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INTELLECTUAL HOMOGRAPHY BASED GLOBAL MOTION ESTIMATION FOR BLOCKS IN VIDEO CODING

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Abstract- Block matching techniques for estimation of motionis very commonly utilized for current video coding standards as it is simple and has reasonable performance.There always lies a homography among the consecutive frames in the sequences of video that is taken using the PTZ cameras because of the restricted movements. This symmetrical relationship of the frame is very useful to decrease the spatial redundancy. The estimation of motion is playing a very significant part in science nowadays. Many algorithms are been proposed to observe movement of the objects present in the space. In this project, a homographybased local maximum search algorithm is proposed for the accurate guidance of the small bodies present in the space. This method will helps for the accurate movement detection.The proposed method is proven to be more for the sequences when compared with the traditional fast algorithms. The simulation is carried out using MATLAB software.

Keywords: Motion Estimation, Homography, Motion Compensation, Gaussian Filter, Image Reconstruction

1. Introduction

From the past few years, the video coding plays a very good role in the advancement of the multimedia technology. These multimedia applications involves VCD,DVD, internet streaming to video conferencing, these applications indicates the usage of this video coding. There are many types of video coding techniques such asH.264 and MPEG-4 AVC that is introduced by the Joint Video Team that has been formed with ITU-T coding expert Group and alsoISO/IEC MPEG. These standards can be very widely used to perform the existing video coding standards. These features can be used to increase the efficiency in compression but it causes huge amount of computation and complexity requirements for the hardware. The main two components for the interface coding in a video compression are the motion estimation and motion compensation.

Our project deals with motion estimation. The method of motion estimation is used to estimate the motion vector that will represents displacement or movement of an object. The most commonly used straight forward method is full search that is able to find the global optimal motion vectors but is very time consuming. So inorder to speed up the motion estimation of the blocks, many new fast blocks matching algorithm is introduced.There are many ways in order to increase the speed of estimation of motion. The major way for improving the search pattern on the basis of the characteristics of motion vector distribution like three step search algorithm(TSS)[9], new three step search algorithm(NTSS)[3] etc.The second method is to reduce the spatial and the temporal correlation between the blocks and will help to obtain better starting points that consists of block matching methods and their corresponding points which helps for increasingthe block matching accuracy. The third option is done by using the initial termination that makes a tradeoff among the complexity and its performance.

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The motion estimation commonly has a wide range of application like in psychological studies, markerless analysisof the human motion, in gesture analysis, hand posture analysis, in biology, in heart surgery, user analysis using lip reading, in cinematography using inertial optical techniques, in breathing analysis, in medical science and space science etc. In space science, to estimate the motion of different space objects to different position, the motion estimation algorithm is utilized. The videos of the unnatural movements are captured using the pan tilt cameras.In this paper, homography based local maximum searchalgorithm for block motion estimation is proposed for space science. This algorithm helps to reduce the computational time and results in a efficient output. There are many different innovative applications for the applying of the different motion estimation algorithms. These geometric constraints are well considered and areused efficiently in this method.One of the major challenging related to the motion estimation is the method for checking the resulting deformation fields [2].

2. Related works

Block matching techniques used for estimation of motion is very widely used in video coding standard like H.26x and MPEG-x because it is very simple and it has high performance. The block matching is a very vital part of the compression of videos as it is a very important factor that can be used for the estimation of the motion of an object in a video. Many algorithms are used to find the homography between two frames within a sequence of video that is taken with the help of the pan tilt zoom cameras during their unnatural motion and this geometric connection can beused to reduce the spatial redundancy of the captured videos [1].Generally there are different algorithms like three step search[9], new three step search[3], four step search[4], homography based search[10], block based gradient descent search[5], diamond search algorithm[6], hexagon based search[7], adaptive rood pattern search [8]for the estimation of movement in blocks. The main disadvantages of these methods are increase in complexity in size of block, reduced performance due to null threshold, high computational requirement, less adaptability, large number of search points and estimation is quite intensive.

