A NOVEL APPROCH FOR IMAGE STABILIZATION AND COMPRESSION MECHANISM USING NEURAL NETWORK

Ankuar Agarwal, Anshuman Sharma
Department of Computer Science & Engineering, People's University, Bhopal M.P., India
csankuragarwal@gmail.com, anshuman515@gmail.com

Abstract: **Image stabilization has become a subject of significant interest and an active research field over the past years due to the wide use of digital imaging devices. The image stabilization process aims at removing irregular motion phenomena from image sequences in order to accomplish a compensated sequence that displays smooth camera movements. A variety of image processing applications requires motion-compensated image sequences as inputs. The unwanted positional vacillations of the video sequence will affect the visual quality and impede the subsequent processes for several applications. An innovative technique for digital image stabilization (DIS) based on the DCT Algorithm is studied. It exploits the basic features of the DCT in order to separate the local motion signal obtained from an image sequence into two different motion vectors. A variety of embedded systems equipped with a digital image sensor, such as handheld cameras, mobile phones, and robots, can produce image sequences with an observed motion caused by two different types of movements: the smooth camera motion (intentional) and the unwanted shaking motion (jitter). Image compression is a problem of reducing the amount of data required to represent a digital image. It is a process intended to yield a compact representation of an image, thereby reducing the image storage/transmission requirements. We present a neural network based Growing Self Organizing Map technique that may be a reliable and efficient way to achieve vector quantization. To verify the effectiveness of the proposed GSOM method, several simulations were performed, and the results were compared with existing stabilization methods. An attempt has been made for estimate Mean square error (MSE), peak signal to noise ratio (PSNR) and structural similarity index (SSIM) to study the performance of GSOM and compared with other existing techniques and showed that HHT-DIS outperforms the existing methods.**

Keywords: Image Stabilization, Neural Network, GSOM

I. INTRODUCTION (HEADING 1)

II. Image stabilization (IS) is a family of techniques used to reduce blurring associated with the motion of a camera or other imaging device during exposure. Generally, it compensates for pan and tilt (angular movement, equivalent to yaw and pitch) of the imaging device, although electronic image stabilization can also be used to compensate for rotation.[1] It is used in image-stabilized binoculars, still and video cameras, astronomical telescopes, and also smartphones, mainly the high-end. With still cameras, camera shake is particularly problematic at slow shutter speeds or with long focal length (telephoto or zoom) lenses. With video cameras, camera shake causes visible frame-to-frame jitter in the recorded video. In astronomy, the problem of lens-shake is added to by variations in the atmosphere over time, which will cause the apparent positions of objects to changeII. WEB USAGE MINING

III. Digital image compression is a key technology in the field of communications and multimedia applications. Image compression is often referred to as coding, where coding is very general term encompassing any special representation of data which satisfies a given need. As with any communication, compressed data communication only works when both the sender and receiver of the information understand the encoding scheme. For example, this text makes sense only if the receiver understands that it is intended to be interpreted as characters representing the English language. Similarly, compressed data can only be understood if the decoding method is known by the receiver. It is useful because it helps to reduce consumption of expensive resources such as hard disk space or transmission bandwidth i.e. a data file that suppose to takes up 50 kilobytes (KB) could be downsized to 25 kilobytes (KB), by using data compression software. A simple characterization of data compression is that it involves transforming a string of characters in some representation (such as ASCII) into a new string (of bits, for example) which contains the same information but whose length is as small as possible. Data compression has important application in the areas of data transmission and data storage. Compressed data required smaller storage size and reduce the amount of data that need to be transmitted. Hence, it increases the capacity of the communication channel.

II. OBJECTIVE

The main purpose of image Stabilization and compression mechanism is

- To discover the concealed relations between image data and annotation data, and annotate image according to such relations.
- To Save more memory space, and in case of web applications, transferring of images and download should be fast
- To Improve Better Accuracy of Image Stabilization
- To Reduction in the amount of space needed to store a piece of data
- The final goal of automatic image annotation is mostly to assist image retrieval by supplying users with semantic keywords for search.

