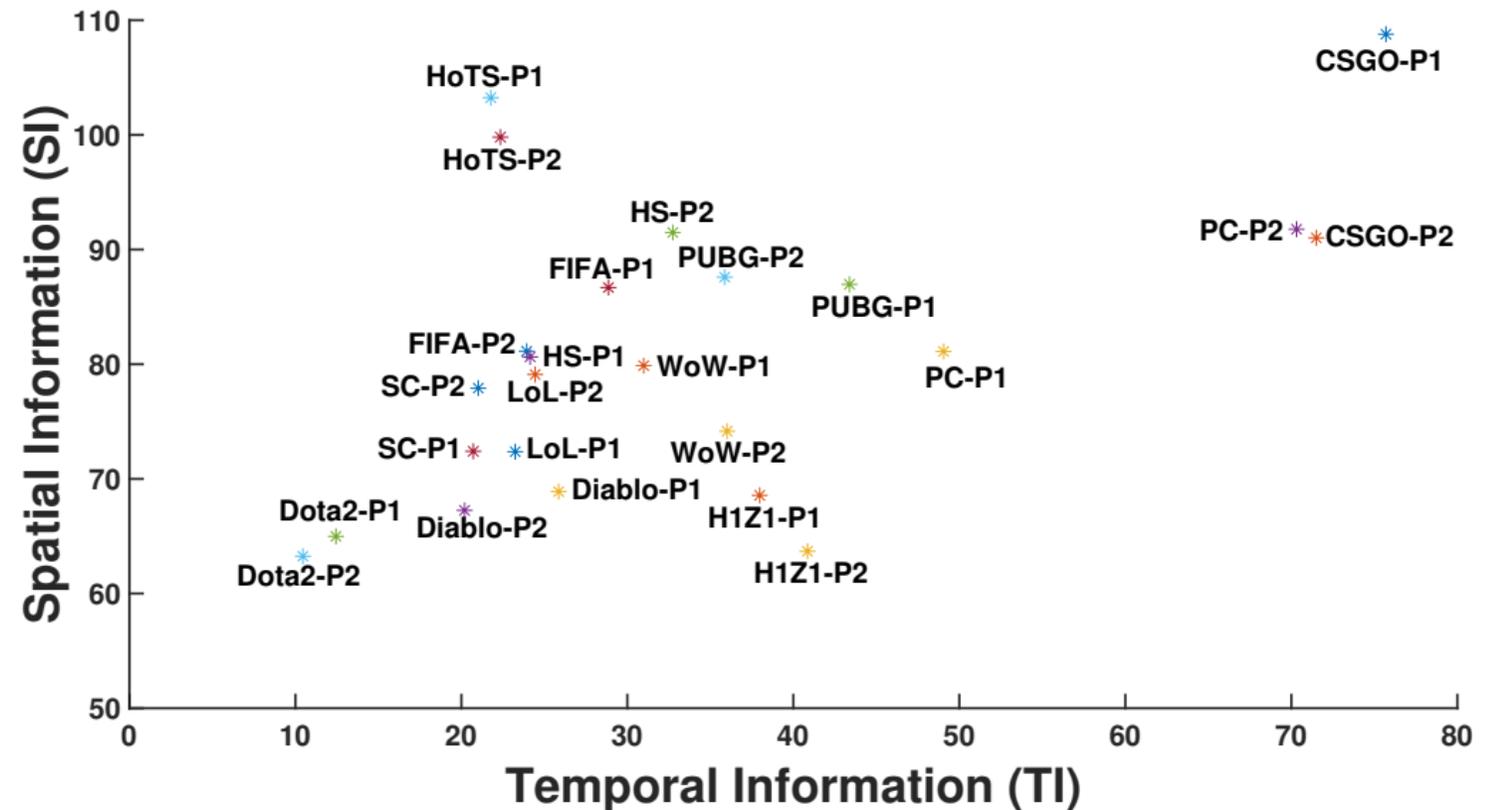
- AV1 comparative performance evaluations in the literature were limited to natural content – contradicting results on performance as compared to HEVC
- Previous comparative studies on codec compression efficiency for gaming content were limited to H.264, VP9 and HEVC (see e.g. [*Barman, Martini, QoMEX 2017*])
- Gaming and Synthetic content is affected differently by compression (see e.g. [*Barman, Martini, Zadtootaghaj, Möller, Lee, QoMEX 2018*])

