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A LOW BIT RATE ENCODING SYSTEM FOR USING VECTOR QUANTIZATION AND EDGE DETECTION

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ABSTRACT :

A low bit rate encoding using VQ gives a real-time image coding. The encoding process applied is independent of the vector dimensions and does not perform any arithmetic operations. The vector quantization is done by the downsample method which faceplates to take decimation factor for image and video compression. The decision tree generated by an offline process. Together with pipeline architecture, high speed encoding is now realizable in a single Chip. A new systolic architecture to realize the encoder of full-search vector quantization (VQ) for high-speed applications. The architecture possesses the features of regularity and modularity. One major challenging subband coding is efficiently coding subbands, which have low energy.

INTRODUCTION :

Recently a new interest has been arisen in the field of the very low bit rate video application. The motivation of this new interest lies in the development of new applications such as videophones, video conferencing, and many others. The major requirements for these applications are the low capacity for transmission and storage, in order to use the existing Public Switched Telephone Networks (PSTN) or mobile channels numerous algorithms have been explored to implement the high compression system, such as model based and object-based methods. The advent of multimedia has evidenced a merger of computer technology and television technology. This merger has resulted in the emergence of several applications such as teleconferencing, videophone and video-on-demand. These applications would not be possible without an efficient video compression algorithm. Several international standardization activities are aiming at developing high performance video compression techniques for different applications, e.g. H.261 for video conferencing, MPEGI for CD-ROM based applications, MPEG2 for broadcast TV etc. Currently the MPEG standardization group has started an investigative effort towards developing a standard (currently referred to as MPEG4) for low bit rate video compression. VQ has been considered as an efficient block-based lossy compression technique. Edge detection provides information on an object's edge transitions instead of a full picture of the object.

RELATED WORK :

Work done in the area of edge detection and vector quantization is reviewed and focus has been made on detecting the edges of the digital images. Edge detection is a problem of fundamental importance in image analysis. In typical images, edges characterize object boundaries and are therefore useful for segmentation, registration, and identification of objects in a scene. Edge detection of an image reduces significantly the amount of

data and filters out information that may be regarded as less relevant, preserving the important structural properties of an image.

OVERVIEW OF VECTOR QUANTIZATION

Quantization is used to reduced the total number of bits needed for a compressed image.

Scalar Quantization:

Maps one sample of input signal to one quantized output.

Vector Quantization:

Set of input Data to single codeword.

Vector quantization is a classical quantization technique from signal processing which allows the modeling of probability density functions by the distribution of prototype vectors. It was originally used for data compression. It works by dividing a large set of points (vectors) into groups having approximately the same number of points closest to them. Each group is represented by its centroid point; The density matching property of vector quantization is powerful, especially for identifying the density of large and high-dimensioned data. Since data points are represented by the index of their closest centroid, commonly occurring data have low error, and rare data high error. This is why VQ is suitable for lossy data compression. It can also be used for lossy data correction and density estimation. Vector quantization, also called "block quantization" or "pattern matching quantization" is often used in lossy data compression. It works by encoding values from a multidimensional vector space into a finite set of values from a discrete subspace of lower dimension. A lower-space vector requires less storage space, so the data is compressed. Due to the density matching property of vector quantization, the compressed data have errors that are inversely proportional to their density

OVERVIEW OF EDGE DETECTION

Edge detection refers to the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterize boundaries of objects in a scene.Edge detecting an image significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image.

Canny Edge Detector

Edges characterize boundaries and are therefore a problem of fundamental importance in image processing. list of criteria to improve current methods of edge detection. The first and most obvious is low error rate. It is important that edges occurring in images should not be missed and that there be NO responses to non-edges. The second criterion is that the edge points be well localized. In other words, the distance between the edge pixels as found by the detector and the actual edge is to be at a minimum.

A third criterion is to have only one response to a single edge. This was implemented because the first 2 were not substantial enough to completely eliminate the possibility of multiple responses to an edge.