III. REVIEW OF LITERATURE

A lot of research works have been carried out in the literature for Image Stabilization and some of them have motivated us to take up this research. Brief reviews of some of those recent significant researches are presented below

Mei Tian et.al(2005) discusses the possibility of Singular Value Decomposition in Image Compression applications. A mistake viewpoint that is about SVD based image compression scheme is demonstrated. His paper goes deep to study three schemes of SVD based image compression and prove the usage feasibility of SVD based image compression

Sheng Liu et.al(2006) had worked in the field of radar image compression of voyage data recorder (VDR). A sheet of radar image is storage in VDR after an interval of time, so the compression algorithm for radar image may be seen as immobile image compression. The image compression process includes Discrete Wavelet Transform (DWT), quantization and entropy coding.

Xiangjian He(2006) laid the emphasis on distributed and network based pattern recognition. For real time object recognition or reconstruction, image compression can greatly reduce the image size, and hence increase the processing speed and enhance performance. Fractal image compression is a relatively recent image compression method. Its basic idea was to represent images as a fixed point of a contractive Iterated Function System (IFS)

Yukinari Nishikawa et.al(2007) described a high speed CMOS IMAGE sensor with on chip parallel image compression circuits. This chip consists of a pixel array, an A/D converter array with noise canceling function and an image compression processing element array and buffer memories. The image compression processing element is implemented with a 4_4 point Discrete Cosine Transform (DCT) and a modified zigzag scanner with 4 blocks

Jian Li et.al(2008) introduced a quadtree partitioning fractal image compression method used for the partial discharge (PD) image remote recognition system. Self similarity in PD images is the premise of fractal image compression and is described for the typical PD images acquired from defect model experiments in laboratory.

Prema Karthikeyan, Narayanan Sreekumar(2010) introduce an adaptive method for image compression that is subjective on neural networks based on complexity level of the image. The multilayer perceptron artificial neural network uses the different Back-Propagation artificial neural networks in processing of the image. The original images taken, for instance 256*256 pixels of bitmap image, each block of image into one network selection, according to each block the value of pixels in image complexity value is calculated.

David Jeff Jackson et.al (1993) addressed the area of data compression as it is applicable to image processing. An analysis of several image compression strategies are examined for their relative effectiveness. Several topics concerning image compression are examined in this study including generic data compression algorithms, file format schemes and fractal image compression. An overview of the popular LZW compression algorithm and its subsequent variations is also given. A survey of several common image file formats is presented with respect to the differing approaches to image compression. Fractal compression is examined in depth to reveal how an interactive approach to image compression is implemented. A comparison of the previously mentioned techniques was performed using several sources. The original GIF images were used to construct the JPEG formatted files.

P. Moravie et.al(1995) emphasized that in the digitized satellite image domain, the needs for high dimension images increase considerably. To transmit or to stock such images (more than 6000 by 6000 pixels), we need to reduce their data volume and so we have to use image compression technique. In most cases, these operations have to be processed in Real Time.

J Jiang (1995) proposed an extensive survey on the development of neural network technology for image compression. Three main categories had been covered .These includes neural networks directly developed for image compression, neural network implementation of traditional algorithms and development of neural network based technology which provide further improvements over the existing image compression algorithms.

IV. INTRODUCTION TO NEURAL NETWORK

An Artificial Neural Network is a network which is inspired by the activity of biological nervous system like the brain process information. The main parameter of such network is the novel structure of the information processing system which is composed of numerous numbers of neurons working in the unison for solving the particular problem. However the Artificial neural network is also used in pattern recognition or data classification domain by means of learning process.Neural network has a capability of extracting meaning full information from the imprecise or complicated data which were further used in extracting the pattern and detecting the trends which were too complex and difficult for the computer or human to detect. The other advantages of neural network are as follows:

1. A Neural network has a capability of Adaptive learning which means the ability of the network to perform task on the basis of data giving for the training purpose.

