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RESEARCH ARTICLE

Lossless Compression for Compound Documents Based on Block Classification

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ABSTRACT- Image and video compressions are required to reduce the number of bits needed to represent the content of the original data. Compression of scanned or compound documents and images can be more difficult than the original data because it is a mixture of text, picture and graphics. The main requirement of the compound document or images is quality of the decompressed data. Here Quality is defined as the achievement of the high compression ratio. The degradation of compound image or document compression is based on storage and the transmission of the document. Reduce the storage size and the lossless quality are challenging task. In this proposed method a block-based compression method used for scanned documents (and also video). This paper presents the study on the implementation of Mat lab based on pattern matching algorithm. A high-quality document compressor even with single and multipage document is known as H.264/advanced video coding (AVC). The segmented blocks of data are inputs. Each block is matched to our previous pattern. Then the method H.264/AVC uses the Integer transform to convert resulting is encoded using CABAC. The compressed image or scanned documents are visually lossless with high compression ratio (compare to previous standards). We now describe the desired features and how one can implement them using AVC. The proposed Encoder is more efficient for transform encoding of the residual data.

Keywords- Block based Pattern matching, Compound document compression, discrete cosine transform, H.264/AVC, Inter Frame and Intra Frame Prediction, Macro block partition.

I. INTRODUCTION

Image processing is a technology of applying computer algorithm to process digital images. It is also a form of signal processing. The input is an image. The outcome of this process can be either an images or a set of characteristics or parameters related to images. When transmitting huge data storage there are large number of applications are used for the transmission. For example the data's are received from the satellites every day in the year. Thus we need a large storage media to store that information. So here it is needed to compress the data and protect it using in small memory devices. While removing the redundant data, it causes the reduction of the image data to be achieved. Normally compression can be used when before transmitting or storing the data. After that the data can be decompressed to get the original data. Compression plays an important role in many areas, including televideo conferencing, remote sensing, control of remotely piloted vehicles in military, space etc. An Increasing number of applications depend on efficient manipulation, storage, and transmission of binary, gray- Scale, and color images. The compression is required to represent the quantity of information.

Documents in digital form play an important role in everyday life. A range of document imaging applications such as scan-to-print, document archiving, internet fax, and internet browsing are driving the need for document compression standards that maintain high quality while achieving high compression ratios [2]. The most critical part in this compound document compression is storage size. Now a day's most of the people are using their confidential and personal information's as digitized or electronic documents so they need to store their document in a minimum size and also they need to save their total storage size and transmitted in a secure way. So the compression of the documents (such as compound documents) is more important. Compression of the compound documents (mixture of text and pictorial contents) is extremely important than the original data. Compression of the compound documents needs more work than the compression of the images because if the compressed image is having some lossy information also the human visual system can't able to identify or it won't affect the whole image content or information but in the documents if it is having text means the little lossy quality also can be easily identify by the HVS and we can't satisfy the users even if the data is compressed also. In single/multi-page document compression, each page may be individually encoded by some continuous-tone image compression algorithm, such as JPEG [5] or JPEG2000 [6]. Multi-layer approaches such as the mixed raster content (MRC) imaging model [7] are also challenged by soft edges in scanned documents often requiring pre- and post-processing [12]. When compressing documents is not easy like compressing a image. It involves too many applications and process documents here using the encoder to compress the video, image and documents. The input may be video, image, or documents. So the variety of inputs can be given.

We proposed the encoder which was to provide high quality video at considerably lower bit rates than previous standards. At the same time, the design needed to be not too complex or expensive to implement. A secondary goal was to make the The proposed encoder is a processing of images or video or documents involves improvement in its appearance and efficient representation. For support of all these applications in this paper we are using the video codec named as H.264. In this final summary is to use the single-coder approach and also that provides a high compression ratio on images, documents and produce the high reconstructed quality on the inputs. Here the users input is encoded before going to upload or transmit to the server or client then it should have to be decode or decompress before getting the original data. The H.264/AVC vastly improves compression performance over standards (such as MPEG-2, MPEG-4) Visual. A brief explanation of this method is discussed in the following section.

