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Title: **Exploration experiments in Wavelet Video Coding**
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1. Introduction

This document defines the Exploration Experiments (EE) to be conducted by the VidWav AHG till the Bangkok meeting. The common software platform was decided to be used by all the participants in the EEs. It is already available on the CVS server provided by RWTH. During the Poznan meeting, tools had been identified as potentially useful, and the associated experiment was not completes for this meeting. These previous EE are being extended till next meeting.

2. Integrating task

- Verify that the integration work conducted before the Nice meeting, can be **jointly** run and update reference software document and algorithmic description accordingly:
  > Stool architecture
- Bug fixes:
  1. Univ. of Brescia will integrate various bug fixes within integrated SW 2 weeks after the Nice meeting. The software will be updated on the CVS server.
  2. Samsung will fix the “intracoding bug” within 6 weeks after the meeting
- Software updates
  1. Univ. of Brescia will integrate AVC base layer compatibility in the 2D+t+2D
  2. RWTH will incorporate the “Deringing in-loop filter” (M12640, 3W after Nice meeting), on the basis of previous EE results, after fixes have been made by Univ. of Brescia. This modality will be made optional.

Reference software manual will be updated accordingly. The performance of the integrated software will be checked.
Partners:

- University of Brescia (Nicola.Adami@ing.unibs.it)
- ENST (Sebastien.Brangoulo@enst.fr)

3. Exploration experiments definition

Timeline:
Nice+3W: New common platform and corresponding documentation to be released.
Bangkok-2W: Final results with integrated tools with description to be submitted for verification.
Bangkok-1W: Verification to be done.
Bangkok AHG meeting: To evaluate each EE.

EE1: improved coding efficiency and extended range of SNR scalability in t+2D implementation
Integrated common platform will be used. Palma testing points plus extented testing points will be evaluated. For each spatio-temporal resolution, the bit-rate of the extended testing point is exactly 3 times of the lowest bit-rate at the same resolution. For Palma testing points, extration pathes of Palma testing are used. The testing points and extraction pathes for the extented testing points are shown in Table 1.
PSNR comparison to JSVM for the highest spatial resolutions should be provided. And subjective comparison to JSVM will be conducted in the next meeting.

Table 1. EE1 Testing condition points

Sequence	Format	Original Bit rates in Palma (kbit/sec)					Extended Bit rates
Bus	QCIF 7.5Hz	64	80	96	112	128	192 (From QCIF15Hz@288k)
	QCIF 15Hz	96	112	128	160	192	288 (From CIF15Hz@576k)
	CIF 7.5Hz	128	160	192	224	256	384 (From CIF15Hz@576k)
	CIF 15Hz	192	224	256	320	384	576 (From CIF30Hz@768k)
	CIF 30Hz	256	320	384	448	512(From CIF30Hz@768k)	768
Football	QCIF 7.5Hz	128	160	192	224	256	384 (From QCIF15Hz@576k)
	QCIF 15Hz	192	224	256	320	384	576 (From CIF15Hz@1152k)
	CIF 7.5Hz	256	320	384	448	512	768 (From CIF15Hz@1152k)
	CIF 15Hz	384	448	512	640	768	1152 (From CIF30Hz@1536k)
	CIF 30Hz	512	640	768	896	1024(From CIF30Hz@1536k)	1536
Foreman	QCIF 7.5Hz	32	40	48	56	64	96 (From QCIF15Hz@144k)
	QCIF 15Hz	48	56	64	80	96	144 (From CIF15Hz@288k)
	CIF 7.5Hz	64	80	96	112	128	192 (From CIF15Hz@288k)
	CIF 15Hz	96	112	128	160	192	288 (From CIF30Hz@384k)
	CIF 30Hz	128	160	192	224	256(From CIF30Hz@384k)	384
Mobile	QCIF 7.5Hz	48	56	64	80	96	144 (From QCIF15Hz@192k)
	QCIF 15Hz	64	80	96	112	128	192 (From CIF15Hz@384k)
	CIF 7.5Hz	96	112	128	160	192	288 (From CIF15Hz@384k)
	CIF 15Hz	128	160	192	224	256	384 (From CIF30Hz@576k)
	CIF 30Hz	192	224	256	320	384(From CIF30Hz@576k)	576
City	QCIF 15Hz	64	80	96	112	128	192 (From CIF15Hz@576k)
	CIF 7.5Hz	128	160	192	224	256	384 (From CIF15Hz@576k)
	CIF 15Hz	192	224	256	320	384	576 (From CIF30Hz@768k)
	CIF 30Hz	256	320	384	448	512	768 (From 4CIF30Hz@2304k)
	4CIF 15Hz	512	640	768	896	1024	1536 (From 4CIF30Hz@2304k)
	4CIF 30Hz	768	896	1024	1280	1536	2304 (From 4CIF60Hz@3072k)
	4CIF 60Hz	1024	1280	1536	1792	2048(From 4CIF60Hz@3072k)	3072
Crew, Harbour, Soccer	QCIF 15Hz	96	112	128	160	192	288 (From CIF15Hz@768k)
	CIF 7.5Hz	192	224	256	320	384	576 (From CIF15Hz@768k)

	CIF 15Hz	256	320	384	448	512	768 (From CIF30Hz@1152k)
	CIF 30Hz	384	448	512	640	768	1152 (From 4CIF30Hz@3072k)
	4CIF 15Hz	768	896	1024	1280	1536	2304 (From 4CIF30Hz@3072k)
	4CIF 30Hz	1024	1280	1536	1792	2048	3072 (From 4CIF60Hz@4608k)
	4CIF 60Hz	1536	1780	2048	2560	3072(From 4CIF60Hz@4608k)	4608

Participants: MSRA(t-jzhxu@microsoft.com), ENST(pesquet@tsi.enst.fr) : verifier

EE2 : Intra-prediction
Intra coding and prediction
Integrated common platform will be used. Palma testing points will be evaluated with the same extraction paths.