2. An Artificial neural network from the information it receives during learning process help in creating its own organization and representation known as self organizing map.

3. A Neural network performs Real Time Operation which were carried out in parallel and also using this capability some special hardware devices can be designed and manufactured.

4. Fault Tolerance via Redundant Information Coding.

V. PROBLEM DESCRIPTION IN IMAGE STABILIZATION

Importance of image dispensation increases with advancing communication technology. Limited hardware and budget is also important in sending of data fast. The amount of data associated with visual information is so large that its storage requires enormous storage capacity. The storage and transmission of such data require large capacity and bandwidth, which could be very expensive. Image data dispensation techniques are concerned with reduction of the number of bits required to store or transmit images without any appreciable loss of information. Image transmission applications are in broadcast television; remote sensing via satellite, aircraft, radar, or sonar; teleconferencing; computer communications; and facsimile transmission. Image storage is required most commonly for educational and business documents, medical images. Because of their wide range of applications, data compression is of great importance in digital image processing.

It is widely believed that a picture is worth more than a thousand words. However, dealing with digital images requires far more computer memory and transmission time than that needed for plain text. Image compression is a process intended to yield a compact representation of an image, hence reducing the image storage/transmission requirements. Generally, images carry three main type of information: redundant, irrelevant, and useful. Redundant information is the deterministic part of the information which can be reproduced, without loss, from other information contained in the image (i.e., inter pixel redundancy): for example, low-varying background information. Irrelevant information is the part of information that has enormous details which is beyond the limit of perceptual significance.

The content available on the Internet is incomparable in quality with respect to the conventional methods. Initially the image contents (photographs etc) were processed and produced by professionals with the help of expensive high-quality cameras and lighting equipments. On the contrast, the current User-generated image contents are produced by naïve users with inexpensive cameras that significantly imperfects the images.

VI. CONVENTIONAL TECHNIQUE FOR IMAGE STABILIZATION AND COMPRESSION

Traditional technique such as DCT Algorithm are used in Image stabilization and compression. But DCT Algorithm has some disadvantage

1. There is one major disadvantage of the DCT. While the input from preprocessed 8 x 8 blocks are integer-valued, the output values are typically real-valued. Thus we need a quantization step to make some decisions about the values in each DCT block and produce output that is interger-valued
2. The time efficiency is low
3. The complexity is very high for large data set
4. For compression, it reduce the image pixcel

VII. NEURAL NETWORK APPROCH FOR IMAGE STABILIZATION

We present the neural network based approach that is used to compress image in the research works. Growing Self Organizing Map algorithm is a widely used learning algorithm in Artificial Neural Networks. Growing Self Organizing Map architecture is capable of approximating most problems with high accuracy and generalization ability. This algorithm is based on the error-correction learning rule. growing self-organizing map (GSOM) is a growing variant of the popular self-organizing map (SOM). The GSOM was developed to address the issue of identifying a suitable map size in the SOM. It starts with a minimal number of nodes (usually 4) and grows new nodes on the boundary based on a heuristic. By using the value called Spread Factor (SF), the data analyst has the ability to control the growth of the GSOM.

All the starting nodes of the GSOM are boundary nodes, i.e. each node has the freedom to grow in its own direction at the beginning. New Nodes are grown from the boundary nodes. Once a node is selected for growing all its free neighboring positions will be grown new nodes. In GSOM, input vectors are organized into categories depending on their similarity to each other. For data compression, the image or data is broken down into smaller vectors for use as input. For each input vector presented, the Euclidean distance to all the output nodes is computed. The weights of the node with the minimum distance, along with its neighboring nodes are adjusted. This ensures that the output of these nodes is slightly enhanced. This process is repeated until some criterion for termination is reached. After a sufficient number of input vectors have been presented, each output node becomes sensitive to a group of similar input vectors, and can therefore be used to represent characteristics of the input data. This means that for a very large number of input vectors passed into the network, (uncompressed image or data), the compressed form will be the data exiting from the output nodes of the network (considerably smaller number). This compressed data may then be further decompressed by another network. We take 50 neuron as a one input hidden layer and one output layer we take learning rate 0.5.the compression and decompression figure of GSOM Algorithm are following:

Algorithm(Growing Self Organizing Map Algorithm)

The Learning Algorithm of the GSOM:

The GSOM process is as follows:

1. Initialization phase:

•Initialize the weight vectors of the starting nodes (usually four) with random numbers between 0 and 1.

