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Document AVC-414

SOURCE : Japan
TITLE : Fix for the noisy background problem in leaky prediction
PURPOSE : Information

1. Introduction

Leaky prediction has been proposed as a mean of temporal localization of errors and channel hopping compensation. However, the noisy background problem degrades visual picture quality. In this document, an adaptive DC quantization method to solve the noisy background problem was examined thorough computer simulation (core experiment F.3).

2. Adaptive DC quantization

The method consists of two steps, which are MB-based background detection and use of fine (fixed) quantization for DC coefficients of the Y blocks for the detected MBs. For the background detection, N_act value which is obtained in step 3 in the TM3 rate control algorithm is used.

3. Computer simulation

Computer simulation were performed based on a TM3 based coding algorithm. In this simulation, 1 bit flag which indicates the background MB is transmitted for each macroblock. An equivalent method can be realized on the adaptive weighting matrix concept which is described in the TM3 quantization core experiment (see Annex). The simulation conditions were as follows.

- Picture format : 4:2:0
- GOP structure : M=1, N=150 (IPPPP....)
- Picture structure : Frame picture
- Prediction method : Adaptive frame/field
- Bit rate : 4 Mb/s
- Background MB decision : N_act <= 0.6
- DC_qpara for background : 4

Table 1 shows the simulation results with and without the proposed method. According to the results, the adaptive DC quantization method gives slightly worse SNRs than those without it. In subjective evaluation of the picture quality, however, the noisy background was significantly improved.

Some of the reproduced pictures will be demonstrated by VCR at the meeting.

3. Conclusion

An adaptive DC quantization method was proposed for the purpose of fixing the noisy background problem. The results indicate that the method is effectiveness and that a simple modification of quantization solve the noisy background problem. Therefore, leaky prediction seems to be a desirable method as a mean of temporal localization of errors.

Table 1: Average SNR(dB) for Flower Garden

Leak factor	Without adaptive method	With adaptive method
0. 8 7 5 (n = 3)	Y : 26. 97 Cb: 32. 60 Cr: 30. 74	Y : 26. 65 Cb: 32. 40 Cr: 30. 55
0. 9 3 7 5 (n = 4)	Y : 27. 82 Cb: 33. 01 Cr: 31. 25	Y : 27. 54 Cb: 32. 87 Cr: 31. 09

Annex to document AVC-414

Adaptive DC quantization

The proposed adaptive DC quantization method is realized by an extension of quantization syntax and an adaptive use of weighting matrices, which are similar to core experiment Q.2 in TM3 document.

1. Extension of the quantization

Quantization for non-intra macroblocks described in section 7.2 in TM3 document and dequantization for non-intra-coded macroblocks in section 7.3.2 are extended as follows.

```
- Quantization
  if(wN(i,j) >= 16)
    same as in section 7.2
  else
    QAC(i,j)  = ac(i,j)/(2*wN(i,j))          IF wN(i,j) == odd
              = (ac(i,j)+1)/(2*wN(i,j))      IF wN(i,j) == even AND ac(i,j)<0
              = (ac(i,j)-1)/(2*wN(i,j))      IF wN(i,j) == even AND ac(i,j)>0

- Dequantization
  if(wN(i,j) >= 16)
    if(QAC(i,j)>0)
      rec(i,j) = (2*QAC(i,j)+1)*mquant*wN(i,j)/16
    if(QAC(i,j)<0)
      rec(i,j) = (2*QAC(i,j)-1)*mquant*wN(i,j)/16
  else
    if(QAC(i,j)>0)
      rec(i,j) = (2*QAC(i,j)+1)*wN(I,j)
    if(QAC(i,j)<0)
      rec(i,j) = (2*QAC(i,j)-1)*wN(i,j)

  if(rec(i,j) is an EVEN number && rec(i,j)>0)
          ...
          ...
          ...
```

2. Weighting matrix adaptation

Algorithms described in Q.2.1 and Q.2.2 can be used as the adaptive DC quantization. An example matrix described below may be used for non-intra and background MBs, and TM3 non-intra matrix may be used for the other non-intra MBs. The optimum weighting matrix for background MBs is further study.

An example of weighting matrix for the background MBs

4	17	18	19	20	21	22	23
17	18	19	20	21	22	23	24
18	19	20	21	22	23	24	25
19	20	21	22	23	24	26	27
20	21	22	23	25	26	27	28
21	22	23	24	26	27	28	30
22	23	24	26	27	28	30	31
23	24	25	27	28	30	31	33