

From: nakagawa@media.flab.fujitsu.co.jp on behalf of Nakagawa, Akira <anaka@flab.fujitsu.co.jp>
Sent: Friday, September 13, 2002 11:45 AM
To: jvt-experts@mail.imtc.org
Cc: anaka@flab.fujitsu.co.jp
Subject: [jvt-experts] Re: Software for Chroma Vector Shift

Dear Gary-san and all,

I have started the simulation with frame/field adaptivity.
I will report the result in a few days(maybe it will take a few days).

Best Regards,
Akira Nakagawa

> > Nakagawa-san,
> > Do you have any idea of average gain over the interlaced common
> > conditions test set with frame/field adaptivity in use?
> > (I think that's F1, Canoa, Rugby, Tempete, and Football.)
> Thank you for your comment.
> In order to estimate the impact of chroma vector shift itself, We
> have simulated under the field condition only at present.
>
> We show the details of our results.
>
> ***** Conditions *****
> Our simulation conditions is :
> *Software: JM3.9a based(already delivered to the experts) *Coding
> mode: GOP structure, GOP size = 15, I:P:B = 1:4:10
> (IBBPBBPBBPBBPBB)(IBBPBBPBBPBBPBB).....
> (Considering from the existing system,
> this structure is more realistic)
> *QP: 40, 26, 32, 28
> Sequences: Mobile, Football, Canoa Valsesia, F1 car, Rugby(VCEG-N85r1)
> Reference: Set NumberRefereceFrames=1 (Previous Top and Bottom)
>
> This illustration shows the GOP structure.
>
> [I0_top:P0_bot][B1_top:B1_bot][B2_top:B2_bot][P3_top:P3_bot].....
>
> Here, [] forms a frame, and inside the fraem[], I/P/B, picture number,
> field parity are indicated respectively.
>
> ***** Results *****
> We have measured three kinds of PSNR
> 1)PSNR of "P0_bot" field where only the field "I0_top" is available
> as a reference. Here, "I0_top" have a different parity.
> 2)PSNR of "P3_bot", "P6_bot", "P9_bot"..... where "P0_bot" and "P3_top"
> are available a reference. We find that encoder sometimes prefoer
> to selecting "P3_top" instead of "P0_bot" because "P0_bot" is far

> from "P3_bot". Here, "P3_top" have a different parity from "P3_bot".

> 3)Overall PSNR

> -----

> 1)PSNR of "P0_bot"

> BDSNR gain in dB

> Y U V

> Mobile&Calendar 0.16 0.87 1.11

> Football 0.02 0.24 0.11

> Canoa Valsesia 0.05 0.29 0.38

> F1 car 0.02 0.26 0.45

> Rugby 0.03 0.18 0.18

> Average 0.056 0.368 0.446

>

> By introduce the exact parallel chroma vector, the improvement is

> suprising! BDSNR gain of UV is up to 1 dB, and avarage is around

> 0.4dB.

>

> -----

> 2)PSNR of "P3_bot", "P6_bot", "P9_bot".....

> BDSNR gain

> Y U V

> Mobile&Calendar 0.08 0.45 0.53

> Football 0.03 0.16 0.06

> Canoa Valsesia 0.04 0.18 0.23

> F1 car 0.01 0.18 0.28

> Rugby 0.02 0.11 0.1

> Average 0.036 0.216 0.24

>

> BDSNR gain of UV is up to 0.5dB, and avarage is around 0.23dB. The

> gain is still high in some sequences.

>

> -----

> 3)Overall PSNR

> BDSNR gain

> Y U V

> Mobile&Calendar 0.04 0.19 0.23

> Football 0.01 0.07 0.03

> Canoa Valsesia 0.01 0.06 0.06

> F1 car 0.00 0.08 0.11

> Rugby 0.01 0.03 0.02

> Average 0.014 0.086 0.09

>

> Overall gain of UV is up to 0.2dB, and average is 0.09dB. Never

> loss!

>

> ***** Conclusion *****

> As long as field structure is used, there are fields which can use

> only the references with different parity(such as "P0_bot").

> This modification especially improve this kind of field very much.

> (up to 1dB)

> Overall quality is also up to 0.2dB, and never loss.