•Calculate the growth threshold ( ) for the given data set of dimension according to the spread factor ( ) using the formula

2. Growing Phase:

•Present input to the network.

•Determine the weight vector that is closest to the input vector mapped to the current feature map (winner), using Euclidean distance. This step can be summarized as: find such that where , are the input and weight vectors respectively, is the position vector for nodes and is the set of natural numbers.
•The weight vector adaptation is applied only to the neighborhood of the winner and the winner itself. The neighborhood is a set of neurons around the winner, but in the GSOM the starting neighborhood selected for weight adaptation is smaller compared to the SOM (localized weight adaptation). The amount of adaptation (learning rate) is also reduced exponentially over the iterations. Even within the neighborhood, weights that are closer to the winner are adapted more than those further away. The weight adaptation can be described by where the Learning Rate , is a sequence of positive parameters converging to zero as . , are the weight vectors of the node before and after the adaptation and is the neighborhood of the winning neuron at the th iteration. The decreasing value of in the GSOM depends on the number of nodes existing in the map at time .
•Increase the error value of the winner (error value is the difference between the input vector and the weight vectors).
•When (where is the total error of node and is the growth threshold). Grow nodes if i is a boundary node. Distribute weights to neighbors if is a non-boundary node.
•Initialize the new node weight vectors to match the neighboring node weights.
•Initialize the learning rate ( ) to its starting value.
•Repeat steps 2 – 7 until all inputs have been presented and node growth is reduced to a minimum level.

3.Smoothing phase.

Reduce learning rate and fix a small starting neighborhood. Find winner and adapt the weights of the winner and neighbors in the same way as in growing phase

VIII. CONCLUSION

In this Paper, we have investigated the problem of automatic image annotation for an image retrieval system. Our approach is based on image processing algorithms combined with machine learning techniques. The proposed approach is composed of three main phases:

• An image processing phase consists of segmenting images into regions and extracting keypoints located in these images. Feature vectors are then computed based on the color, texture, orientation histogram and the location of corresponding regions and keypoints.
• A semantic learning phase consists of constructing an intermediate level of semantics (the visual terms). The relation between words and visterms is captured by the word-by-visterm matrix. This stage helps to fill the semantic gap between high-level image semantic and lowlevel image features extracted by image processing algorithm.
• An annotation phase that uses the image processing stage to extract the visual features and the quantisation process to compute the occurrence of visterm in the new image. The propagated words are based on the ranked similarity values of image-by-visterm vector with each vector extracted from the word-by-visterm matrix

In this paepr it was proposed to extract features using Discrete Sine Transform (DST) and select the top 50 attributes based on class attribute using information gain. The extracted features were trained and compared with MLP Neural network classifier. The classification accuracy of the proposed method improved by a percentage of 3.45. Using less number of features in the proposed method decreases the overall processing time for a given query

