Research paper UGC CARE Listed (Group -I) Journal Volume 12, Iss 1 Jan 2023

Edge Detection Using SOC Technique

Dr.E.Gajendran[1], Dr.S.Britto Raj[2], Dr.S.Prabakaran[3],Dr.S.Sharavanan[4],Dr.J.Vijay Anand[5], Dr.G.Chinnadurai[6]
[1,2]Associate Professor, [3] Professor, Department of Computer Science Engineering, Mohamed Sathak A.J College of engineering, Chennai, India
[4]Professor, Department of Computer Science Engineering, Karpagam Institute of Technology, Coimbatore, India
[5,6]Assistant Professor, Department of ECE,J.N.N Institute of Engineering, Chennai, India
[1]gajendrane@gmail.com, [2]sbrittoraj@gmail.com, [3]pra_spin2@yahoo.com, [4]sharavanan.cse@karpagamtech.ac.in, [5]jvanandan@gmail.com, [6]china_durai1@yahoo.co.in

ABSTRACT

With the growth of multimedia and internet, compression techniques have become the thrust area in the fields of computers. Multimedia combines many data types like text, graphics, still images, animation, audio and video. Image compression is a process of efficiently coding digital image to reduce the number of bits required in representing image. Its purpose is to reduce the storage space and transmission cost while maintaining good quality. Many different image compression techniques currently exist for the compression of different types of images. In the present research work back propagation neural network training algorithm has been used. The neural network model has been trained and tested for the different types of images. This paper proposes the new method of image compression. We have already developed self-organized image compression. Several nodes are yielded and self- organized according to a gray scale level of pixels. In this report, edge information is extracted by comparing these blocks and input signal is also compressed into each nodes by the using similar self organized clustering(SOC). The method of edge detection is not realized by the change of the pixel but by the difference of properties which have each cluster area. Only by using a quite simple algorithm, an accurate edge are evaluated and then a good image compression can be realized. Additionally, we introduce Genetic Algorithm to optimize the cluster structure.

Keywords:SOC,Cluster,GA,Edge Detection

1. INTRODUCTION:

The objective of image compression techniques is to remove as much redundancy as possible without Destroying the image integrity. Several image compression algorithms have been proposed in the literature. The block truncation coding (BTC) technique for image compression has the advantage of being easy to implement compared to other block based compression methods such as transform coding.

Many methods have been proposed as high compression algorithms on image processing. Among those methods, it is important to detect edges in the area of image processing for compression and recognition.Therefore many methods to detect edges have been proposed[l][2].The authors have proposed a method[3] to detect edges by using self-organized clustering[4] [5] [6]. In transform coding, correlation between pixels in an image is reduced. image data is first transformed into transform coefficients. therefore the compression can be achieved by packing as much information as possible into a smaller number of transform coefficients. only few of the transformed coefficients having significantly higher energy are then transmitted after quantization and entropy coding. the most commonly used transform is the discrete cosine transform, which is also used in JPEG standard. In early work explored the potential of neural network to achieve data encoding /decoding, which later utilized by many researches for image compression employing the standard back propagation training algorithm. In most of the methods, an image is divided into number of non overlapping pixel blocks, and fed as patterns for network training .Image compression is achieved by encoding the pixel blocks into the trained weight set,which is transmitted to the receiving side for reconstruction of the image In comparison with the vector quantization, this method has certain advantage because here no utilization of code books are required and encoding/decoding time are much less. But in such cases very limited amount of compression is achieved since it exploited only the correlation between pixel within each of the training patterns.Higher compression ratio was achieved in by developing hierarchical NN that cost heavily due to the physical structure of the NN. Adaptive one hidden layer feed forward neural network has been developed for successful image compression that reduces the network size as well as the computational time based on the image size. But none of the above method considers the difficulty of tackling the huge image size during training .Generally depending upon the nature of the image to be compressed there are two basic possibilities of this approach , first shorter image blocks results huge number of training pattern and second bigger image block results huge dimensions of the training pattern. Therefore each of these cases is difficult to handle with respect to training time as well as physical structure of the network. To make image compression practical, it is mandatory to reduce the huge size of most image data that eventually reduces physical structure of the NN. In order to reduce the size considerable several image processing steps namely edge detection, threshold , thinning are applied on the image and discussed briefly. The main concern of the second phase of the work is to adaptively determine the structure of the NN that encodes the image using back propagation training method .The basic aim is to develop