> We think that this is a kind of bug in FCD, and the definition of

> the chroma vector calculation should be changed.
>
> Best Regards,
> Akira Nakagawa
> FUJITSU LABORATORIES LTD.
>
> > +> -----Original Message-----
> > +> From: Nakagawa, Akira [mailto:anaka@flab.fujitsu.co.jp]
> > +> Sent: Wednesday, September 11, 2002 9:12 PM
> > +> To: jvt-experts@mail.imtc.org
> > +> Cc: anaka@flab.fujitsu.co.jp
> > +> Subject: [jvt-experts] Software for Chroma Vector Shift
> > +>
> > +>
> > +> Dear Experts,
> > +>
> > +> As I reported yesterday, we found the modification of chroma
> > +> vector definition in field mode will improve the quality of
> > +> chroma up to 1dB.
> > +>
> > +> Again, the summary of this implementation is as follows:
> > +> - Chroma vector is shifted when the vector is defined between fields
> > +> with different parities.
> > +> - Up to 1 dB gain in chroma (at the first bottom field in GOP).
> > +> - No syntax change.
> > +> - Very simple implementation:
> > +> 4 lines modification in encoder, and 8 lines in decoder in
> > +> JM3.9a
> > +>
> > +> As I wrote in the previous e-mail, I will attach the software
> > +> with our ideas. Of course, perfect match between encoder/decoder
> > +> is checked. The usage is written at the following part.
> > +>
> > +> We are welcome to your questions and comments.
> > +>
> > +> Best Regards,
> > +> Akira Nakagawa
> > +>
> > +> ----- The usage of the software
> > +> -----
> > +> ===== Restrictions =====
> > +> * 1/4 pel only
> > +> * Telenor bitstream format only
> > +> (Problem in the display of statistics values)
> > +>
> > +> ===== How to compile =====
> > +> Step1: How to form the Directory
> > +> - unzip the attached file.
> > +> - overwrite the attached files to the original JM3.9a
> > +>
> > +> Step2: Compile
> > +> - Please decide which version to use. That is, with or without

>> +> the chroma vector shift.

>> +> - In order to enable chroma vector shift, enable the line

>> +> "#define CVEC_SHIFT"

>> +> in lcommon/inc/options.h

>> +> - In order to disable chroma vector shift, disable the line

>> +> //"#define CVEC_SHIFT"

>> +> in lcommon/inc/options.h

>> +> - Then compile both encoder and decoder.

>> +>

>> +> ==== Details about this patch =====

>> +> We have implemented it based on JM3.9a. In order to

>> +> implement chroma vector shift, we add 4 lines into

>> +> lencode/macroblock.c and

>> +> 8 lines into ldecode/macroblock.c. The definition "CVEC_SHIFT"

>> +> will help you to find the newly added lines.

>> +>

>> +> In order to use the field coding mode with periodic intra

>> +> field, we have modified other part. However, this is only for

>> +> the simulation purpose, and will never give an impact on the coding

>> +> algorithm itself. These part can be enabled or disabled by using

>> +> the compile option. In order to find such parts, the definitnin

>> +> "ORIGINAL_JM39A" will help you.

>> +> This definition is defined in "lcommon/inc/options.h".

>> +> In order to restrict the reference in the field just after the

>> +> first intra field of GOP, please disable the definitnin

>> +> "ORIGINAL_JM39A".

>> +>

>> +> === Default setting =====

>> +> The default setting in lcommon/options.h is as follows.

>> +> CVEC_SHIFT : Enabled(with chroma vector shift)

>> +> ORIGINAL_JM39A: Disabled (the reference at the top of GOP is

>> +> restricted)

>> +>

>> +> === Brief simulation using this patch ===== In the bin directory,

>> +> the cropped field picture(176x128) is included.

>> +> You can compare the performance just after the compiling.

>> +>

>> +> %% "Nakagawa, Akira" <anaka@flab.fujitsu.co.jp> %% [jvt-experts]

>> +> About the modification of chroma motion vector in field mode %%

>> +> Wed, 11 Sep 2002 21:48:25 +0900

>> +>

>> +> > 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

>> +> > paralell, 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=>L0 and C1=>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=>L1 and C0=>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:Bb
>>+> ot4).....
>>+>>
>>+>> 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 diffenrent parity.
>>+>>
>>+>> When the scheme is 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 ot GOP.
>>+>>
>>+>> We are welcome to any comments ;-)
>>+>>
>>+>> In a few days, I will send the software where this mothod is
>>+>> implemented.
>>+>>
>>+>> ---
>>+>> Akira Nakagawa
>>+>> FUJITSU LABORATORIES LTD.
>>+>>
>>+>> ---
>>+>> 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).
>>+>>

> > +> > You are currently subscribed to jvt-experts as:
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