INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.263
Appendix I
(03/97)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

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ITU-T Recommendation H.263 – Appendix I

(Previously CCITT Recommendation)

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FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Geneva, October 1996).

Appendix I to ITU-T Recommendation H.263 was prepared by ITU-T Study Group 16 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 27th of March 1997.

NOTE

In this Appendix, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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VIDEO CODING FOR LOW BIT RATE COMMUNICATION

Appendix I

error tracking

(Geneva, 1997)

I.1 Introduction

This Appendix describes a method to recover efficiently after transmission errors if erroneous MBs are reported via a feedback channel to the encoder. The capability of sending and processing feedback information is signalled via external means (for example, by Recommendation H.245). Furthermore, format and content of the feedback message are defined externally (for example, by Recommendation H.245).

I.2 Error tracking

Because INTRA coding stops temporal error propagation, it should be used for macroblocks which are severely affected by transmission errors. This requires that the location and extent of image artefacts can be made available to the encoder. The following algorithm provides an estimated error distribution based on feedback information received by the encoder. It considers spatial error propagation caused by motion-compensated prediction as well as the delay until the reception of the feedback message. The algorithm illustrates one possible approach to evaluate feedback messages for spatio-temporal error tracking. Other algorithms are possible.

Assume N macroblocks within each frame enumerated mb = 1...N from top-left to bottom-right. Let $\{n_{err}, mb_{first}, mb_{last}\}$ be the feedback message to the encoder, where $mb_{first} \leq mb \leq mb_{last}$ indicates a set of erroneous macroblocks in frame n_{err}.

To evaluate the feedback message, the encoder must continuously record information during the encoding of each frame. First, the initial error $E_0(mb, n)$ that would be introduced by the loss of macroblock mb in frame n needs to be stored. Assuming a simple error concealment where erroneous macroblocks are treated as not coded, $E_0(mb, n)$ is computed as the Summed Absolute Difference (SAD) of macroblock mb in frame n and n – 1. Second, the number of pixels transferred from macroblock mb_{source} in frame n – 1 to macroblock mb_{dest} in frame n is stored in dependencies $d(mb_{source}, mb_{dest}, n)$. These dependencies are derived from the motion vectors.

Assume that a feedback message arrives before frame n_{next} is encoded, such that $n_{next} > n_{err}$. Then, the estimated error $E(mb, n_{err})$ in macroblock mb and frame n_{err} is initialized as:

$$E(mb, n_{err}) = \begin{cases} E_0(mb, n_{err}) & \text{for } mb_{first} \leq mb \leq mb_{last} \\ 0 & \text{else} \end{cases}$$

For subsequent frames n, with $n_{err} < n < n_{next}$, the error may be estimated as:

$$E(mb, n) = \sum_{i=1}^{N} E(i, n-1) \frac{d(i, mb, n)}{256}$$

where a uniformly distributed error in each macroblock is assumed after each iteration.

The estimated error E(mb, $n_{next} - 1$) is incorporated into the mode decision of the next frame. For example, macroblock mb is coded in INTRA mode, if E(mb, $n_{next} - 1$) exceeds a threshold.

In practice, error tracking information will only be stored for the latest M frames. Then, if $n_{err} < n_{next} - M$, no error-tracking information is available and the encoder must take special action. For example, the next frame may be coded in INTRA mode. However, other procedures are possible and may be more effective.