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Coding of video Sequences using Three Step Search Algorithm

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Abstract

The rapid development in the technology has dramatic impact on the medical health care field. Medical data base obtained with latest machines like CT Machine, MRI scanner requires large amount of memory storage and also it requires large bandwidth for transmission of data in telemedicine applications. Thus there is need for video compression. As the database of medical images contain number of frames (slices), hence while coding of these images there is need of motion estimation. Motion estimation finds out movement of objects in an image sequence and gets motion vectors which represents estimated motion of object in the frame. In order to reduce temporal redundancy between successive frames of video sequence, motion compensation is performed.

In this paper three step search (TSS) block matching algorithm is implemented on different types of video sequences. It is shown that three step search algorithm produces better quality performance and less computational time compared with exhaustive full search algorithm.

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1. Introduction

Due to rapid developing technology in medical health care field, ultra modern machines are available which include CT scanner, Magnetic resonance imaging (MRI), echo cardiographs, etc.[9]. With these machines doctors can diagnose and analyses patient's health. Medical data sets containing video obtained by above techniques need large amount of memory space and it requires large bandwidth for sending the data from one place to another for tele monitoring applications. Thus there is necessity for video compression technique which will reduce the amount of data for representation of a video [1].

In some applications of video compression only compression ratio is important and quality can be comprised, but in medical applications it requires both high quality and good compression ratio hence it is challenging task [3]. For diagnose purpose, compression ratio should not cause loss of details, no artifacts should be introduced. There is also limit for storage and transmission band width. Thus there is much scope for progress in this area [6].

The paper is organized as follows. In Section II, we present review of previous research on compression of video sequences. Section-III describes motion compensated coding, Block matching technique is explained in section-IV. Three step search technique for motion estimation is elaborated in section-V. Implementation results are given in section-VI. Finally conclusion is presented in section-VII.

2. Literature Survey

In medical field, Tsai *et al.* [2] developed a compression scheme for angiogram video sequence in 1994. It was based on a full frame discrete wavelet transform. The local characteristics of frame are exploited to develop compensated frame and it achieved high compression ratio. Gibson *et al.* [4] proposed that by adaptively searching prediction error and modifying it accordingly, it is possible to eliminate artifacts from final image, thus they proposed a lossy wavelet based approach for compression of digital angiogram videos. Analysis of angiogram videos, by higher frequency sub band wavelet decomposition reveals that significant sized regions contain no diagnostic information [12].

Thus for diagnostically unimportant regions, texture modelling approach is used to encode high frequency sub band wavelet coefficients and diagnostically important regions are coded in normal manner. This concept is applicable in hybrid coding where loss less compression is performed for region of interest (ROI) and lossy compression in the regions where high compression and reasonable good quality is required. ROI coding is performed to segment diagnostic important region and it achieves good balance between video quality and compression ratio.

Up till now, numbers of efforts have been made to establish common video compression standard for medical applications. The common standard is DICOM (Digital imaging and communication in medicine) which is used for distribution and viewing of medical images [10]. For echo-cardiographs and CT image sequences this standard is used which allows loss less and lossy compression. Enhanced CT image model has been coded into new version of DICOM to improve transfer mechanism of CT frames. The popular lossy compression methods in DICOM are JPEG 2000 and MPEG-2[13].

3. Motion Compensated Coding

Successive video frames may contain the same objects which are either still or moving. . Motion estimation examines the movement of objects in an image sequence and gets vectors representing estimated motion . Data compression is achieved through motion compensation which makes the use of object motion. In the consecutive frames, there is high correlation, hence motion estimation and motion compensation is good technique for inter frame coding [5].In real video scenes there is complex combination of translation and rotational motion. Such motion is difficult to estimate and large amount of processing is required for it. Translation motion can be implemented successfully because it can be estimated easily [8].

There is fact that for the number of frames of movie, the only difference between successive frames is the result of either moving camera or an object in the frame is moving. Motion compensation exploits this fact [11]. Thus information represented in one frame will be the same as information used in next frame. Fig.1 shows the block diagram of motion compensated coding.

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