The concept of motion estimation is undergoing a very significant usage in all the areas nowadays which is not been discussed for long years. This new found application of the motion estimation had made a detailed study and motivation to introduce new, reliable and efficient algorithms than the existing algorithms. This technique is moving deeper in to the opportunities that is very much new to us. The motion estimation has many applications like traffic movement tracking, study plant rootgrowth, hand posture analysis, gesture controlled gaming [2]. The homography based motion search algorithm is the extension of algorithm that uses a special mechanical device that can be used for obtaining angle to compute the homography. The estimation of the homography between twoframes will help to get more relevant information about the image. This existing work is done using optical flow tracking algorithm. Many methods like full search, new three step search ,three step search, hexagon based search, diamond search and block based gradient descent search for estimating the movement that has been occurred in a video.

The main advantage of the block motion estimation is it helps to track the movement of the object in a video sequences. By using this information, we can estimate the relationship between two frames in the video. Here homography basedlocal maximumsearch algorithm is proposed for block motion estimation for videos that is taken using the pan tilt zoom cameras. In addition, a comparison of the existing algorithm is done with the homography based local maximum search algorithm and proven that the newly proposed algorithm is more efficient.There are many works done based on motion estimation relating to security systems, medical science, space exploration. The main purpose for this estimation of movement in a video sequence is to reduce the complexity in the computation. Different methods are been selected on the basis of the requirements of the application as like computational power available, time needed for the computation and also the required accuracy[2].

There are many existing methods that has been used to decrease the complexity in the computation for

vary amount in accordance with the chosen algorithms like fast full search block matching algorithms[16], three step search[9], new three step search[3], block based gradient descent search[5] , simple and efficient search[15], four step search[4], diamond search[6] and hexagonal based search[7]. This different algorithms for motion estimation will helps to reduce the computational complexity, need for different requirements and also the response type of the system that is been used for estimation. There are different techniques that are used for the estimation in different fields. This application of algorithms varies according to the requirements.Visual speech recognition method is been used for motion estimation analysis of the movement of lips[2]. Continuous wavelet transform is used to estimate the accurate and efficient movement of the lander in the space[2]. There are many algorithms that has been introduced in order to detect motion that are taking place in different area that may include many fields like medicine and security. The various algorithms are applied on the basis of different requirements such as accuracy, time needed for the output [15].

3. Proposed Work

A. *Introduction*

Motion estimation is mainly used to find the motion of object in 2 frames. This homography is very commonly used in most of the visual applications and most of the current video techniques are based on this block motion estimation. These video sequences are captured using PTZ cameras that sometimes cause zipper effect too. Using this algorithm, the zipper effect is also been removed. Block motion estimation based on homography has both advantages and disadvantages when it is compared with the traditional block matching algorithms. By combining this existing block matching algorithm with the block motion estimation on the basis of the homography makes a direct method to keep a good efficiency in coding. This method of motion estimation algorithms helps to get easy result[16].

For this, it has to consider two issues.The first one is to classify the blocks as most of the blocks in the background. The motion estimation is becoming a very wide criterion in many applications that is able to solve many real time problems related to medical science, space exploration etc[2]. This proposed method helps to reduce the complexity in computational and helps to get accurate output very easily by reducing the number of input files comparing to the actual video sequence given as the number of inputs are reduced[12][13].

B. Block Diagram

The block diagram for the proposed system is given in figure 3.1. Videos are generally called as the collection of moving images. For easy estimation of these videos are divided in to frames. The adjacent frames mostly have the same homographyrelation. Images are given as input files. There are many processes taking place in this algorithm. The first step is the preprocessing. This method has 3 steps such as colorconversion, filteration and segmentation.