LOW BIT RATE PICTURE CODING

Very low bit rate image coding is an important problem regarding applications such as storage on low memory devices or streaming data on the internet. The state of the art in image compression is to use 2D wavelets. The advantages of wavelet base multiscale nature and in their ability to separtly present functions that are Piecewise smooth. Their main problem on the other hand, is that in 2D wavelets are not able to deal with the natural geometry of images, i.e they cannot separately represent objects that are smooth away from regular sub manifolds ability to present functions that are piecewise smooth. Their main problem on the other hand, is that in 2D wavelets are not able to deal with the natural geometry of images, i.e they cannot sparsely represent objects that are smooth away from regular sub manifolds

Object Extraction:

Enables structured object based coding at different bit streams , and Vector Quantizer is to encode blocks by simple numbering. The block-based coding has been conventionally employed by a number of picture coding algorithms such as MPEG1/2, H.263, etc. However, usually the edges of an object in a picture spread over numbers of blocks. This is the reason why the block-based coding causes the so-called block distortion in coded images which considerably degrades the picture quality. To overcome this drawback of the block-based coding, the object-based coding is adopted so that at the subsequent stage the objects in a picture can be classified into a number of groups according to their motions and sizes.

Motion Compensator:

A motion compensator is a device that decreases the undesirable effects of the relative motion between two connected objects. Motion compensators are usually placed between a floating object and a more stationary object, such as a vessel or a structure fixed to the seabed. The motion compensator does not prevent the motion, but tries to eliminate the negative effects of the movement.

Geometric Vector Quantization:

Geometric Vector Quantization (GVQ), is one type of product vector quantization methods, in this method the code vectors are inspired by edge related features of the high-frequency sub bands. The code vectors for a two-level GVQ that we used are composed of binary-valued blocks reflecting the basic shapes found in the upper sub bands and **two** locally adapted intensity values, which indicate minimum and maximum intensities for each coded block.

SYSTEM FLOW FOR IMAGE

Basic step for Simulation of an Image

- Initially generate Do image file in MATLAB
- Run Do file in MATLAB
- Enter the name of entity in MATLAB

- Select the path for input image in MATLAB in temporary folder
- Create new project in modelsim
- Run VHDL file
- After compiling the VHDL code generate Text file
- Run Text file then generate matrix
- Put the matrix in MATLAB command window
- Run the matrix to get the output result

Result of Vector Quantization using image

Fig 1. Input Image

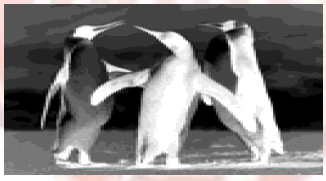

Fig 2. Output of compress image

SYSTEM FLOW FOR VIDEO

- Basic step for Simulation of a Video
- Initially generate Do Video file in MATLAB
- Run Do video file in MATLAB
- Enter the name of entity in MATLAB
- Enter number of frames to be extracted
- Select the path for input Video in MATLAB in temporary folder
- Create new project in modelsim
- Run VHDL file
- After compiling the VHDL code generate Text file

- Run Text file then generate matrix
- Put the matrix in MATLAB command window
- Run the matrix to get the output result

Result of Vector Quantization using video

Fig 3. Input Video

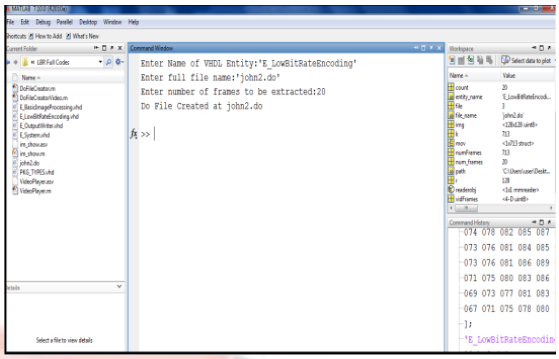

Fig 4. Result of Video on MATLAB

The do file is created for taking the input video. The do file is created followed by enter the name of entity that must be match with entity name in modelsim. After that give the name of file that be created along with the extension .do.

