Joint Video Team (JVT) of ISO/IEC MPEG & ITU-T VCEG
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Title: **Skip Mode Motion Compensation**

Status: Input Document to JVT

Purpose: Proposal

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1. Introduction

The various GMVC (Global Motion Vector Coding) proposals, e.g. [1], pointed out that a low overhead Macroblock mode with motion compensation can significantly improve the JM coding efficiency. This proposal achieves the same or slightly larger improvements by introducing a very simple modification to the existing SKIP mode motion compensation. This allows the SKIP mode to use a predicted motion vector in motion compensation. The motion vector is generated similarly to the prediction motion vector of the current 16x16 motion mode.

Proposed modification does not change the current JVT bitstream syntax at all. Only decoder action is altered by introducing the generation of the SKIP mode motion vector. Advantages of the proposed method include:

- No syntax change
- No complexity increase in encoder
- No complexity increase in decoder
- No additional memory needed
- Very small software change (the motion vector prediction for 16x16 mode is reused)
- Performance very close or better than full GMC/GMVC methods

2. Method description

Instead of copying the SKIP mode Macroblock from the original reference picture location, a motion vector is generated and used to motion compensate the Macroblock. The motion vector is generated identically to the prediction motion vector for the 16x16 motion compensated Macroblock mode. However, to allow accurate and efficient coding of stationary background, a zero motion vector is used in two cases:

1. If a Macroblock immediately above or to the left is not available (that is, is out of the picture or belongs to a different slice).
2. If a Macroblock or block immediately above or to the left that is used in motion vector prediction has a zero motion vector and uses the latest picture as reference in motion compensation.

Otherwise the coding and interpretation of the SKIP mode remains unchanged. That is, no delta motion vectors and no prediction error coding data is sent for the SKIP mode Macroblocks.

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3. Results

Attached spreadsheet JVT-C027.xls contains RD curves for the test set proposed by the GMC/GMVC Ad Hoc group. JM 1.7 was used in the tests with RD-optimization, 32 pixel search range, UVLC coding and RestrictSearchRange set to 0.

It can be seen that the proposed method provides consistent improvements and up to 20% bitrate savings. BD-PSNR bitrate reductions for one and five reference frames are listed in the table below. The average gain for all the sequences and bitrates were 2.2% for one reference frame and 2.1% for five.

Table 1: BD-PSNR bitrate reduction percentage with the proposed method.

	Cont	Fore	News	Sile	Pari	Mobi	Temp	Fore	Stef	Coas	Average
1 frame	2.18	2.5	-0.21	-0.85	0.44	3.17	2.3	6.65	2.73	3.21	2.21
5 frames	1.02	2.34	-0.49	-0.27	0.37	2.96	1.95	7.28	2.89	3.41	2.15

Table 2 lists the BD-PSNR results for the GMVC scheme [2] with the same test settings. Software provided by Sharp on April 1st 2002 was used. Average bitrate reduction against JM 1.7 is 1.5%.

Table 1: BD-PSNR bitrate reduction percentage with the GMVC sheme.

	Cont	Fore	News	Sile	Pari	Mobi	Temp	Fore	Stef	Coas	Average
1 frame	-0.15	2.49	-0.05	-0.05	-0.01	2.12	0.44	5.15	1.47	3.74	1.515

4. Conclusions

The compression efficiency of the proposed Skip mode motion compensation is on average better than that of a full GMVC scheme. Given the extremely simple nature and very good compression performance of the Skip mode motion compensation, the authors of this document ask JVT to adopt it to the next version of JM.

References

[1] Shijun Sun and Shawmin Lei, " Global Motion Vector Coding (GMVC)", document VCEG-O20, ITU-T Video Coding Experts Group (VCEG) Meeting, Pattaya, Thailand, 4-7 December 2001.

[1] Shijun Sun and Shawmin Lei, " Experimental results of GMVC and "Motion Copy"", document JVT-C021, Joint Video Team (JVT) Meeting, Fairfax, VA, USA, 6-10, May 2002.

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(Append for Proposal Documents)

JVT Patent Disclosure Form

International Telecommunication Union
Telecommunication Standardization Sector

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Joint Video Coding Experts Group - *Patent Disclosure Form*

(Typically one per contribution and one per Standard | Recommendation)

Please send to:

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Relevant Recommendation | Standard and, if applicable, Contribution:

Name (ex: "JVT")	**JVT**
Title	**Skip Mode Motion Compensation**
Contribution number	**JVT-C027**

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