The rest of the paper is organized as follows the next section 2 is gives an brief overview of compound images or document, section 3 provides an overview of the new Codec H.264, section 4

presents an explanation of optimized block diagram of our proposed works, Finally, conclusions are drawn in Section 6.

II. RELATED WORK

Electronic documents are basically represented in two forms: vectorial or raster [2]. To compress the vectorized documents is not too complex because the full content of file is compressed without loss. But compress the rasterized document is complex. Compound documents are rasterized so the problem is compressing the compound document (mixture of text, image or pictorial). When compressing the text it is more important to protect it from the damage or loss. Reason behind this is shape and edge of the characters accurate to understand the words that are written. An example of a compound and scanned documents are shown in Fig. 1 In this work also related to compress the video and also scanned book may be decomposed into multiple frames. It focus on inter and intra frame prediction, block based pattern matching, encoding and decoding process.

Fig. 1 Example of Compound document (adapted from [10])

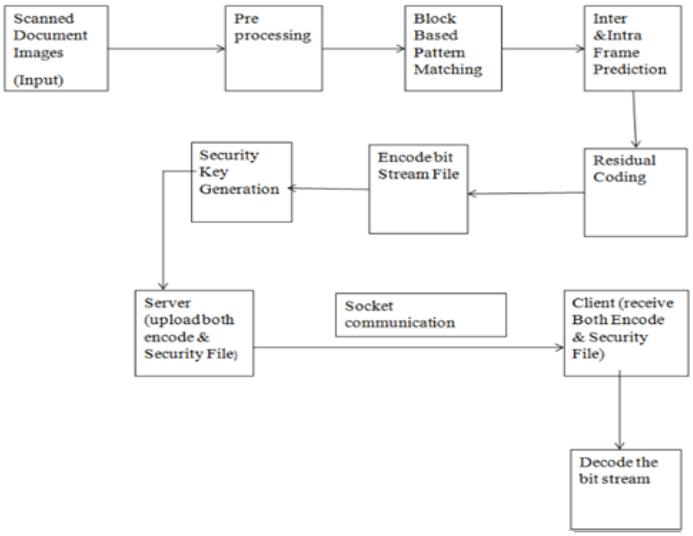

Fig. 2 The block diagram of the H.264 video codec (proposed scheme)

III. ADVANCE VIDEO CODING

H.264/AVC is developed by ITU-T Video Coding Expert Group (VCEG) and Motion Picture Expert Group (MPEG). This is the big boss; and also the number one codec today. H.264/AVC is an open licensed (Standard) for video compression. It gives superb quality at small file sizes and also it is perfectly suited for all kinds of video for the internet or mobile devices. H.264 started a very successful entry in this world and become an adopted for content as well as communication services Worldwide. When compared to existing standard it achieves an improvement on high rate distortion efficiency providing, fact of two bit rate savings.

A. Technical Overview of AVC

The H.264/AVC design [1] supports the coding of video that contains either progressive or interlaced frames, which may be mixed together in the same sequence. While H.264 uses the same general

coding techniques as previous standards, it has many new features that distinguish it from previous standards and combine to enable improved coding efficiency and also good video quality substainly at lower bit rates. The coding performance is reported in terms of PSNR (Peak Signal to Noise Ratio) and bit rate. To address the requirement of flexibility and customizability to various applications, the H.264/AVC [7], [17] design covers a video coding layer (VCL), which is designed to efficiently represent the video content, and a network abstraction layer (NAL), which formats the VCL representation of the video and provides header information to package that data for network transport [8]. This standard is further designed to give lower latency as well as better quality for higher latency. A more detailed description of the technical contents of H.264 is given [16]-[17].The main objectives of the H.264/AVC standard are focused on coding efficiency, architecture, and functionalities. The basic coding structure of this standard is commonly referred to as block-based motion compensated-transform coding structure. Coding of video is performed as picture by picture. In this paper work H.264/AVC contains a number of refinements and enhancements of prior coding Tools, while making use of a similar basic structure.

