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COMPARATIVE STUDY ON MATCHING CRITERION AND MOTION ESTIMATION OF ARRIVAL WAVES

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ABSTRACT

The matching criterion or the distortion function is used to quantify the similarity between the target block and candidate blocks. If due to the large search area, many candidate blocks are considered, the matching criteria will be evaluated many times. Hence choice of the matching criteria has an impact on the success of the compression. If the matching criterion is slow, then the block matching will be slow. If the matching criterion results in bad matches then the quality of the compression will be adversely affected. Fortunately a number of matching criteria are suitable for use in wave compression.The paperdescribs the relation between matching criterion and block matching between arrival data.

Keywords: Block data; Matchingcriterion; Wave compression;

INTRODUCTION

Data processing consists of a wide variety of techniques and mathematical tools to process an input data. An data is processed as soon as we start extracting data from it. The data of interest in object recognition systems are those related to the object under investigation. An data usually goes through some enhancement steps, in order to improve the extractability of interesting data and subside other data. Extensive research has been carried out in the area of data processing over the last 30 years. Data processing has a wide area of applications . [1,2] Some of the important areas of application are business, medicine, military, and automation.Data processing has been defined as a wide variety of techniques that includes coding, filtering, enhancement, restoration registration, and analysis. In many applications, such as the recognition of three-dimensional objects, data processing and pattern recognition are not separate disciplines. Pattern recognition has been defined as a process of extracting features and classifying objects. [4,5] In every three-dimensional (3-D) object recognition system there are units for data processing and there are others for pattern recognition.There are two different approaches to wave arriving (1) Analog processing- This approach is very fast since the time involved in analog-to-digital (AD) and a digital-to-analog (DA) conversion is saved. But this approach is not flexible since the manipulation of data's is very hard (2) Digital processing- This approach is slower than the analog approach but is very flexible, since manipulation is done very easily. The processing time of this approach is tremendously improved by the advent of parallel processing techniques.

DIGITAL DATA ARRIVING

Data processing is defined as the processing of two dimensional datas by a digital computer. A digital data is represented by an array of regularly spaced and very small quantized samples of the data. Two processes that are related to any digital system are sampling and quantization. When a picture is digitized, it is represented by regularly spaced samples of this picture .[3,6] These quantized samples are called pixels. The array of pixels that are processed in practice can be quite large. To represent an ordinary black and white television (TV) data digitally, an array of 512 × 512 pixels is required. Each pixel is represented by an 8 bit number to allow 256 gray levels. Hence a single TV picture needs about 2×10^6 bits. Digital data processing encompasses a wide variety of techniques and mathematical tools. They have been developed for use in one or the other of two basic activities that constitute digital data processing: data preprocessing and data analysis. An approach called the state-space approach has been recently used in modeling data processors.[7] These data processors are made of linear iterative circuits. The state-space model is used efficiently in data processing and data analysis. If the model of an data processor is known, the realization of a controllable and observable data processor is then very simple.The matching criterion mostly used in the literature is minimum mean absolute error, which at point (i, j) for an N x N block and search window of size ±p, is defined as

$$MAE(i,j) = \frac{1}{N^2}\sum_{x,y}|c(x,y) - r(x+i, y+j)| \quad \text{...... 1}$$

Where, −p<= i , j<= +p and c(x,y) and r(x,y) are pixel values at position (x,y) in the current and reference frame respectively.

Motion vector is defined as the value of (i, j) for which MAE(i, j) is minimum. Obviously, the residue error between the predicted and actual block in the current frame should be minimum for good matching.

Algorithm: Arrival pixel 2x2 pixel matching criterion

In MAE based criterion, the average error value is considered while ignoring the individual error term.S. Wang and H. Chen proposed vector matching criteria for block matching to overcome this drawback. In this approach, each N x N block is represented by a vector. Further, each block is subdivided into smaller blocks of size like 2x2, which is represented by a component of the corresponding vector and MAE is calculated between each temporally adjacent sub block in the current and reference frame. A threshold value is chosen by exhaustive search and vector components (out of N2 / 4, assuming the sub block size as 2x2 having value smaller than the threshold value are counted for a given block. Finally, the block having maximum number of such vector components within the defined search area is declared to be the best matching block.

Algorithm: Arrival pixel 8x8 pixel matching criterion

In wave data compression, the residue frame which is calculated by taking the difference of the current and the predicted frame is coded using transform coding technique, called Discrete Cosine Transform (DCT). According to the characteristics of this transform, the number of bits required to code a smooth residue frame will be smaller than the non smooth residue frame. Therefore, X. Jing, C. Zhu and L. Chau[8] proposed a smooth constrained based MAE as block matching criteria for motion compensation to reduce the required number of bits for coding besides minimizing the total distortion. In this method, not only the MAE over the residue block is taken into consideration but also the maximum and minimum residue value error, denoted as MME, is taken care of as well. Since DCT is applied over 8x8 block, each residue block (16x16) is divided into four equal size sub blocks (8x8) and MME is calculated for each sub block

$$MME_i = r^i_{max} - r^i_{min} \quad \text{.......................... 2}$$

$$SC - MAE = MAE + \alpha \sum_{i=1}^{4} MME_i \quad \text{.......... 3}$$

Where alpha is a weighing factor. The block which has minimum SC-MAE value in the search area, is declared as the best matched block.