The first task is to fix the bug as mentioned earlier in this document. An evaluation of intra coding and prediction will be performed. The previously proposed techniques will be implemented and tested and further improvements, in particular prediction with smaller block sizes, explored. PSNR comparison and subjective comparison will be conducted in the next meeting.
Participants: Mitsubishi Electric (soroush.ghanbari@vil.ite.mee.com),
Samsung (wjhan.han@samsung.com), University of Sheffield
(c.abhayaratne@sheffield.ac.uk)

EE3: Bidirectional motion estimation for MCTF using t+2D implementation, and possibly multilayer one.
Integrated common platform will be used. Palma testing points will be evaluated with the same extraction paths.

A comparison between the classical separate ME/MC and the joint ME/MC will be provided. Some tests will be carried out, using several iterations (1,1.5,2,2.5), as a half iteration corresponding to one ME in one direction, starting from the backward. 16x16 block sizes will be tested, and compared possibly in an adaptive way with other block sizes (e.g. 8x8, 4x4, …) with quarter pel accuracy. The output document will report on coding efficiency and complexity of the ME/MC. PSNR comparison and subjective comparison will be conducted in the next meeting.
Participants: ENST(pesquet@tsi.enst.fr), Univ. of Brescia (Michele.Brescianini@ing.unibs.it): verifier

EE4: Entropy coding efficiency – comparison with (3D)-EBCOT, CABAC, EMDC
Delayed till Bangkok meeting

EE5: Visual performance evalutation of Video Wavelet Reference Systems
The following specifications will be reviewed in the first weeks after the Nice meeting, by the AhG on Wavelet Video Coding Exploration.

Objectives

O1. Understand the top quality level that can be achieved for certain points.
O2. Document improvement of "visual quality" in "wavelet based video coding schemes" and eventually "JVT approach" from 70th ISO/MPEG to 75th ISO/MPEG.
O3. Compare quality with respect to standard JSVM configuration (common JSVM testing conditions as minimum set)
O4. Projection of performance for high resolution material (over 4CIF)

Required test material

1. Have 16CIF original material. Try to get material from Sony (Tobias Oelbaum (TUM) will extract material and inform the reflectors for downloading it from a set-up ftp site).

Mean

1. (O1): Extract the rate points starting from a higher maximum rate point (with respect to current max point). Plot for the highest resolution, the PSNR curves on the top 2-3 rate points.

2. (O2): Perform visual evaluation on a subset of working points/sequences tested in Palma. 3 levels of spatial sequences.
    a. 4CIF: up to 3 points (combination of temporal and rate)
    b. CIF: 2 points (combination of temporal and rate)
    c. QCIF: 2 points (combination of temporal and rate)

    Exact rate points with respect to those tested in Palma will be decided in the next 3-4 weeks

3. (O3): Experiments based on
    a. CIF data
        i. Bus
        ii. Mobile
        iii. Football
        iv. Foreman
    b. 4CIF data
        i. City
        ii. Harbour
        iii. Soccer
        iv. Crew
        v. 2 additional sequences (provided by Vittorio Baroncini (FUB))

    For known data, a different extraction path and different rate points will be used in this case with respect to Palma experimental conditions, so as to assess whether the visual performance assessment changes substantially. Common JSVM extraction path and rate points will be used for this test.

    Notes: Additional test cases may be defined beyond the operating ranges of common JSVM testing conditions. Under constraints of the given timeline, it may not be possible to achieve full optimization of the wavelet video codec using JSVM extraction path and rate points. Test O3 may only be possible at the 76th meeting in this case.

4. (O4): HD material
    a. Highest spatial resolution rate point 6-8 Mbps (to be determined jointly with the Test SG chair)
    b. 16 CIF evaluation on numbers, + 4CIF cropped version
    c. Perform visual evaluation on extracted versions from 16 CIF bitstream (4 CIF, CIF, and QCIF) + 4CIF cropped version of 16 CIF (PSNR values will be provided for the cropped area and the surrounding one)

    Comparisons will also be made with respect to JSVM configuration provided JSVM can run on 16CIF input material.

For additional 4CIF and 16CIF sequences, rate points and extraction paths will be decided by the AhG on Wavelet Video exploration on the basis of the selected content characteristics.

For JSVM, all bit-streams will be generated using the latest standard configuration of the JSVM software (JSVM 4.0, if available, else JSVM 3.0).
For t+2D, WCS1.1 will be used.
For 2D+t+2D, WCS1.1 (with possibly modified interlayer configuration) will be used.

Visual evaluation will be carried out at the 75th meeting.

Participants: ENST(pesquet@tsi.enst.fr), Univ. of Brescia (Nicola.Adami@ing.unibs.it), QMUL (Marta.mrak@elec.qmul.ac.uk), RWTH (wien@ient.rwth-aachen.de)