IV. OPTIMIZED AVC SCHEME

The block diagram of the proposed scheme for H.264/AVC is depicted in Fig. 2. First the input may be given as compound image, scanned document or video. If the input images are color images means we are convert to gray scale from that color images. Then we need to resize that image because in this method we are using macro block partition like 16 × 16, 8 × 8 and 4 × 4 pixel block partitions. Block based pattern matching improves the ability and better quality of the given input. Pattern matching is used as a encoding scheme. It divides the block of pixels from the given images or document. So now each and every block is matched with the existing Pattern. Hence the image or document may be decomposed into many frames. Inter prediction and intra prediction methods are used as reference frame and current frame. The encoding process for inter picture prediction includes selecting and encoding motion data. Such data identifies the reference picture and spatial displacements that are applied to the samples of each block.

Residual coding receives the results are like an encoded format that the data's are too high so we can't convert those Results. To reduce the Storage size we are filtering the same bits from the lengthy bit. H.264/AVC uses DCT and the resulting coefficients are encoded using CABAC. Next in encode bit stream converting the results into bit stream. So here the files or documents are in safe. Now both the secure Key and the encoded bit streams are uploaded to the server. Using the socket communication the client receives the both encoded and the secure key file. Both encoded and security files are downloading from server. So after getting those files client has to decode the bit streams from that encoded file to get the original content. When decoding the bit stream the client must use the secure key. Bit stream is used to find the encoded images width, height, and quantization parameter. Finally, we are decoding I & P frames from encoded file. Client gets the resized and the high quality data. The whole process can be achieved when we get the high PSNR ratio, resized data and high quality.

A. Pre-Processing

The main Goal of the pre-processing is to enhance the visual appearance of images and also improve the manipulation of datasets. Pre-processing not only good performance for compression but also fast processing. Pre-Processing uses some of the methods are Image resampling, Grayscale contrast enhancement, Noise removal, Mathematical operations, and Manual correction. These all methods are mainly used to improve the quality of the inputs. Every method has a different type of processing the

inputs. In our proposal method we are using only the grayscale contrast enhancement. Grayscale contrast enhancement is uses to improve the visualisation by brightening the data set or inputs.Grayscale contrast enhancement is working as follows. The inputs may be scanned document or images or video. If the given inputs are RGB color images means we should have convert it into gray scale from that RGB color images. Then it is necessary to resize that image because in this method we are using macro block partition like 16 × 16, 8 × 8 and 4 × 4 pixel block partitions. Why we are converting only the RGB Color image means if it is an RGB image Colors are usually represented in the 24 bits RGB. Three values for the each pixel but in the grayscale image have only one value for each pixel. Gray scale image are like single dimension. So it is easy to process such an image like single value. After converting the gray scale image the next step is to resize the image. Here we used the actual pixel values within 240. In some case if it is more than that value it's needed to divide the block within our average value. So our concept is to resize the image within the maximum range 240. After finishing this process the next step is to do the pattern matching for an input. Typically, it will be the data provider who will preprocess the image data before delivery of the data to the customer or user.

B. Block–Based Pattern Matching

Finding a pattern or template in a signal is an important Problem for signal and image processing. This so-called Template matching can be applied to many applications such as image and video coding, pattern recognition, and visual tracking. First we have the "macro blocks" which are 16×16 pixels wide, used by the inter-prediction process. Then we have the "blocks" of 4×4 pixels, used by the intra-prediction process. Pattern matching is to find a pattern, which is relatively small, in a text, which is supposed to be very large Rather than text if the inputs may be video means each frame is divided into blocks of pixels. This pattern matching divides an image into blocks of regions. Each region follows approximate object boundaries [2]. The size of the blocks may vary within the same region to better approximate the actual object boundary [2]. Block-based algorithms are developed mostly for grayscale or color compound images Pattern matching methods are specialised in varying degrees. Some pattern matching methods are specialised to detect or recognise a restricted class of shapes such as circles and squares [8].