Source Sequences

GamingVideoSET

- 24 reference gaming videos
- 1920x1080
- 30 fps
- 30 seconds

[Barman, Zadtootaghaj, Schmidt, Martini, Möller, NetGames 2018]



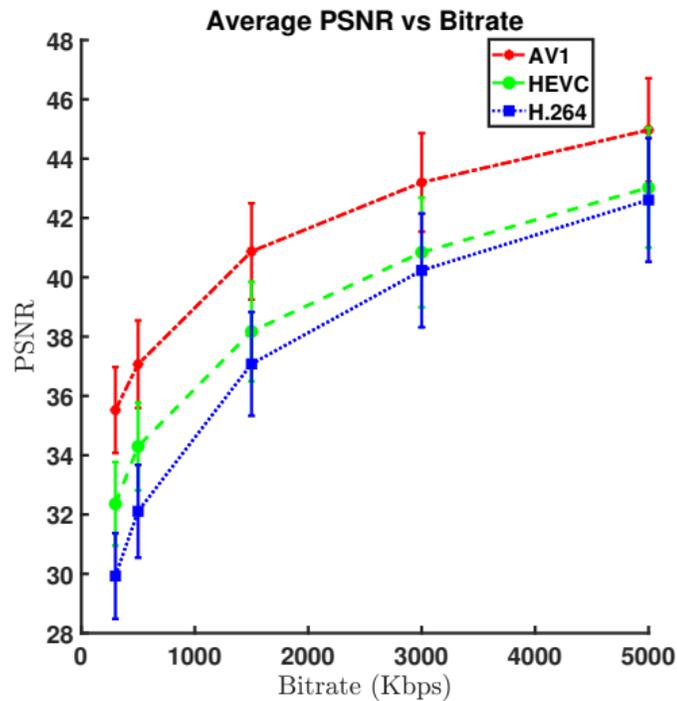
Encoding Settings Summary

Parameter	Value
Duration	30 sec
Resolution	1080p
Bitrates (kbps)	300, 500, 1500, 3000, 5000
Frame Rate	30.00
Encoder	FFmpeg
Encoding Mode	CBR
Video Compression Standards	H.264, HEVC, AV1
Preset	default (medium)

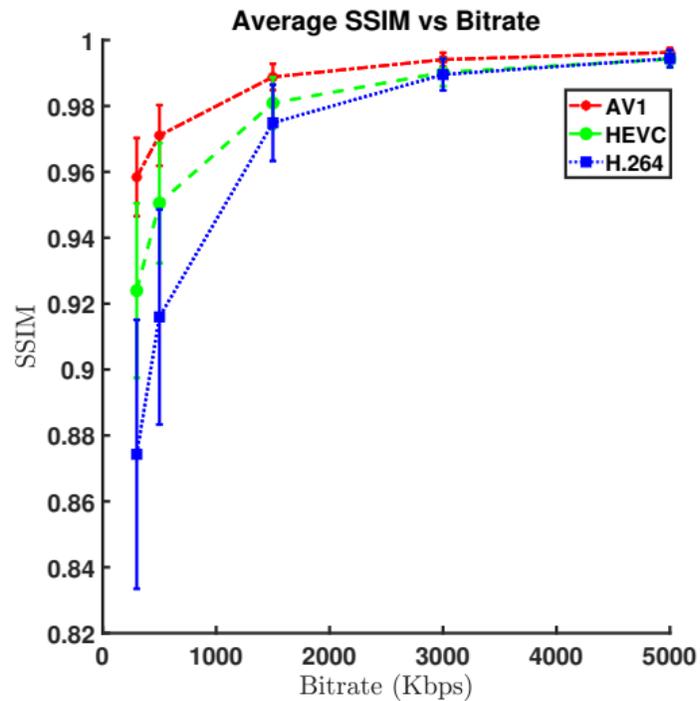
- Constant Bitrate Encoding achieved by *-minrate* and *-maxrate* parameters
- Tiles 2x2 used for faster decoding performance

