

Multimedia Systems, Standards, and Networks

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Describes ITU H H.323 and H.324, H.263, ITU-T video, and MPEG-4 standards, systems, and coding; IP and ATM networks; multimedia search and retrieval; image retrieval in digital laboratories; and the status and direction of MPEG-7.

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where $\{(MVx[i], MVy[i]), i = 1, 2, 3\}$ are the MVs of the colocated macroblock and TRB is the difference in temporal reference of the B-VOP and the previous reference VOP. TRD is the difference in temporal reference of the temporally next reference VOP with the temporally previous reference VOP, assuming B-VOPs or skipped VOPs in between.

Generation of Prediction Blocks. Motion compensation for luminance is performed individually on 8×8 blocks to generate a macroblock. The process of generating a prediction block simply consists of using computed forward and backward motion vectors $\{(MVFx[i], MVFy[i]), (MVBx[i], MVBx[i]), i = 0, 1, 2, 3\}$ to obtain appropriate blocks from reference VOPs and averaging these blocks, in the same way as in the case of bidirectional mode except that motion compensation is performed on 8×8 blocks.

b. *Motion Compensation in Skipped Macroblocks.* If the colocated macroblock in the most recently decoded I-or P-VOP is skipped, the current B-macroblock is treated as the forward mode with the zero motion vector $(MVFx, MVFy)$. If the modb equals 1, the current B-macroblock is reconstructed by using the direct mode with zero delta vector.

G. Results of Comparison

For the purposes of performance evaluation and comparisons with other standards, the subset of MPEG-4 tools listed in Table 10 is selected. The selected subset contains all (14) tools up to and including binary shape coding, as well as the tool for temporal scalability of rectangular VOPs. Further, the tools for B-VOP coding, frame/field DCT, frame/field motion, binary shape coding, and temporal scalability of rectangular VOPs are used in some experiments, whereas the remaining tools are used in all experiments.

In principle, to evaluate the statistical performance of a standard, a fixed set of test conditions and an existing standard are needed as a reference. Thus, it would appear that the comparison of statistics of the standard to be evaluated against an existing standard is sufficient. However, a major difficulty in such a comparison is that while the various standards standardize bitstream description and the decoding process, it is the differences in encoding conditions (such as motion range and search technique, quantization matrices, coding mode decisions, I/P/B structure, intra frequency, and rate control) that end up influencing the statistics. A similar choice of encoding conditions (whenever possible) for the standard being evaluated and the reference standard may be able to reduce any unnecessary bias in the statistics.

Because of the wide range of coding bit rates, resolution and formats, and other functionalities offered by MPEG-4 video, instead of evaluating its performance with respect to a single standard as reference, we perform comparisons against three video standards—H.263, MPEG-1, and MPEG-2—selecting a standard most appropriate for the conditions being tested. The purpose of the comparison is mainly to show that a single standard such as MPEG-4 video does offer the functionality and flexibility to address a number of different applications covered by the combined range of the reference standards (and beyond) while performing comparably to each of them. However, caution is needed in drawing conclusions about the superiority of one standard over another because of our limited set of comparisons and difficulty in normalizing encoding conditions.

1. Statistical Comparison with H.263

Table 2(a) presents the results of a comparison of video coding based on H.263 (TMN5) with that based on MPEG-4 video (VM8). Coding is performed using QCIF spatial resolu-