CCITT SGXV
Working Party XV/1
Experts Group for ATM Video Coding

Document AVC -194
December 1991

ISO/IEC JTC1/SC29/WG11
MPEG92/024
December 1991

SOURCE : Takeshi Yukitake, Matsushita
TITLE : Field adjusted MC for frame-base coding
PURPOSE : proposal

Abstract

*In this document, the new motion compensated prediction method "**Field Adjusted MC**"(**FAMC**) for frame-base coding is proposed for TM0.*

The fundamental coding structure for FAMC is frame-base SM3 and only motion compensated prediction is replaced to FAMC. (It is noted that for FAMC P-frame needs 1 motion vector and B-frame needs 2 motion vectors as same as SM3.) It means the bit stream syntax is exactly the same as SM3 and FAMC does NOT require any field-base processing such as field-base MV or field-base DCT block, just requires frame-base processing as SM3. According to preliminary experiments, FAMC improves the image quality very much and the SNR is about ~~x~~dB higher than SM3. FAMC accompanies with D! tape demonstration. 0.4~1.2

For confirmation of FAMC, the source program of FAMC will be provided (Language C) . Contact to

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1.Introduction

In Kurihama meeting, it is agreed that in order to create TM we start with SM3 syntax. In this document, new motion compensated prediction method (**Field Adjusted MC (FAMC)**) for frame-base coding is proposed for TM0. FAMC does not require any change of SM3 syntax, so it has a good commonality with MPEG I. And it also leads a good image quality improvement.

2.Coding structure

The fundamental coding structure for FAMC is frame-base coding with simple merging two fields. Here we use frame-base SM3 as a basic coding algorithm and only motion compensated prediction is replaced to FAMC. *(It is noted that for FAMC P-frame needs 1 motion vector and B-frame needs 2 motion vectors as same as SM3.)* It means the bit stream syntax is exactly the same as SM3 and FAMC does NOT require any field-base processing such as field-base MV or field-base DCT block, just requires frame-base processing as SM3. It is illustrated in Fig. 1.

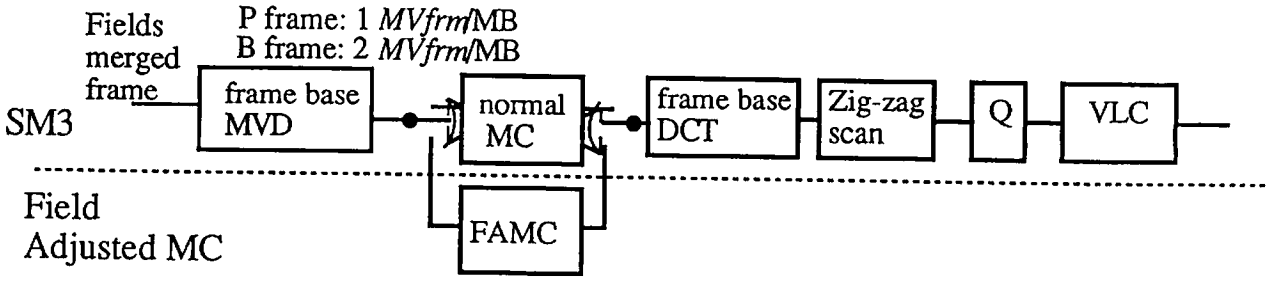

Fig.1 Coding structure of FAMC

3.Field Adjusted MC (FAMC)

The following is the outline of FAMC.

Since the input frame is simply merging two fields, there is one field-time difference between even and odd lines. So the basic idea of FAMC is that even lines of coding frame are predicted from the even field of the reference frame and odd line is predicted from odd field. And the same frame-base motion vector (*MVfrm*) is used for even and odd line prediction. However, the resolution of field image is low due to 1 line (field) dropping and it is hardly expected the high performance MC predictions. So, to get the higher resolution images, the different parity field of reference frame is utilized with compensating the one field-time difference in FAMC. This one field-time difference compensation vector (*MVfld*) is calculated from the frame-base motion vector (*MVfrm*). (See Fig. 2)

FAMC is specified as below. Fig.3 depicts the generation of reference image for even line.

step1: The one field-time difference compensation vector is calculated as follows.