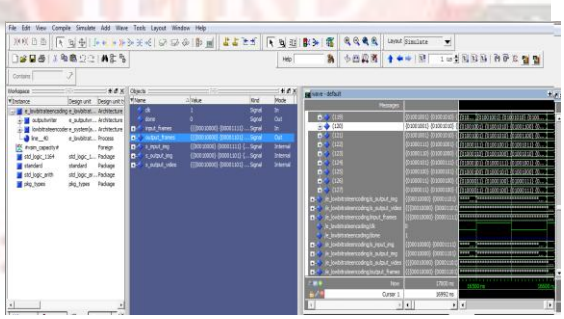

Fig 5. Input frames in modelsim

After copying the text file in matlab window then run the video player for view the output compressed video

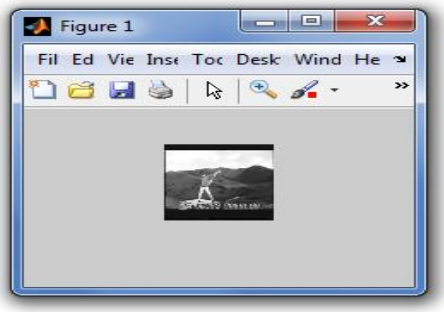

Fig 6. Output of compressed Video

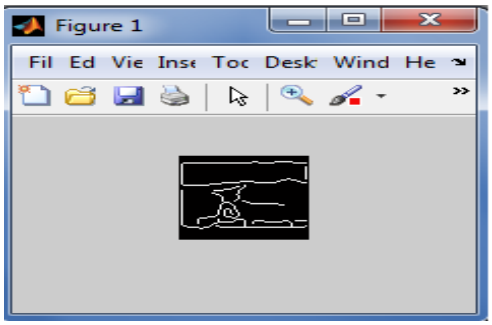

Fig 7. Edge detection of compressed video

Result of compressed video using Haar Transform

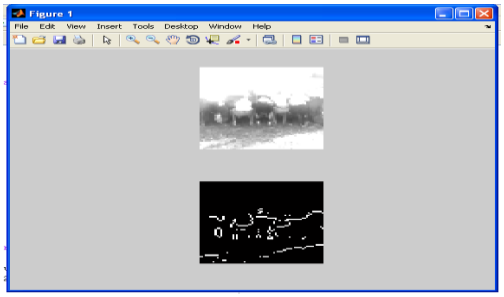

Fig 8. Compressed video with Edge detection using Haar Transfom

COMPARISONS BETWEEN HAAR AND DOWNSAMPLE METHOD WITH RESPECT TO TIME AND COMPRESSION RATIO

Method	Video	Time	Compression Ratio
Downsample	aamir	2 us	94.67%
Haar	aamir	1.58 s	75%
Downsample	Flower	6 us	99.67%
Haar	Flower	10.75 s	75%
Downsample	Car	15 us	94.67%
Haar	Car	12.81 s	75%
Downsample	Man	12 us	94.67%
Haar	Man	12.81 s	75%
Downsample	Traffic	9 us	78.67%
Haar	Traffic	8.38 s	75%
Haar	aamir	1.58 s	75%

From the table and the output of the videos it has been cleared that the compression quality of the downsample method is much good compared with the Haar transform and the compression ratio also get increased. The edge detection part is also done very accurately in the downsample method.

CONCLUSION :

This paper contain Vector Quantization used for lossy data compression, lossy data correction, and coding parts. it also measure image compression ratio with specified extracting number of frame which have been selected by input image with image size by generating text matrix in VHDL run at MATLAB command window. This paper

also describes an edge detection technique which recognize the edges of an image to show that compression is perfect.

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