REFRENCES: -

1] Ajjimarangsee, P. und Huntsberger, T. L., "Neural network model for fusion of visible and infrared sensor outputs, in: Proc. SPIE", Vol. 1003, S. 153-160, March 1988.
[2] Beckerman, M. und Sweeney, F. J., "Segmentation and cooperative fusion of laser radar image data, in: Proc. SPIE", Vol. 2233, S. 88-98, April 1994.
[3] Beylkin, G. "On the representation of operators in bases of compactly supported wavelets, in: SIAM J. Numer. Anal", Vol". 29, No. 6, S. 1716-1740, 1992.
[4] Burt, P. J. und Kolczynski, R. J., Enhanced image capture through fusion, in:Proceedings of the 4th International Conference on Computer Vision", S. 173-7, 1993.
[5] Fechner, T. und Godlewski, "G., Optimal fusion of TV and infrared images using artificial neural networks, in: Proc. SPIE", Vol. 2492, S. 919-925, 1995.
[6] Gonzalez, R. C. und Wintz, P. "Digital Image Processing, Addison Wesley, Reading", Vol. 2400, S. 819-825, 1977.
[7] Li, H.; Manjunath, B. S. und Mitra, S. K., "Multisensor image fusion using the wavelet transform, in: Graphical Models and Image Processing", Vol. 57,S. 235-245, 1995.
[8] Luo, R. C. und Kay, "M. G., Data fusion and sensor integration: State of the Art 1990s, in: Data fusion in robotics and machine intelligence", Academic Press, San Diego, S. 129-135, 1992.
[9] Mallat, S. G. "A theory for multiresolution signal decomposition: The wavelet representation, in: IEEE Trans. Pattern Analysis and Machine Intelligence", Vol. 11, No. 7, S. 674-693, 1989.
[10] Newman, E. A. und Hartline, P. H.,"The infrared vision of snakes, in: Scientific American", Vol. 246, No.3, S.116-127, 1982.
[11] Nichols, L. W. und Lamar, "J.Conversion of infrared images to visible in color, in: Applied Optics", Vol. 7, No. 9, S. 1757-1762, 1968.
[12] Ranchin, T.; Wald, L. und Mangolini, "M. Efficient data fusion using wavelet transform: The case of SPOT satellite images, in: Proc. SPIE", Vol. 2034, S. 171-178, 1993.
[13] Toet, A., "Image fusion by a ratio of low-pass pyramid, in: Pattern Recognition Letters", Vol. 9, No. 4,S. 245-253, 1989.
[14] Toet, A., "A morphological pyramidal image decomposition, in: Pattern Recognition Letters", Vol. 9, No. 4, S. 255-261, 1989,.

[15] Toet, A. und Walraven, J.”New false color mapping for image fusion, in: Optical Engineering”, Vol. 35, No. 3, S. 650-658, 1996.
[16] Unser, M.,”Texture classification and segmentation using wavelet Frames, in: IEEE Trans. Image Processing”, Vol. 4, No. 9, S. 1549-1560, 1995.
[17] Viola, P. A.,”Aligment by Maximization of Mutual Information, Technical Report” No. 1548, Artificial Intelligence Laboratory, MIT, 1995.
[18] Waxman, A. M., Fay, D. A.; Gove, A. N.Seibert, M.; Racamato, J. P.,Carrick, J. E. und Savoye, E. D., “Color night vision: fusion of intensified visible and thermal IR imagery, in: Proc”. SPIE, Vol. 2463, S. 58-68, 1995.
[19] Boykov, Y., Veksler, O., Zabih, R., “Fast approximate energy minimization via graph cuts. IEEE Trans. Pattern Anal. Machine Intell”. 23(11), S.1222–1239 ,2001.
[20] Dempster, A., Laird, N., “Rubin, D.Maximum likelihood from incomplete data via the EM algorithm”. Vol 39, S.38, 1977.
[21] Geman, S., Geman, “D.Stochastic relaxation, Gibbs distribution and the Bayesian restoration of images”. IEEE PAMI 6(6), 721–741,1984.
[22] Kohli, P., Torr, “P.H.S.Dynamic graph cuts for efficient inference in Markov random fields”. IEEE Trans. Pattern Anal. Intell, 29(12), S. 2079–2088 . Mach2007.
[23] Kolmogorov, V., Zabih, R.” What energy functions can be minimized via graph cuts”. IEEE Trans. Pattern Anal. Intell. 26(2), S. 147–159, Mach2004.