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ISO/IEC JTC1/SC29/WG11
CODING OF MOVING PICTURES AND AUDIO

Title: **Report of AhG on Exploration in Wavelet Video Coding**
Status: **AhG report**
Source: **AhG on Exploration in Wavelet Video Coding**
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1 Mandates

The AHG on Exploration in Wavelet Video Coding [1] was established at the 73rd MPEG meeting in Poznan, Poland, with the following mandates:

1. To identify and describe new applications of wavelet video coding.
2. For such applications, define coding conditions and plan a performance comparison with other codecs.
3. Conduct the exploration experiments.
4. Maintain and validate the exploration reference software.
5. Maintain and edit the wavelet codec reference document.

All discussions took place over the reflector, mpeg-vidwav@lists.rwth-aachen.de, i.e., ~ 100 emails have been exchanged.

AhG meeting: Saturday October 24th, 14:30-18:30, Nice Acropolis

AhG meeting agenda:

1.- review of conducted exploration experiments on wavelet video coding
2.- review 74th ISO/MPEG meeting input documents of interest to this AhG
3.- review this AhG mandates and prepare AhG report, includine recommendations

2 AHG Activity

Mandate 1 [identify and describe new applications of wavelet video coding.]:

This mandate can be considered a long-term one. Initial discussions that took place within the AhG led to the following considerations: Wavelet video coding appears promising for applications:

1. targeting storage of high definition content (no delay constraint), with non predefined scalability range (e.g., Digital Cinema)
2. targeting a very high number of spatio-temporal decomposition levels (e.g. surveillance)
3. targeting non dyadic decompositions (e.g., video editing, conversion format between SD and HDTV, ...)
4. targeting fast moving region of interest tracking over time (e.g., surveillance)

Wavelet video coding may also provide advantages for
1. Multiple Description Coding which would lead to better error-resilience (e.g., wireless broadcasting)
2. easily providing means to optimally prioritize temporal versus spatial information for fast decoding purposes (surveillance, video browsing)
3. extremely fine grain SNR scalability (naturally implemented given the multiresolution framework enabled by wavelet representation).
4. enabling efficient similarity search in large video databases (fast indexing of multimedia documents for e.g. browsing, information retrieval)
5. better R(D) performance for very high resolution material (HD, DC, medical imaging), since it naturally will naturally deal with redundancy at various scales.
6. "better" compatibility with J2K and MJ2K.

Mandate 2 [For wavelet video coding applications tailored applications, define coding conditions and plan a performance comparison with other codecs.]:

Not withstanding the need to define precise testing conditions for tailored applications, the AhG felt that Mandate 1 needs to be fully addressed and that vidwav wavelet reference codec reaches an appropriate level of maturity.

In reference to this mandate, input document m12643 [3] was reviewed at the AhG meeting. This document provides information about the current state of performance of the exploration reference software in different working modalities with respect to JSVM 3.0. Experiments were conducted following Palma di Mallorca test conditions.

Mandate 3 [Conduct the exploration experiments.]:

Out of the 5 EE's planned between the ISO/MPEG 73rd and 74th meetings [2], only one of them was reviewed at the Ad Hoc meeting namely **EE4** (Joint reduction of ringing and blocking artefacts), since the proponents of all other EE's proponents were unable to complete the EE between the meetings. It is likely that some of such EE's will be continued.

The AhG felt that the results of EE4 are convincing enough to recommend the incorporation of the proposed in-loop filter for vidwav reference software (with the possibility to disactivate the tool).

Mandate 4 [Maintain and validate the exploration reference software.]:

Input contributions m12616 [4] and m12642 [5] were made at the 74th ISO/MPEG meeting. These address specifically bug fixes and configuration modalities of the exploration reference software, in line with this mandate. These contributions were reviewed at the AhG meeting.

Mandate 5 [Maintain and edit the wavelet codec reference document]:

Input contribution m12639 [6] was reviewed at the AhG meeting. Further work will be carried out during the ISO/MPEG meeting.

<u>Other contributions revision</u>

Input contribution m12633 [7] was reviewed at the AhG meeting. The results appear interesting and may outperform the functionality of the intracoding tool in the exploration reference software. An exploratory experiment may be conducted to verify such performance advantage.

3 Recommendations

The AhG on Exploration Wavelet Video Coding recommends:

1. To incorporate into the exploration reference software all components that have led to improvement of performance according to the EE's results and the conducted maintenance work of the Wavelet Video Coding Exploratory reference software.
2. To define the test conditions for performance evaluation of wavelet video coding exploration with respect to other codecs, tailored to particular application scenarios.
3. To define new Exploration Experiments to be conducted after the end of the meeting.
4. To identify weak components in the current Exploratory reference architecture and to plan a joint program of activities to improve the performance of such components, after the ISO/MPEG meeting.
5. To incorporate a Section in the wavelet codec reference document (N7334 [8]) that will detail the "optimal" configuration file for currently achieving the best performance with the Exploratory reference software.

References

[1]   "AHG on Exploration in Wavelet Video Coding", ISO/IEC JTC1/SC29/WG11 N7433, Poznan, Poland, Jul. 2005.
[2]   "Exploration experiments in Wavelet Video Coding", ISO/IEC JTC1/SC29/WG11 N7333, Poznan, Poland, Jul. 2005.
[3]   "Performance evaluation of the current Wavelet Video Coding Reference Software", ISO/IEC JTC1/SC29/WG11 M12643, Nice, France, Oct. 2005.
[4]   "Proposal of Vidwav OBMC bug fix", ISO/IEC JTC1/SC29/WG11 M12616, Nice, France, Oct. 2005.
[5]   "New prediction schemes for scalable wavelet video coding", ISO/IEC JTC1/SC29/WG11 M12642, Nice, France, Oct. 2005.
[6]   "Edited version of the document SC 29 N 7334", ISO/IEC JTC1/SC29/WG11 M12639, Nice, France, Oct. 2005.
[7]   "<u>Motion Driven Adaptation of Spatial Wavelet Transform</u>" ISO/IEC JTC1/SC29/WG11 M12633, Nice, France, Oct. 2005.
[8]   "Wavelet Codec Reference Document and Software Manual V1.0", ISO/IEC JTC1/SC29/WG11 N7334, Poznan, Poland, Jul. 2005.