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TITLE: A STUDY OF THE USE OF MULTIPLE VLCS AND SINGLE VLCS IN THE OKUBO REFERENCE MODEL 2.

SOURCE: UK, SWEDEN, NETHERLANDS, GERMANY.

Introduction

This report represents a synopsis of the work done by the above sources. Potentially several areas exist where an independent VLC could be used. These are : quantiser coefficients, block and coefficient addressing, motion vectors, picture, GOB or block attributes. As the bitrate associated with picure or GOB attributes is relatively small no special attention is given to these attributes. The majority of the bitrate is accounted for by the coefficients, motion vectors and block attributes, therefore maximum attention is devoted to these aspects. No work has yet been reported on the use of VLCs for the motion vectors.

The report examines the use of multiple VLCs for coding the quantised transform coefficients, the use of a single VLC for multiple applications and the use of a 2 dimensional run length table for simultaneously addressing and coding the quantised transform coefficients.

Quantiser Coefficients

Sweden [1], and Netherlands [2] have indicated that the use of multiple VLCs for the quantiser coefficients yields a very small gain. The gain was typically 170 bits per frame.

Addressing of Quantiser Coefficients

Germany [3] has indicated that a 11% to 20% gain in coding efficiency can be obtained by using a 2 dimensional run length table for coding non-fixed blocks. The comparison is made aginst an optimal amplitude and run length coding for coefficients. This represents an average saving of 2 - 3 bits per non-fixed block. The run length table used optimal Huffman codes, which were not self synchronising codes , thus this saving may be reduced slightly by the use of such codes. It has been shown that the Huffman codes used are very robust with respect to source data being coded. Typically less than a 1% loss in coding efficiency was found when coding picture material the codes were not generated for.

The hardware of this scheme is likely to be more complex than using a single VLC for the Quantiser. The suitabilty of the VLC structure for other applications has not yet been assessed.

Relative Block Addressing

UK has shown [4] that the VLC table suggested in document #122 [5] for quantised transform coefficients can be efficiently used in a relative block addressing scheme. The scheme suggested used run lengths of fixed blocks and can be implemented with little additional hardware complexity with a gain of 700 to 1000 bits per frame. The gain is estimated by comparing it with the address information required for an absolute addressing scheme. The coding performance has been found to be close to values obtained by entropy calculations.

Shifting the EOB Marker

Sweden [6] has suggested that by placing the EOB code before the last non-zero coefficient a special VLC can be used to code the last coefficient. This leads to a gain of 1 - 2 bits per block. It is possible to achieve this gain by using the same VLC of the other coefficients but modifying the interpretation of some of the codes. The EOB and zero codes are redundant in the codebook and can be allocated to coefficient values. This allows the effective use of a second VLC without the extra synchronising problems associated with different VLCs under error conditions.

Conclusion

It has been shown that little coding efficiency is to be gained by the use of multiple VLCs for coding the quantised transform coefficients. Further it has been shown that a single VLC can be used successfully for the quantiser coefficients, a relative block addressing scheme, and the 'End of Block' modification. The use of a 2 dimensional run length table has been shown to yield a significant gain in the coding of quantiser coefficients, however at the time of writing this work required further investigation for a full assessment.

Proposal

It has been shown that the Okubo Reference Model 2 operates efficiently with a single VLC, therefore on this basis a single VLC is recommended for hardware purposes. Further the use of a single VLC has the advantage of minimising re-synchronisation problems after transmission errors.

References

[1].....Private communication

[2].....Private communication.

[3].....Coding of the Coefficients with a two dimensional table. Germany (PKI). Nov 86 CCITT SGVX/1 Okubo Group.

[4].....A report on the merits of using relative addressing for blocks within a group of blocks structure. Doc # 146 CCITT SGXV/1. Nurnberg Nov 86.

[5].....VLC set proposal for n*384kbits/s. Document #122 CCITT SGXV June 86.

[6].....A Trick fot the Last Non-zero. Sweden. Doc # CCITT SGXV/1 Okubo Group Nurnberg Nov 86.