Nokia Exhibit 2015, p. 1
Amazon.com v. Nokia
IPR2024-00848

Joint Video Team (JVT) of ISO/IEC MPEG & ITU-T VCEG
(ISO/IEC JTC1/SC29/WG11 and ITU-T SG16 Q.6)
3rd Meeting: Fairfax, Virginia, USA, 6-10 May, 2002

Document: JVT-C027
Filename: JVT-C027.doc

Title: **Skip Mode Motion Compensation**

Status: Input Document to JVT

Purpose: Proposal

Author(s) or Contact(s): Jani Lainema, Marta Karczewicz
Nokia Research Center
6000 Connection Drive
Irving, TX 75039, USA

Tel: +1 972 894 4045
Email: jani.lainema@nokia.com

Source: Nokia Inc.

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.

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.

(Append for Proposal Documents)

JVT Patent Disclosure Form

International Telecommunication Union
Telecommunication Standardization Sector

International Organization for Standardization

International Electrotechnical Commission

Joint Video Coding Experts Group - *Patent Disclosure Form*

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

Please send to:

JVT Rapporteur Gary Sullivan, Microsoft Corp., One Microsoft Way, Bldg. 9, Redmond WA 98052-6399, USA

Email (preferred): Gary.Sullivan@itu.int Fax: +1 425 706 7329 (+1 425 70MSFAX)

This form provides the ITU-T | ISO/IEC Joint Video Coding Experts Group (JVT) with information about the patent status of techniques used in or proposed for incorporation in a Recommendation | Standard. JVT requires that all technical contributions be accompanied with this form. *Anyone* with knowledge of any patent affecting the use of JVT work, of their own or of any other entity ("third parties"), is strongly encouraged to submit this form as well.

This information will be maintained in a "living list" by JVT during the progress of their work, on a best effort basis. If a given technical proposal is not incorporated in a Recommendation | Standard, the relevant patent information will be removed from the "living list". The intent is that the JVT experts should know in advance of any patent issues with particular proposals or techniques, so that these may be addressed well before final approval.

This is not a binding legal document; it is provided to JVT for information only, on a best effort, good faith basis. Please submit corrected or updated forms if your knowledge or situation changes.

This form is *not* a substitute for the *ITU ISO IEC Patent Statement and Licensing Declaration*, which should be submitted by Patent Holders to the ITU TSB Director and ISO Secretary General before final approval.

Submitting Organization or Person:	
Organization name	**Nokia Inc.**
Mailing address	**6000 Connection Drive,** **Irving, TX 75039** **USA**

Country	**USA**
Contact person	**Marta Karczewicz**
Telephone	+1 972 894 4188
Fax	+1 972 894 4589
Email	marta.karczewicz@nokia.com
Place and date of submission	Fairfax, VA, 5/4/2002

Relevant Recommendation | Standard and, if applicable, Contribution:

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

(Form continues on next page)

Disclosure information – Submitting Organization/Person (choose one box)

☐ 2.0 The submitter is not aware of having any granted, pending, or planned patents associated with the technical content of the Recommendation | Standard or Contribution.

or,

The submitter (Patent Holder) has granted, pending, or planned patents associated with the technical content of the Recommendation | Standard or Contribution. In which case,

☐ 2.1 The Patent Holder is prepared to grant – on the basis of reciprocity for the above Recommendation | Standard – a free license to an unrestricted number of applicants on a worldwide, non-discriminatory basis to manufacture, use and/or sell implementations of the above Recommendation | Standard.

☐ 2.2 The Patent Holder is prepared to grant – on the basis of reciprocity for the above Recommendation | Standard – a license to an unrestricted number of applicants on a worldwide, non-discriminatory basis and on reasonable terms and conditions to manufacture, use and/ or sell implementations of the above Recommendation | Standard.

Such negotiations are left to the parties concerned and are performed outside the ITU | ISO/IEC.

☒ 2.2.1 The same as box 2.2 above, but in addition the Patent Holder is prepared to grant a "royalty-free" license to anyone on condition that all other patent holders do the same.

☐ 2.3 The Patent Holder is unwilling to grant licenses according to the provisions of either 2.1, 2.2, or 2.2.1 above. In this case, the following information must be provided as part of this declaration:

- patent registration/application number;
- an indication of which portions of the Recommendation | Standard are affected.
- a description of the patent claims covering the Recommendation | Standard;

*In the case of any box **other than 2.0** above, please provide the following:*

Patent number(s)/status _____

Inventor(s)/Assignee(s) _____

Relevance to JVT _____

Any other remarks: _____

(please provide attachments if more space is needed)

(form continues on next page)

Third party patent information – fill in based on your best knowledge of relevant patents granted, pending, or planned by other people or by organizations other than your own.

Disclosure information – Third Party Patents (choose one box)

☒ 3.1 The submitter is not aware of any granted, pending, or planned patents *held by third parties* associated with the technical content of the Recommendation | Standard or Contribution.

☐ 3.2 The submitter believes third parties may have granted, pending, or planned patents associated with the technical content of the Recommendation | Standard or Contribution.

For box 3.2, please provide as much information as is known (provide attachments if more space needed) - JVT will attempt to contact third parties to obtain more information:

3rd party name(s) _____

Mailing address _____

Country _____

Contact person _____

Telephone _____

Fax _____

Email _____

Patent number/status _____

Inventor/Assignee _____

Relevance to JVT _____

Any other comments or remarks: