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Sent: Wednesday, September 11, 2002 2:48 PM
To: jvt-experts@mail.imtc.org
Subject: [jvt-experts] About the modification of chroma motion vector in field mode

Dear experts,

When the motion compensation is used between fields with different parity, we find that chroma vector is not parallel with the luma vector.

And when the chroma and luma vectors are formed to be parallel, BDSNR gain in chroma (up to 1 dB gain at the first bottom field of GOP) can be observed.

This figure shows the vertical position of Luma and Chroma pixels.

-----> Time

Top0 Bot1 Top2

L0		L0
C0		C0
	L1	
C'1	C'0	
L2		L2
	C1	
	L3	
L4		L4
C0		C0
	L5	

There are 3 fields, Top0, Bot1, Top2. L0,L1... shows the position of Luma pixels, and C0, C1... shows the position of Chroma pixels.

When the L1 of Bot1 field points the L0 in Top0 field, C1 in Bot1 field points C0 in Top0 field according to the current draft. Obviously, vector $L1 \Rightarrow L0$ and $C1 \Rightarrow C0$ is not parallel. In this case, C1 in Bot1 should be point C'1 in Top0.

In the same way, when the L0 of Top2 field points the L1 in Bot1 field, C0 in Top2 field points C1 in Bot1 field according to the current draft. Obviously, vector $L0 \Rightarrow L1$ and $C0 \Rightarrow C1$ is not parallel either. C0 in Top2 field should be point C'0 in Bot1 field.

The simple solution is to modify the vertical chroma vector calculation according to the following table.

+-----+-----+			
Parity		Vy: Vertical component of luma vector	
Ref	Cod	Chroma Vector	VCy: Vertical component of Chroma vector
+---+---+-----+			
Top	Bot	$VCy = Vy/2 + 1/4$	
+---+---+-----+			

| Bot | Top | VCy = Vy/2 - 1/4 |

+-----+-----+-----+

| Otherwise | VCy = Vy/2 |

+-----+-----+-----+

This scheme needs no syntax change.

And implementation is also very easy.

When the scheme is implemented in JM3.9a, the number of lines modified in JM3.9a are 4 in encoder, and 8 in decoder respectively.

This scheme improves the PSNR especially in case that only the field with different parity is available as a reference. This sometimes happens in (IBBPBBPBBPBBPBB)(IBBPBBPBBPBBPBB).... structure such as broadcast.

This illustrate a "GOP" structure in the field coding mode.

(Itop0:Pbot0)(Btop1:Bbot1)(Btop2:Bbot2)(Ptop3:Pbot3)(Btop4:Bbot4).....

Here, the first bottom field "Pbot0" in GOP should not use the fields in the previous GOP as a reference. "Pbot0" field can use only "Itop0" field. As a result, "Ptop0" (Top of GOP) always have to use references with different parity.

When the scheme is applied to the standard sequences, we found that the improvement of BD-SNR in chroma is up to 1 dB in the first predictive field in GOP, i.e, Pbot0 (where only the field with different parity is available).

Summary:

- Chroma vector shift when the vector is defined between fields with different parities.
- No syntax change.
- Easy implementation:
 - 4 lines modification in encoder, and 8 lines in decoder in JM3.9a
- Up to 1 dB gain in chroma at the first predictive field of GOP.

We are welcome to any comments ;-)

In a few days, I will send the software where this method is implemented.

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The use of the jvt-experts list is intended only for the video coding standardization work conducted by the Joint Video Team (JVT) of ISO/IEC JTC1/SC29/WG11 (MPEG) and ITU-T SG16 Q.6 (VCEG).

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