ISSN PRINT 2319 1775 Online 2320 7876
Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 12, Iss 1 Jan 2023

an edge preserving image compression technique using one hidden layer feed forward neural network of which the neurons are determined adaptively based on the images to be compressed .Edge detection is important data reduction step since it encodes information based on the structure of the image. Using edge detection vital information of the image is preserved while keeping aside less important information that effectively reduces dynamic range of the image and elements pixel redundancy. As a next step the image is threshold to detect the pixel having less influence on the image and therefore removed. A threshold function has been designed using gray level information of the edge detected image and applied to reduce the size further. Finally thinning operation has been applied based on the interpolation method to reduce thickness of the image. Now vital information has been preserved in the single image block (PIB) while its size has been reduced significantly and fed as a single input pattern the NN. It is worth to mention here that processing never destroy spatial information of the original image which has been stored along with the pixel values. The number of pixels present in the PIB determines number of input and output neurons of the NN. Input pattern vector has been framed using gray level information of the pixels of the PIB while output pattern vector is constructed using gray level information of the pixel taking from the original image having same spatial coordinates of the PIB. The training pattern thus generated image dependent and is flexible enough compare to the previous NN based technique where output pattern are just replica of the input patterns. The input and output pattern vectors are normalized within and are fed to the input and output layer of the NN. Neurons at the hidden layer are determined adaptively and set to the number of distinct gray level present in the PIB, which is surely less than the number of input/output neurons. The inputs neurons representing the same gray values are connected with the output neurons representing the same gray value that of input. Thus, adaptively the network has been formed and provides modularstructure, which facilitates fault detection and less susceptible to failure.

The compressed image after clustering is not usually optimum. Although there are many cluster nodes which play an important role, there are other redundant cluster nodes. Therefore the evaluation of each cluster node is demanded after self-organization. The authors introduce a genetic algorithm as the method of evaluation[7][8]. After self organization, the clusters are regarded as the first generation. The parents' information is used as a gene and the evolution such as crossover and mutation is performed. In this report, a new accurate edge detection method is developed for the self-organized based image compression. Both edge detection and pixel clustering are realized in the same mechanism, i.e., autonomous agent mechanism. Therefore, only by using a quite simple algorithm, an accurate edges are evaluated and then a good image compression with high PSNR can be realized.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper UGC CARE Listed (Group -I) Journal Volume 12, Iss 1 Jan 2023

2.SOC FOR EDGE DETECTION

A method to detect edge information is developed by selforganization clustering(SOC).

2.1. Outline of a system

The self-organization is given as an algorithm which classifies input data. For the edge detection, self-organization is introduced. As the input vector of the edge detection, the information of gray scale level at a pixel and its location is used. In addition, the similarity measure is defined on Euclid Distance. The model diagram of adaptive self organization. The input vector is fed into every node. It has many cluster nodes in parallel. An input vector is classified into a node chosen among many nodes. The classification is based on the internal information in each node. Each node holds the number of members of thedata which belong to the node, the node pattern which is the central value of a member and error variance. When input data is given, the distance with the central value of a cluster is calculated. The standard Euclid distanceaccording to internal information is used as the calculation of distance. The distance from all nodes are given into a comparator. A comparator outputs the number of the node with the highest similarity. The comparator takes out an updating command to the selected node. The node which receives the updating command adds input data as a new member, and updates the internal information of the node

2.2. Edge detection

Edge preserving smoothing is an image processing technique where the edge information ispreserved during the smoothing process. It usesnon linear operator which is able to remove texture and noise, while keeping edges and corners. The technique is known also as edge and corner preserving smoother (ECPS). Smoothing is an important task in image processing. The best known smoothing technique is low pass linear filtering. The most widely used filter deploys a Gaussian function as a smoothing kernel. However, since linear low pass filtering strongly attenuates high frequency components, not only noise, but also edges and corners, are smoothed.Therefore, there has been a remarkable effort to develop nonlinear operators able to remove texture and noise while preserving edges and corners. In the following we refer to such an operator as an Edge and Corner Preserving Smoother (ECPS). Several ECPSs have beenproposed in the literature. The best known ones are based on median filtering, morphological analysis, bilateral filtering, mean shift, total variation, and anisotropic diffusion. The latter is probably the most popular ECPS, for which much research has been carried out in the last fifteen years. However, it is not computationally efficient since it requires much iteration to achieve the desired output. An important aspect of ECPSs is their ability to produce images that are visually similar to paintings. Not all existing ECPSs are suitable for

ISSN PRINT 2319 1775 Online 2320 7876
Research paper UGC CARE Listed (Group -I) Journal Volume 12, Iss 1 Jan 2023

producing such an artistic effect. For this purpose, an interesting class of ECPSs stems from the early work of Kuwahara, where a fast

and conceptually simple ECPS is introduced. A symmetric square neighborhood around each pixel is divided in four square windows. The value of the central pixel is replaced by the gray level average over the most homogeneous window, i.e. the window with the lowest standard deviation. Although this operator was not specifically designed for producing artistic images the obtained effects are quite interesting.

2.3. THE METHOD OF EDGE DETECTION

After self-organization, each cluster is explored whether it includes a part of edges. The method which we have proposed calculates the mean of gray scale value in each node cluster and compare with all neighborhood clusters. The mean of each cluster is estimated as :

$$ave(i) = sum(i)/ mem(i) \qquad (1)$$

where sum(i) denotes the total of gray scale value and

mem(i) denotes the total number of members in the i – th node.