Horizontal : $MVfld(h)=nint\{[MVfrm(h)/fd/2] *2\} /2$
Vertical : $MVfld(v)= MVfrm(v)/fd/2$

where *MVfld*: one field-time difference compensation vector
MVfrm: frame-base motion vector
fd : frame distance for *MVfrm*
nint( ) : nearest integer

For simplification of calculation, accuracy of *MVfld(h)* is rounded into half pel here.

step2: The different parity field of reference frame is compensated and it gives the unequal interval pels of reference image. (Fig.3 (b))

step3: By linear interpolation of unequal interval pel image, half pel accuracy reference image is obtained for even or odd line prediction. (Fig.3(c))

step4: Get the motion compensated prediction for even or odd line of coding frame.

It should be noted that ;
(1) FAMC needs only frame-base motion vector (*MVfrm*) and the one field-time difference compensation vector (*MVfld*) is calculated by *MVfrm*.
(2) If *MVfld* is forced to zero, FAMC is completely the same as normal MC used in SM3.
(3)*MVfrm* is detected on MB basis, so reference image for even and odd line prediction is also generated on MB basis.

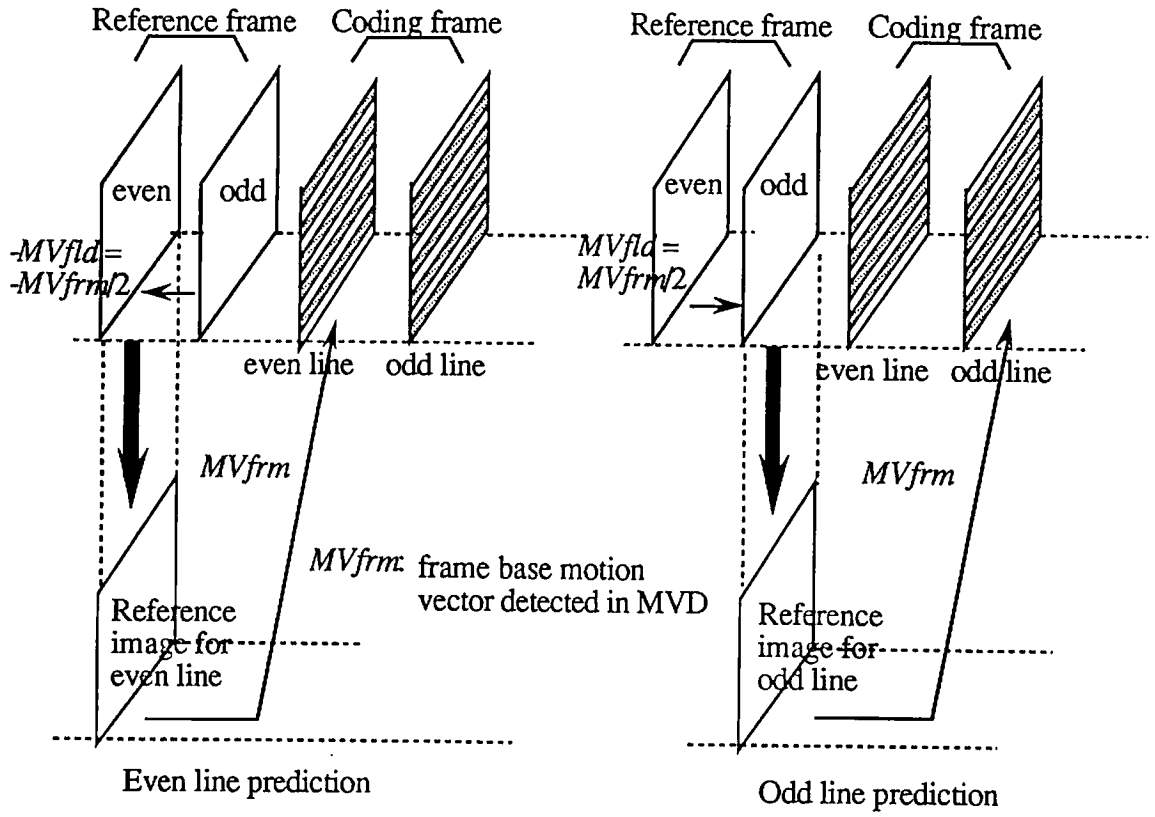

Fig.2 Field Adjusted MC

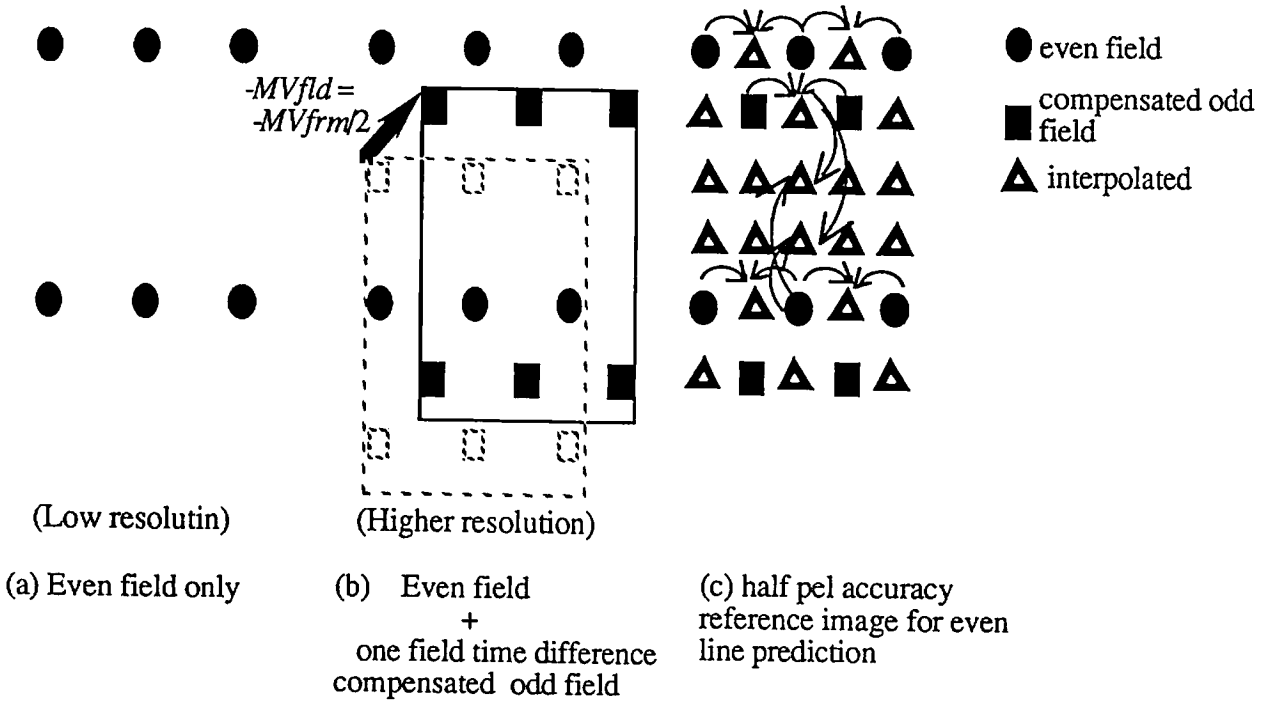