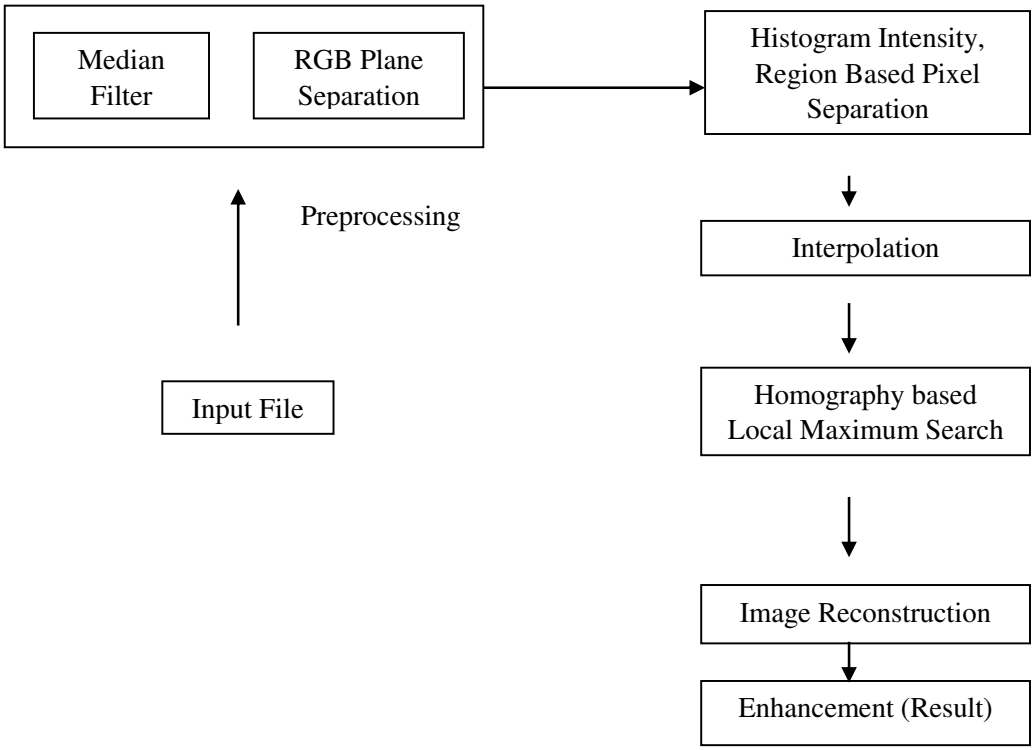


Fig.1: Block diagram of proposed system

Colour image is not able to process in MATLAB. So the colour image is converted in to RGB (RGB separation) and then it is converted to greyscale images that are able to process using MATLAB.

Filteration: Normally an image is consisting of large amount of information. So inorder to extract the useful information from the images, filteration is done. There are mainly two types of filter very commonly used, Gaussian filter and median filter. In this case, median filter is used because in this we can set both threshold and offset. The process of filteration helps us to remove the unwanted data from the frames and to extract the required information from the given frames of the video sequences. This will helps us to reduce the amount of data used for the processing.

Segmentation: segmentation is a step that is used to divide a image or data in to subparts. In this step, the images are segmented to 256 pixels.Considering any two frames, estimating the amplitude with the help of this pixel values, we can find if there is any movement in the objects present in the images.In RGB plane separation, the red, blue and green planes are separatedindividually. In the next step the intensity is calculated for each pixel and contrast values for the histogram are identified. In this step similar data are identified and the region with high threshold value is been omitted. This step will help to collect the similar data together .This is a very much time consuming technique and then it is compared with the original data.Interpolation is used to add the dummy samples (like nearest pixel data) with the residual data of the frame after the peak threshold value is been removed.Homography based local maximum search is used to find the local maximum in the first video frame and following the next frame. With the help of this values, the homography between the two framers are calculated and thus for the video sequence. This algorithm can be used for similar data identification, motion tracking, etc. Image reconstruction is the step in which the frames in which the motion is high are combined after grouping the images.

C. Results and Discussions

The input frames and the output areshown in figure 3.2, 3.3, 3.4 and 3.5 given below.

