Developing A Low Bit Rate Encoding System Using Vector Quantization & Edge Detection

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Abstract

Developing a low bit rate encoding for VQ problems such as real-time image coding. The encoding process applied is independent of the vector dimensions and does not perform any arithmetic operations. 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 modularit. One major challenging subband coding is efficiently coding subbands, which have low energy, but contains important visual information. In this paper we used an efficient selection and coding of edge information in subband transform domain for compression of high temporal subbands .while maintaining their sperceptual information.

1. 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.

2. 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.

3. 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.

Original Image

Canny operator

Fig 1: Edge detection of cameraman image

4.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

a) 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.

b) 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.

Motion compensation is an algorithmic technique employed in the encoding of video data for video compression, for example in the generation of MPEG-2 files. Motion compensation describes a picture in terms of the transformation of a reference picture to the current picture. The reference picture may be previous in time or even from the future. When images can be accurately synthesized from previously transmitted/stored images, the compression efficiency can be improved. Motion compensation exploits the fact that, often, for many frames of a movie, the only difference between one frame and another is the result of either the camera moving or an object in the frame moving. In reference to a video file, this means much of the information that represents one frame will be the same as the information used in the next frame. Motion compensation takes advantage of this to provide a way to create frames of a movie from a reference frame. For example, in principle, if a movie is shot at 24 frames per second, motion compensation would allow the movie file to store the full information for every fourth frame. The only information stored for the frames in between would be the information needed to transform the previous frame into the next frame. If a frame of information is 1 MB in size, then uncompressed, one second of this film would be 24 MB in size. Applying motion compensation, the file size for one second of the film can often be reduced to 6 MB, for typical video material.

c) 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

5. Subband Analysis and Synthesis

A sub band coder contains three main components: analysis filters, coding, and synthesis filters. The input signal is first decomposed using a bank of bandpass filters and then each filtered signal is downsampled at it respective Nyquist rate using the corresponding subband is then coded for transmission or storage.In three-dimensional subband filtering the digital video signal is filtered and sub-sampled in all three dimensions(temporally, horizontally and vertically) to yield the subbands, from which the input signal can be lossless reconstructed in the absence of coding loss.

6. Multiscale Edge Detection

Extreme representation of wavelet transform, which is in fact a multi scale edge detection process, is an efficient method for compression of signals with sharp variations. Matlab described a compact still image coding algorithm based on the

wavelet transform modulus maxima**.** We follow a similar way for coding high frequency subbands here .In this method by choosing the filter bank properly the extreme of subbands will show the positions of sharp variation (edge) of low temporal subband.In fact the algorithms is doing some kind of adaptive sampling by selection of most important information of image. By scalar quantization and entropy coding of characteristics of these extreme (amplitude, angel and position), it is possible to code these bands at very low bit-rate. The coding algorithm involves two steps. First, select the points, or can say the edges, that consider important for the visual video quality and then make an efficient coding of these points information. To code efficiently the edge information, we need to take advantage of the similarities between edges obtained at different scales. **A s**it can be observed in one dimensional case, they have similar positions at the three finer scales. These scales cover most of the signal information. We build encoding process from these scales only. The edge selection is first performed at the coarser scale, because at the finer scales, edges are too greatly contaminated by high-frequency noises. thus remove any edge curve whose length is smaller than a given length threshold. Among there meaning curves, we select the ones that correspond to the sharpest image variations. This is done by removing the edge curves along which the average value of the wavelet transform modulus is smaller than a given amplitude Threshold.

7.Conclusion

Edge detection is an important pre-processing step in image analysis. Edge detection is an important work for object recognition and is also an essential pre-processing step in image segmentation. These edge detection operators can have better edge effect under the circumstances of obvious edge and low noise. There are various edge detection methods in the domain of image edge detection, each having certain disadvantages. Hence we will acquire satisfactory result if choosing suitable edge detection operator according to specific situation in practice.

In this project, a new algorithm for the very low bit rate video coding system is presented. This algorithm contain Vector Quantization is used for lossy data compression, lossy data correction and density estimation, and coding parts. it also measure video compression ratio with specified extracting number of frame which have been selected by input video with image size by generating text matrix in VHDL run at MATLAB command window.

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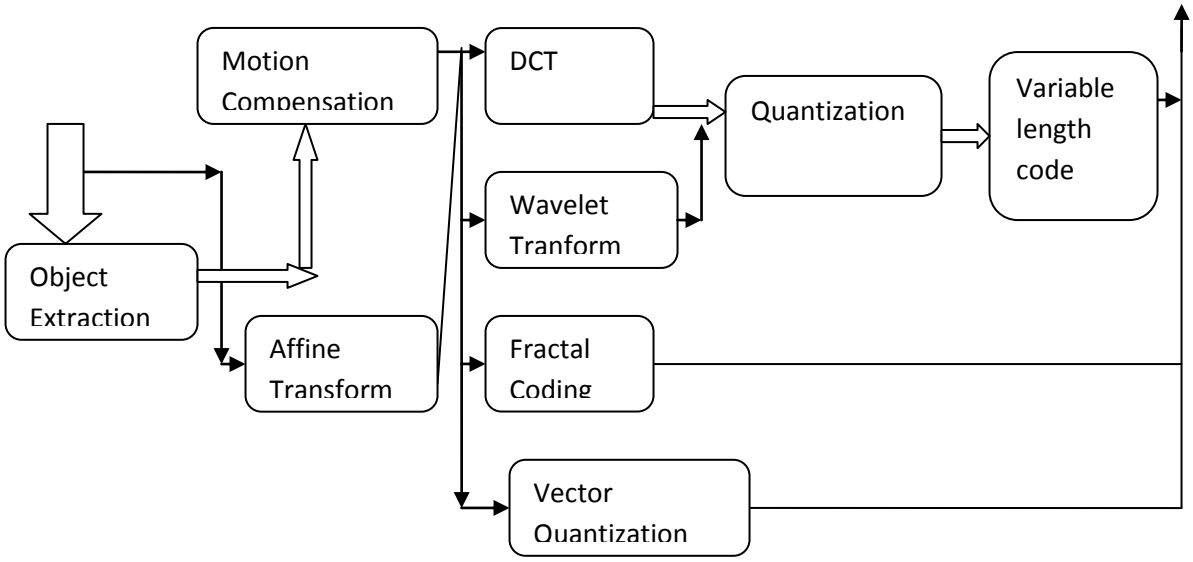
Motion Compensation
DCT
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Variable length code
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Affine Transform
Fractal Coding
Vector Quantization