Fig.3 Generation of reference image for even line prediction

4. Simulation

Simulations are carried out over three coding method listed in Table 1 under following conditions. The results are shown in Table 2. And the coding image quality is demonstrated by D1 tape.

Base coding algorithm: frame-base SM3 with simple merging fields
M=12, N=3
No Mquant
Bit rate: 4Mb/s
Sequences: Football, Mobile & Calendar, Flower Garden 5GOP (0-59 frame)

Table 1 : Compared method

	Frame base MVD	MC prediction	frame base DCT – VLC
Method 1 (frame base SM3)	Detect MV on field merged image (same as SM3)	Normal MC (same as SM3)	
Method 2		FAMC	same as SM3
Method 3	Detect MV which gives minimum MSE according to FAMC method (optimum MVD for FAMC)		

Table 2 Simulation Results (S/N at 4Mb/s)

(dB)

Sequence	Method 1 (frame base SM3)	Method 2	Method 3
Football	31.38	31.35	31.80
Mobile & Calendar	28.74	29.08	29.28
Flower Garden	29.88	30.37	31.07

5.Conclusion

The new motion compensated prediction method "Field adjusted MC" for frame-base coding is studied. FAMC can improve S/N about ~~xx.xx~~ 0.4~1.2 dB and image quality without any field-base processing and any change of SM3 syntax.

We propose this FAMC for TM0.

END