For the judgement of the edge detection, a square error is used as :

$$d_s(i, j) = (ave(i) - ave(j))^2 \quad (2)$$

After the judgement of the edge detection, the areas which have edge information are seperated from the areas without edges. This research is carried out according to these properities.

2.4 SELF-ORGANIZATION ALGORITHM

In this section, the method how input data belongs the specific cluster is explained. By the self-organization algorithm, edge information is detected. The block with edge information and a block which it does not have are separated, and another processing is performed. The blocks without edge information are performed compression to a cluster nodes using same self- organization algorithm.

2.5 PROPOSED EDGE THRESHOLDING ALGORITHM

Automatic edge thresholding is a serious drawback of the gradient methods for edge detection [2] and it is well known that the choice of an appropriate threshold is vital if good edge detection performance is to be achieved, Several approaches have been proposed to automatically determine thresholds for binarising raw image [3,4]. Most of these appraxhes, such as the iterative threshold selection algorithm [3], assume that the histogram of the image intensities is bimodal or multimodal. In contrast, the histogram of edge magnitudes is usually

ISSN PRINT 2319 1775 Online 2320 7876
Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 12, Iss 1 Jan 2023

unimodal. As a result image thresholding techniques cannot be applied dmtl~to edge thresholdiog. Recently, Aggoun et. [1] proposed an automatic edge thresholding algorithm based the application of the iterative threshold selection [3] to the local histogram of small non- overlapping blocks of the differential image [I]. Assuming that the block size is small enough to contain at most one edge, the edge strength of each block will have either a unimodal or a bimodal distribution. As a result, the threshold for bimodal blocks can be selected using the iterative threshold selection algorithm. The threshold for unimodal blocks can be determined by interpolation form local thresholds that were found for the nearby bimodal blocks.

3. EXPERMENT AND DISCUSSION

The experiment is done using 8bits gray scale image. By the above preparation a compression image and its ratio. The following results are obtained from the study of self-organization algorithm and a genetic algorithm. By the self-organization algorithm, edge information is detected and using same algorithm, input data is compressed into clusters. Therefore clusters with many members are generated and structure of clusters is maden. And finally, the cluster structure generated by self-organization algorithm is to be optimized structure by genetic algorithm.

5.CONCLUSION

In this report, we have proposed the method to compress an image by using self-organization and genetic algorithm. Especially, after the edge detection, the areas which have edge information, are seperated from areas which do not have. And the edge information is treated as important area in this study. For compression of image, Self-organization technique is introduced in order to divide the pixels of an image to some clusters. On the other hand, genetic algorithm is used in order to realize the high performance optimum structure. We also checked out the effect of the proposed method by some experiments. In the future work in order to improve the accuracy of edge detection, we will analysis each cluster area using inner information.

6.REFERENCES

[l] J.Canny, “A computional approach to edge detection”,IEEE Trans. Pat. Anal Machine Intell., vol.PAM1-9,no4, pp569-698,Nov.1986

[2] T.Sugiyama, K.Abe,“Edge Feature Analysis by a Vectorized Feature Extractor and Multiple Edge”, IEICE Trans. Electron.,Vol.J80-D-I1, No.6,pp.1379- 1389,1997

ISSN PRINT 2319 1775 Online 2320 7876
Research paper UGC CARE Listed (Group -I) Journal Volume 12, Iss 1 Jan 2023

[3]Hironori Nagai,Yoshikazu Miyanaga,Koji Tochinai,“ An Edge Detection by Using Self Organization”, Proc. of ICASSP98, pp. V2749-2752, 1998.

[4] Y.Miyanaga, S.Okumura and K.Tochinai, “On Generalization and Adaptation of a Self-organized Clustering” , IEICE Trans. Vol.j75-A No.7 pp1207-1215 July 1992 (in Japanese)

[5]Yoshikazu MIYANAGA and Koji TOCHINAI, “Pararell VLSI Architecture for Multi-Layer Self- Organizing Cellular Network” JEICE Trans. Vol.e76-c No.7 JULY 1993

[6] Xiao Zhou WANG, Yoshikazu Miyanaga, Koji Tochinai, “Agent Oriented Vector Quantization using Self- Organization realized in JAVA”, Proc. ISCAS’97.

[7] HongLan Jin, Yoshikazu Miyanaga, Koji Tochinai, “On the Optimum Design of Clustering Structure by Genetic Algorithm”, IEICE Trans. Vol. J80-A, No.4, pp.620-629, April 1997(in Japanese)

[8] HongLan Jin, Yoshikazu Miyanaga, Koji Tochinai: “Design of a Compact Cluster Structure by using (genetic Algorithms”,Proc. ISCAS’95, pp1512-1515, May 1995

[9] Heeburm Ryu, Yoshikazu Miyanaga, Koji Tochinai, “An Image Compression Using Self-organization with Genetic Algorithm” ,Proc. ISCAS’99.