

**Joint Video Experts Team (JVET)
of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC
29/WG 11**

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29th Meeting, by teleconference, 11-20 January 2023

Title: EE1-1.10: Complexity Reduction on Neural-Network Loop Filter

Status: Input document to JVET

Purpose: Proposal

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Abstract

This contribution reports the experimental results of EE1-1.10. The models for complexity reduction in this EE test are originally proposed in JVET-AA0080 and JVET-AB0136, with the introduction of parallel fusion of deblocked samples and NNLF outputs for further improvement. In EE1-1.10.1, the model with CP decomposition plus fusing adjacent 1x1 convolution is tested. In EE1-1.10.2, the model with CP decomposition, fusing adjacent 1x1 convolution and split architecture for luma and chroma components is tested. The models are implemented on top of NNVC common software NNVC-3.0. They are also implemented with fixed point using SADL. BD-Rate results are reported compared to NNVC-3.0 anchor. While the JVET-X0140 low complexity model achieves about 5.16% luma gain for AI and 4.98% for RA with worse case block level complexity of 33.6 KMAC/Pixel, the proposed models can achieve better trade-off with lower complexity. The AI and RA results of {Y, Cb, Cr} BD-Rate gain are as follows:

EE1-1.10.1: CP-decomposition with fusing, worst case block level complexity of 16.2 KMAC/Pixel

Built from JVET-AC0106_NNLF_complexity.docx

LINKS

CARD

JVET-AC0106

<http://vexpertise.stbit.ru/documents/JVET-AC0106>

JVET Search

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EE1-1.10: Complexity Reduction on Neural-Network Loop Filter

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ABSTRACT

MEETING NOTES



SOURCE

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Preview document JVET-AC0106

Document Information

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Comments

Associated Resources



ARCHIVE

archive

https://jvet-experts.org/doc_end_user/documents/29_Teleconference/wg11/JVET-AC0106-v2.zip

PDF

JVET-AC0106-NNLF-complexity_v1.pdf

DOC

JVET-AC0106_NNLF_complexity.docx

XLS

JVET-AC0106_Split24L8C_SADLfp32.xlsm

XLS

JVET-AC0106_Split24L8C_SADLint32Q14.xlsm

XLS

JVET-AC0106_Split24L8C_TF.xlsm

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JVET-AC0106_X0140_SADLfp32.xlsm

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JVET-AC0106_X0140_TF.xlsm



MEETING NOTES

external meeting notes

http://vexpertise.stbit.ru/meeting-notes/source/meeting_29_ac

Joint Video Experts Team (JVET) of ITU-T SG21 WP3/21 and ISO/IEC JTC 1/SC 29

29th Meeting: by teleconference, DE, January 202

Document: JVET-AC0106

Title: Meeting Report of the 41st Meeting of the Joint Video Experts Team

Status: Report document from the chair of JVET

Purpose: Report

1 Summary



MEETING NOTES

JVET-AC0106 EE1-1.10: Complexity Reduction on Neural-Network Loop Filter [J. N. Shingala, A. Shyam, A. Suneia, S. P. Badya (Ittiam), T. Shao, A. Arora, P. Yin, S. McCarthy (Dolby)]

This contribution reports the experimental results of EE1-1.10. The models for complexity reduction in this EE test are originally proposed in JVET-AA0080 and JVET-AB0136, with the introduction of parallel fusion of deblocked samples and NNLF outputs for further improvement. In EE1-1.10.1, the model with CP decomposition plus fusing adjacent 1x1 convolution is tested. In EE1-1.10.2, the model with CP decomposition, fusing adjacent 1x1 convolution and split architecture for luma and chroma components is tested. The models are implemented on top of NNVC common software NNVC-3.0. They are also implemented with fixed point using SADL. BD-Rate results are reported compared to NNVC-3.0 anchor. While the JVET-X0140 low complexity model achieves about 5.16% luma gain for AI and 4.98% for RA with worse case block level complexity of 33.6 KMAC/Pixel, the proposed models can achieve better trade-off with lower complexity. The AI and RA results of {Y, Cb, Cr} BD-Rate gain are as follows:

EE1-1.10.1: CP-decomposition with fusing, worst case block level complexity of 16.2 KMAC/Pixel

- LibTensorflow, fp32: AI {-4.65%, -5.66%, -5.03%}, RA {-5.05%, -6.29%, -4.46%}
- SADL, fp32: AI {-4.64%, -5.62%, -4.97%}, RA {-5.02%, -6.36%, -4.38%}
- SADL, int32: AI {-4.62%, -5.62%, -4.96%}, RA {-5.01%, -6.24%, -4.32%}

EE1-1.10.2: CP-decomposition with fusing and split luma chroma (24L, 8C), worst case block level complexity of 17.7 KMAC/Pixel

- LibTensorflow, fp32: AI {-4.94%, -7.76%, -7.69%}, RA {-5.43%, -7.79%, -6.57%}
- SADL, fp32: AI {-4.91%, -7.21%, -6.97%}, RA {-5.37%, -7.61%, -6.31%}
- SADL, int32: AI {-4.88%, -7.24%, -6.99%}, RA {-5.34%, -7.64%, -6.34%}

This was presented in session 12.

The method uses 4 models, each of size about 57K parameters, 17.7 kMAC/Pix

It was agreed to study this in a next EE, including:

- Training crosscheck
- Int16 implementation
- If possible, SIMD implementation in SADL

The possibility of further reduction of number of computations should be considered.

CITATION

J. N. Shingala, A. Shyam, A. Suneia, S. P. Badya, T. Shao, A. Arora, P. Yin, Sean McCarthy, "EE1-1.10: Complexity Reduction on Neural-Network Loop Filter", JVET-AC0106, 29th Meeting: by teleconference, DE, January 2023.