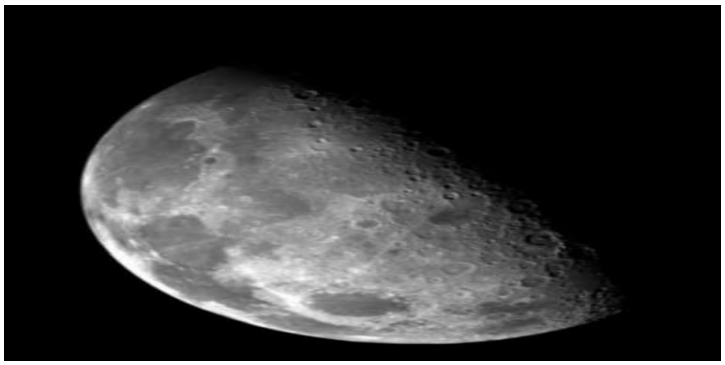


Fig.2: Actual Image

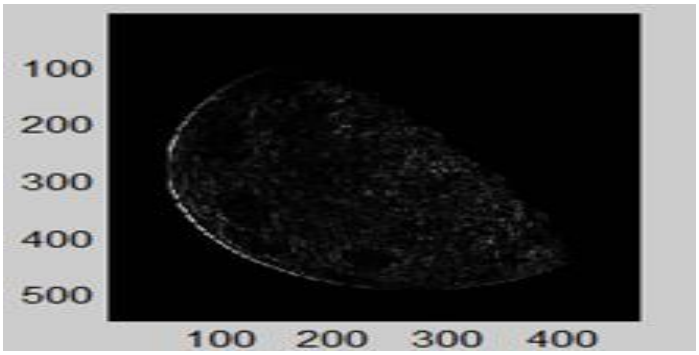


Fig.3: Residual Vertical Image

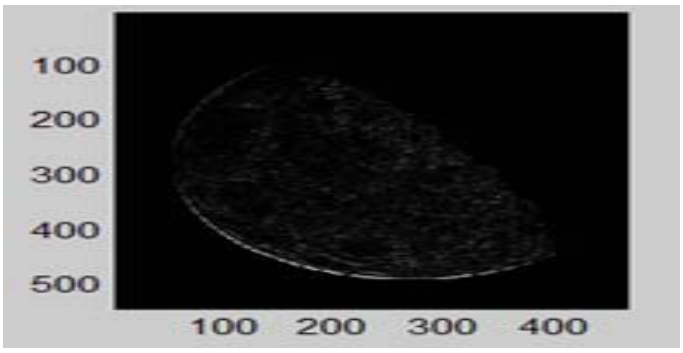


Fig. 4: Residual Horizontal Image

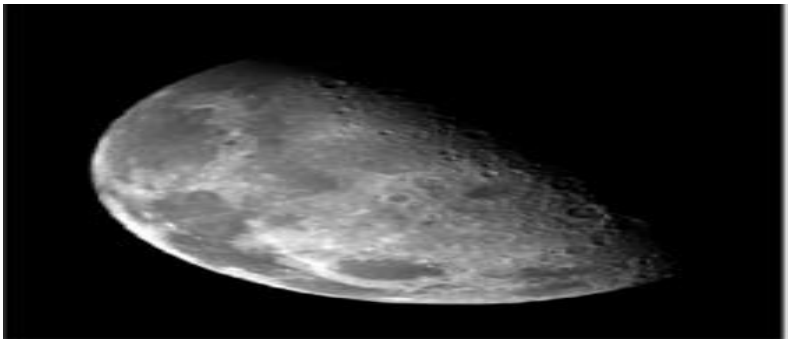


Fig.5: Reconstructed Image

This algorithm helps to estimate the apparent motion of the objects present in the space. For this algorithm, the actual residue and the reduced residue is been calculated for individual frames. The actual residue is the original frame which consists of all the pixel values. The reduced residue is the output that has been obtained as the optimization is done. Based on the neighboring pixels, they are grouped in to subpixels. So with the help of the value reference, the number of inputs is reduced. This method will helps to get an easy output and also reduces the computational complexity and detects the accurate movement.