For the purpose of video compression, a pattern matching algorithm can be used to determine the similarities between the still images in multiple images are detected and replaced with pointers to a single pattern. The Block based pattern matching algorithm outperforms on compound images at high Bit rate. Fig.3 illustrates the cause of using interframe prediction as an approximate pattern matching algorithm. Fig. 3 (a) and (b) show examples of a reference and a current text area, respectively. Fig. 3 (c), (e) and (g) represent the predictions of the current text using 8 × 8 and 4 × 4 block partitions. Fig 3 (d), (f) and (h) are the corresponding residual data. Notice that the 4 × 4 prediction generates a lower-energy residual, when compared with the 16 × 16 and in a digital video recording [19]. Using this block prediction our frames as video are divided and send it to the inter AVC. To send that blocks H.264 has a capacity to divide the Macro blocks from 16 x 16 pixels into more valid combinations are 16 x 8, 8 x 16, 8 x 8, 8 x 4, 4 x 4 pixels. After send the frame to the AVC then the event is responsible for the motion estimation algorithm. It is one of the advantage of the video content that are in the same frame in neighbour frames are usually such correlated. To remove the spatial redundancy our search window must hide as much as possible of the whole frame or of reference frame.

C. Interframe and Intraframe Prediction

AVC also supports Inter Intra Frame prediction. Inter-frame coding in H.264 leverages most of the key features in earlier standards and adds both flexibility and functionality including various block sizes for motion compensation, quarter-pel compensation, multiple Reference frames, and adaptive loop deblocking. When using intra coding, intra prediction attempts to predict the current block from the neighbouring pixels in adjacent blocks in a defined set of directions. The difference between the block and the best resulting prediction is then coded rather than actual block. This results in a significant Improvement in intra coding efficiency. Inter coded frame is divided into blocks known as macro blocks. After that, instead of directly encoding the raw pixel values for each block, the encoder will try to find a block similar to the one it is encoding on a previously encoded frame, referred to as a reference frame. This process is done by a block matching algorithm. If the encoder succeeds on its search, the block could be encoded by a vector, known as motion vector, which points to the matching block at the reference frame. The process of motion vector determination is called motion estimation. Fig. 4 illustrates the block based motion estimation. Using this video frames are searched by the motion estimation. The reference frames may be a previous Frame or a next frame. In most cases the encoder will succeed, but the block found is likely not an exact match to the block it is encoding. This is why the encoder will compute the differences between them. Those residual values are need to be transformed and sent to the decoder. To sum up, if the encoder succeeds in finding a matching block on a reference frame, it will obtain a motion vector pointing to the matched block and a prediction error. Using both elements, the decoder will be able to recover the raw pixels of the block.

Fig. 5 shows the intra frame prediction method. Intra-frame coding is used in video coding. It is part of an intra-frame codec like Pores: a group of pictures codec with inters frames. The term intra - frame coding refers to the fact that the various lossy and lossless compression techniques are performed relative to information that is contained only within the current frame and not relative to any other frame in the video sequence. Intra prediction uses 16x16 and 4x4 block size to predict the macro block from surrounding, previously coded pixels within the same frame.

D. Residual Coding

The nature of the residuals is clearly dependent on the quality of the original image, i.e., how well symbols can be clustered, and on the quality of the clustering algorithm itself [13]. In our method using the DCT (discrete cosine Transform) the residual macro blocks are transformed. Residue macro block is necessary to accurately encode the symbols. The part of encoding uses the arithmetic coding for transforming the blocks. Integer transforms to be uses in H.264/AVC with some of the properties such as that is called as DCT. Residue macro block is necessary to accurate accurately encode the symbols. Then the resulting from the DCT is like Coefficients. So that coefficients also have to encode using the method called as CABAC (context-adaptive binary arithmetic coding). It is also used in the High Efficiency Video Coding standard. It is a lossless compression technique.

E. Encoding and Decoding Process

In our proposed method the inputs are given into the AVC like a normal video coder in a sequence. Encoding process is done as follows: The encoder processes a frame of video in units of a Macro block. It forms a prediction of the macro block based on previously-coded data, either from the current frame (intra

prediction) or from other frames that have already been coded and transmitted (inter prediction). The encoder subtracts the prediction from the current macro block to form a residual. Intra prediction uses 16x16 and 4x4 block sizes to predict the macro block from surrounding, previously coded pixels within the same frame. Inter prediction uses a range of block sizes to predict pixels in the current frame from similar regions in previously-coded frames.