Results

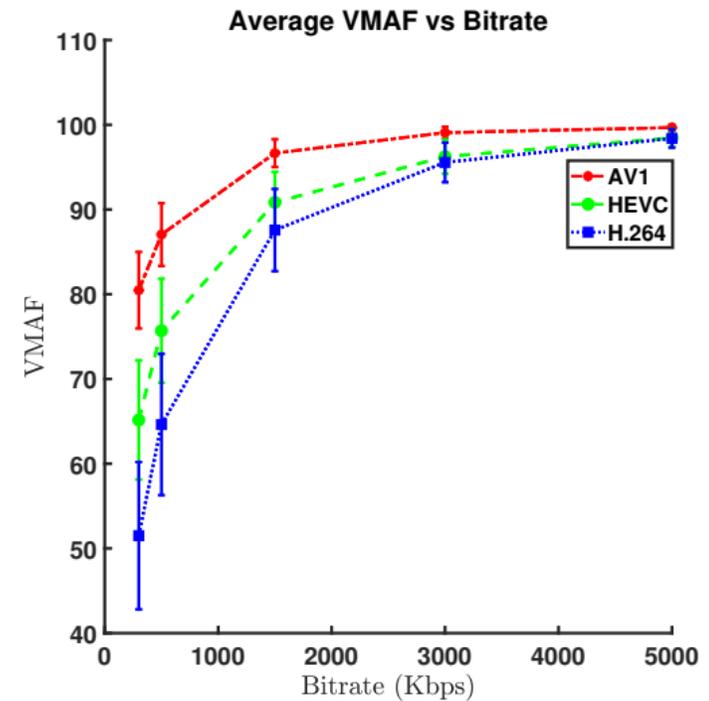
Objective Quality Values



(a) PSNR vs. Bitrate (kbps)



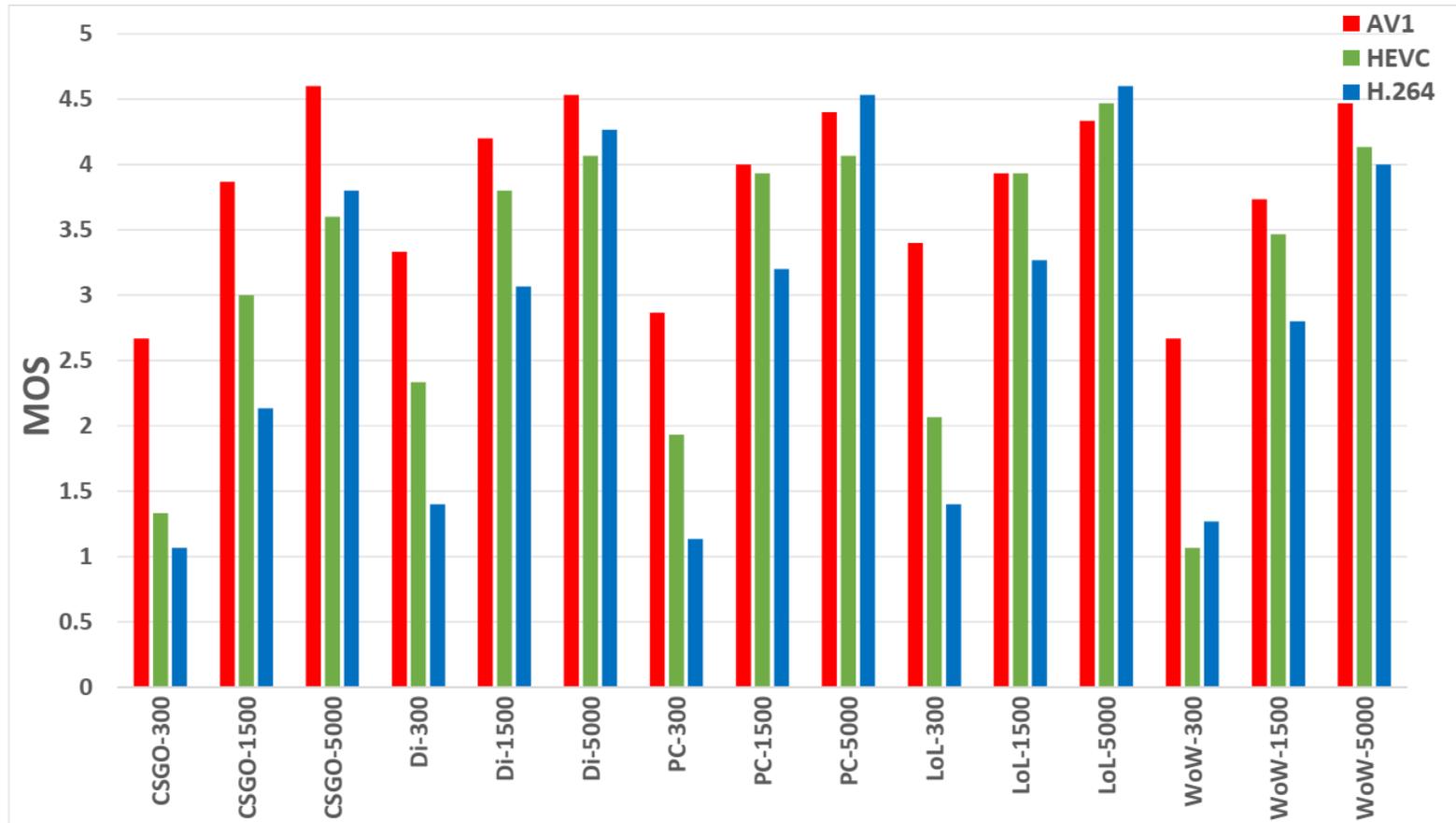
(b) SSIM vs. Bitrate (kbps)