4. Conclusion and Future Scope

By concluding the above discussion, it is very clear that motion estimation is becoming a widespread tool to create many accurate and innovative applications. Motion estimation is very important in proving security through monitoring suspicious activities taking place in space. Using the algorithms like homography based local maximum search, it helps to replace and help human operators to monitor the interesting activities occurring in the space[14]. There are many applications for the motion estimation involving medical field, security systems and robotics. So it concludes that the estimation of motion is a very good tool for works from different fields to generate newer and efficient applications that helps to solve many real life problems relating to medical field and security systems.

5. References

[1]. XiaomingGuo, Guang Jiang, Zhaopeng Cui and Pie Tao 2016 Homography based block motion estimationfor video coding of PTZ cameras J.Vis.Commun. and Image R 164-71.

[2]. Vijay Kumar P, Aman Kumar and SidharthBhatia 2011 latest trends, application and innovation in motion estimation research J. Scientific &Engg Research**2**.

[3]. Li R, Zeng B and Liou M L 1994 A new three step search algorithm for block motion estimation IEEE Trans. Circuits Syst. Video Technol.**4** 438-42.

[4]. Po L M and Ma W C 1996Anovel four step search algorithm for fast block motion estimationIEEE Trans. Circuits Syst. VideoTechnol.**6**313-17.

[5]. LuiL K and Feig E 1996A block based gradient descent search algorithm for block motion estimation in video coding IEEE Trans. Circuits Syst. Video Technol. **6** 419-22.

[6]. ZhuS and MaK K 2000 A newdiamond search algorithm for fast block matching motion estimationIEEE Trans. Circuits Syst. Video Technol.**9** 287-90.

[7]. Zhu C, Lin X and Chau L P 2002 Hexagon based search pattern for fast block motion estimation IEEETrans.Circuits Syst. Video Technol.**12** 349-55.

[8]. Nie YandMaKK2002 Adaptive rood pattern search for fast block matching motion estimation IEEE Trans, Image Process.**11** 1442-49.
[9]. Koga T, Linuma K, Hirano A, Lijima Y and Ishiguro T 1981 motion compensation interframe coding for video conferencingOroc. Nat. Telecommun.Conf.G.5.3.1-G.5.3.5.
[10]. Cui Z, Jiang G, Wang Dand Wu C 2011 A novel homography based search algorithm for block motion estimation in video coding IEEE International Conference Multimedia and Expo16.
[11]. Aroh Barjatya2004 Block matching algorithms for motion estimations DIP 6620 Spring.
[12]. LIU Zhang Wen-Jun and Cai Jun 2006 A fast block matching algorithm based on variable shape search Liu / j Zhejiang un iv Science A**7** 194-98.
[13]. Murray R.M, Li Z and Sastry SS1994 A mathematical introduction to robotic manipulation CRC Press.
[14]. YongHeng Shang, Phil Palmerm 2010 The Dynamic motion estimation of a lunar lander using optical navigation 21st Int. symposium on spaceflight Dynamics.
[15]. Jianhua Lu and Ming L Liou1997A simple and efficient search algorithm for block matching motion estimationIEEE Trans. Circuits syst. Video Technol.**7** 429-33.
[16]. Sharon Elsa Mathew and Kokila S 2018 A study on algorithm for block motion estimation in video coding Indo Iranian J. Scientific Research **2**
[17]. Mv Ngo Tien HoA,High Speed And Reliable Double Edge Triggered D- Flip-Flop For Memory Applications",Journal of VLSI Circuits And Systems, 1 (01), 13-17,2019
[18]. MN BORHAN,"Design Of The High Speed And Reliable Source Coupled Logic Multiplexer",Journal of VLSI Circuits And Systems 1 (01), 18-22,2019