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A Proposed Adaptive Error Concealment Algorithm for Block Loss in Multiple View Video Coding

By

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ABSTRACT

Efficient compression of multi-view images and videos is an open and interesting research issue that has been attracting the attention of both academic and industrial world during the last years. The considerable amount of information produced by multi-camera acquisition systems requires effective coding algorithms in order to reduce the amount of transmitted data while guaranteeing a good visual quality in the reconstructed sequence. There are many applications for the multi view imaging like Three Dimensions Television (3DTV) and free viewpoint video (FVV) systems. 3DTV and FVV used in number of new applications in entertainment, medicine, remote manipulation, gaming and art.

The classical approach of multi-view coding is an extension of the H.264/AVC video coding standard, based on motion estimation and compensation and on disparity estimation and compensation along temporal and view dimensions respectively. The MVC adopts the hierarchical B prediction structure that exploits the inter-view correlations as well as spatio-temporal correlations in multi-view video sequences to achieve a high coding gain. The prediction structure, however, makes compressed bitstreams very sensitive to transmission errors. If an error occurs in a frame, it propagates to adjacent views and subsequent frames, degrading the reconstructed video quality severely.

The standard of MVC only considers the proper definition of the syntaxes and definitions of the bit-stream and it does not give any solution for erroneous bit-streams.

Most of previous algorithms did not take into account neither the size of the lost Macro Block (MB) nor the selection of candidate MBs according to current used view in concealment operation. The present thesis considers those points.

In this thesis, we propose efficient Error Concealment (EC) algorithms for multi-view sequences corrupted by an error mask. The locations of lost MBs assumed to be known , three EC algorithms exploiting the property of the hierarchical B prediction structure to conceal block losses are proposed. The proposed algorithms are inserted in MVC standard software JMVC version 8.0. Simple error detection algorithm is proposed to determine the locations of corrupted MBs, which are generated with MBs loss due to intra prediction. The type of MBs may be inter or intra. The size of MB may be 16x16, 16x8, 8x16 or 8x8.

For intra lost MBs, Spatial Inter View (SIV) algorithm is proposed for concealment in the three developed algorithms.

The first proposed algorithm conceals the lost and corrupted MBs according to lost MB's types and sizes using a proposed Outer Boundary Match Algorithm (OBMA) with variable size. So it adaptively changes its behaviour according to the size of lost inter MBs. Then two enhancement algorithms are applied to enhance the initially concealed MBs depending on the MB's size. Weighted Block Motion and Disparity Concealment (WBMDC) algorithm is proposed for 16x16 MB enhancement and Overlapped Block Motion Compensation (OBMC) algorithm is proposed for other MBs sizes.

The second proposed algorithm adaptively changes its behaviour according to the size of lost inter MBs during concealing the lost inter MBs and it adaptively generates the required candidates MBs according to the current used view in error concealment operation to get more similar MBs.

The third proposed algorithm mixes the first algorithm and the second algorithm to get higher objective and subjective results. The third algorithm adaptively changes its behaviour according to the size of the lost MBs to conceal them, then it adaptively generates the required candidates MBs according to the current view to initially conceal the lost MBs. The initial concealed MBs are enhanced using the proposed enhancement algorithms in the first algorithm. The WBMDC algorithm is proposed for 16x16 MB enhancement and OBMC algorithm is proposed for other MBs sizes enhancement.

Experimental results show that the visual quality of decoded frames by decoder software with proposed EC algorithms is improved and the PSNR values are clearly increased comparing to applying normal decoder software.

Keywords- Video coding; H.264/AVC; Multi view video coding; Error concealment algorithms; Spatial and temporal error concealment algorithms.

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of PhD of Science in Electrical Engineering (Electronics and Communication Engineering).
The work included in this thesis was carried out by the author at the Electronics and Communication Engineering Department, Faculty of Engineering, Ain Shams University, Cairo, Egypt.
No part of this thesis was submitted for a degree or a qualification at any other university or institution.

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TABLE OF CONTENTS

LIST OF ARTICLES/PUBLICATIONS FROM THIS THESIS

1. M. Ebian, M. El-Sharkawy , S. El-Ramly ," Dynamic Error Concealment Algorithm for Multiview Coding Using Lost MBs Sizes and Adaptively Selected Candidates MBs," *in IOSR Journal of Computer Engineering (IOSRJCE), ISBN: 2278-8727 Volume 5, Issue 3 (Sep-Oct. 2012), PP 40-44,India.*

2. M. Ebian, M. El-Sharkawy , S. El-Ramly," Enhanced Dynamic Error Concealment Algorithm for Multiview Coding Based on Lost MBs Sizes and Adaptively Selected Candidates MBs,", in Proceedings of the Fourth International Conference on Signal and Image Processing 2012 (ICSIP 2012), Springer 2013,PP 435-443, India.

3. M. Ebian, M. El-Sharkawy , S. El-Ramly," Adaptive Error Concealment Algorithm for Multiview Coding based on lost MBs sizes and using dynamic selection of lower candidates MBs ," in IEEE 2012 8th International Computer Engineering Conference (ICENCO), December 2012,PP 26-29,Cairo,Egypt.

LIST OF FIGURES