(c) VMAF vs. Bitrate (kbps)

Results

Subjective (MOS) Scores



Results

Objective vs. Subjective (MOS) Scores - Correlation

Metrics	PSNR		SSIM		VMAF	
	PLCC	SROCC	PLCC	SROCC	PLCC	SROCC
H.264	0.77	0.71	0.51	0.75	0.94	0.92
HEVC	0.86	0.93	0.80	0.94	0.95	0.93
AV1	0.91	0.93	0.74	0.96	0.95	0.99

Conclusion and Future Work

- AV1 results in the best quality for most bitrates and contents considered
- The performance gain is particularly evident for the lower range of the bitrates considered
- Comparative performance comparison of codec compression efficiency for higher bit-depth (10 bit), HDR gaming content is still an open issue and is left for a future work

References

- Ashimov, D., Martini, M. G., & Barman, N. (2020, May). Quality assessment of gaming videos compressed via AV1. In *2020 Twelfth International Conference on Quality of Multimedia Experience (QoMEX)* (pp. 1-4). IEEE.
- Pezzulli, S., Martini, M. G., & Barman, N. (2020). Estimation of Quality Scores from Subjective Tests-beyond Subjects' MOS. *IEEE Transactions on Multimedia*, published ahead of print.
- Barman, N., Schmidt, S., Zadtootaghaj, S., Martini, M. G., & Möller, S. (2018, June). An evaluation of video quality assessment metrics for passive gaming video streaming. In *Proceedings of the 23rd packet video workshop* (pp. 7-12).
- Barman, N., Martini, M. G., Zadtootaghaj, S., Möller, S., & Lee, S. (2018, May). A comparative quality assessment study for gaming and non-gaming videos. In *2018 Tenth International Conference on Quality of Multimedia Experience (QoMEX)* (pp. 1-6). IEEE.
- Barman, N., Zadtootaghaj, S., Schmidt, S., Martini, M. G., & Möller, S. (2018, June). GamingVideoSET: a dataset for gaming video streaming applications. In *2018 16th Annual Workshop on Network and Systems Support for Games (NetGames)* (pp. 1-6). IEEE.
- Barman, N., & Martini, M. G. (2017, May). H. 264/MPEG-AVC, H. 265/MPEG-HEVC and VP9 codec comparison for live gaming video streaming. In *2017 Ninth International Conference on Quality of Multimedia Experience (QoMEX)* (pp. 1-6). IEEE.

Thank you



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