Algorithm: Arrival pixels matching criterion in Matrix form

Though VMC and SC-MAE based methods have partially reduced the drawbacks of MAE criterion, but they are not suitable for input wave dataespecially with rotation and zoom effect. Further, the similarity measurement of blocks in VMC is dependent on the input threshold value. In this section, a new criterion for block matching is being proposed which not only removes all the shortfalls of MAE but also gives better results than VMC and SC-MAE based techniques.

Let R and C are two frames of equal size (N x N) in the reference frame and current frame respectively. Further, let R = $[R_1, R_2 \ldots R_{N2}]$ and C=$[C_1, C_2 \ldots C_{N2}]$ be the pixel values in these blocks. Since the data block may have different range of pixel values along each dimension, the pixel values are redefined on the basis of the higher range of intensities in the frame. If the minimum and maximum intensity values in reference block R are R_{min} and R_{max}, and same for the current block are C_{min} and C_{max}, then the new intensity values of the reference block Rnew and Curent block Cnew are defined as given below:

If $(C_{max} - C_{min}) \leq (R_{max} - R_{min})$

then,

$$R_{new} = (R_{old} - R_{min}) \qquad (4)$$

And

$$C_{new} = (C_{old} - C_{min})\, round\{\frac{(R_{max} - R_{min})}{(C_{max} - C_{min})}\} \qquad (5)$$

Otherwise,

$$C_{new} = (C_{old} - C_{min}) \qquad (6)$$

And $$R_{new} = (R_{old} - R_{min})\, round\{\frac{(C_{max} - C_{min})}{(R_{max} - R_{min})}\} \qquad (7)$$

This gives new rescaled intensity values for all the pixels. The matching function M(R, C) between block R and block C, is defined as

$$M(R, C) = \frac{1}{N^2} \sum_{k=1}^{N^2} f(|(R_{new}) - (C_{new})|, \tau) \qquad (8)$$

Wheref(d, $\boldsymbol{\tau}$) is,

$$f(d, \boldsymbol{\tau}) = \begin{cases} d & if\ d \leq \boldsymbol{\tau} \\ max(R_{max}, C_{max}) & else \end{cases} \qquad (9)$$

The function $f(|(R_{new}) - (C_{new})|, \tau)$ measures the degree of matching between (R_{new}) and Cnew and the positive threshold parameter $\tau = max((C_{max} - C_{min}), (R_{max} - R_{min}))$, determines the selection of pixels for matching purposes, i.e. for a value of $|(Rnew) - (Cnew)| \leq \tau$ Finally, the location of any such block R in the reference frame in a given search window for which the value of M(R, C) is minimum, gives motion vector.

RESULTS

In finding the results for the different block matching criteria using three step search method for the block based search, three sample waves have been used in this paper for comparison . The Results from all the predefined three criteria along with the proposed one are given in graphical form and also are shown using for the comparison. These experiments have been performed in terms of two parameters- average error per pixel and average search points per block on three waves. When the changes in adjacent frames are nominal, it has been observed that the proposed criterion gives the better results in comparison to that of MAD and SC-MAD. If the degree of variation in intensities of the adjacent frames is high, the proposed algorithm gives the best results, when compared with other criterions.

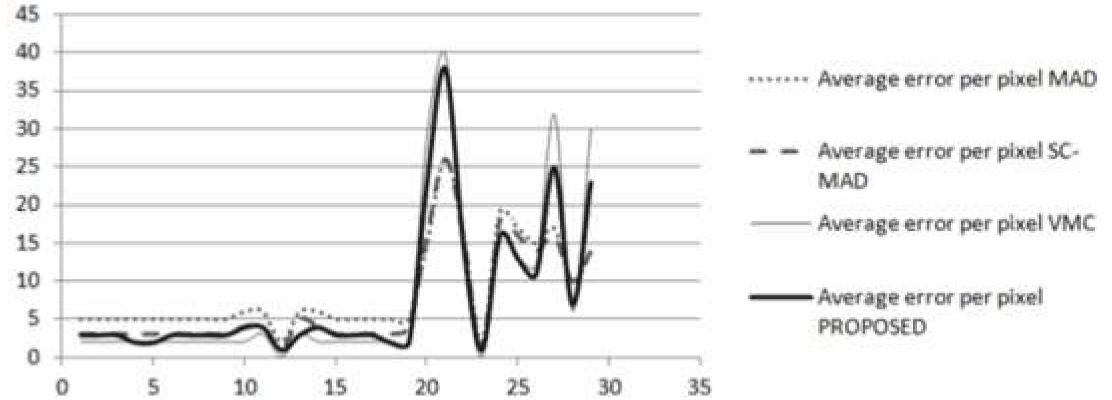

Figure 1.1 Comparison of Average errors per pixel for viptraffic.avi

These results have been found experimentally by taking first thirty frames form these mentioned waves. Detailed results can be understood by above corresponding graphs.

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