In the step of transform and quantization a block of residual samples are transformed using a 4x4 or 8x8 integer transform, an approximate form of the DCT. The output of the transform, a block of transform coefficients, is quantized. Quantization reduces the precision of the transform coefficients according to a QP. In Bit stream encoding the video coding process produces a number of values that must be encoded to form the compressedbit stream.These values and parameters are converted into binary codes using variable arithmetic coding. Each of these encoding methods produces an efficient, compact binary representation of the information. The encoded bit stream can then be stored and/or transmitted. After encode the bit Stream we are generating the secure key for our document security because we have keep some of all the documents are in safe. Next step is to upload all the encoded bit stream files and security key to the server. Now in the client side Both Encoded and Security files are download from the server. then both files are given to the decoding part. Next step is decoding the both files.

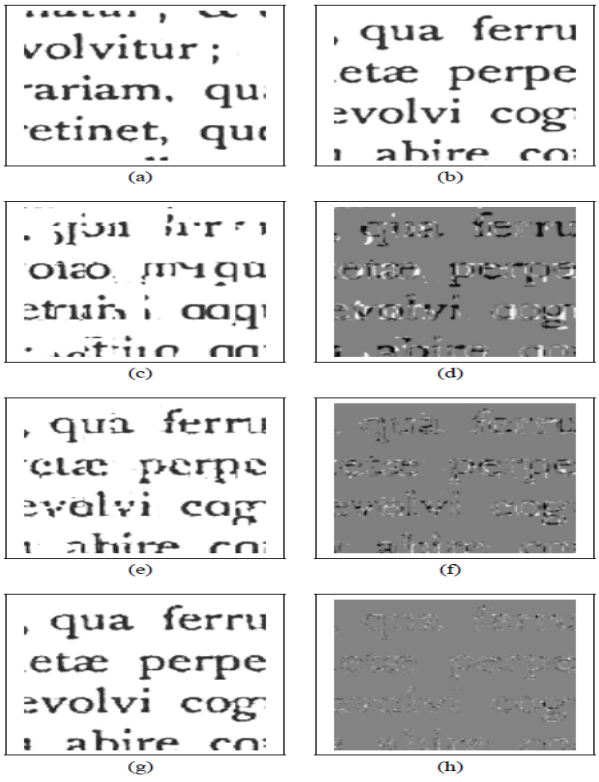

Fig. 3 Approximate pattern matching using inter frame prediction: (a) reference text; (b) current text; (c) predicted text (block size: 16 × 16 pixels); (d) prediction residue (block size: 16 × 16 pixels); (e) predicted text (block size: 8 × 8 pixels); (f) prediction residue (block size: 8 × 8 pixels); (g) predicted text (block size: 4 × 4 pixels); and (h) prediction residue (block size: 4 × 4 pixels) [Adapted from (4)].

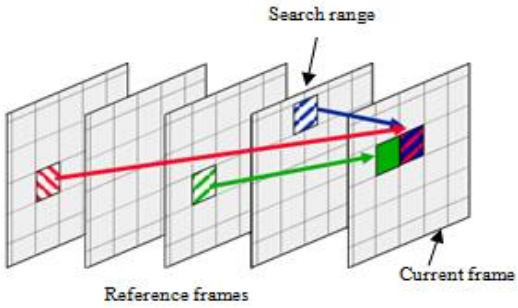

Fig. 4 Block-based motion estimation

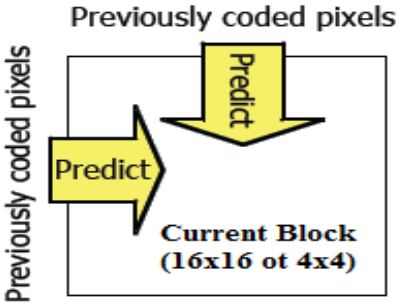

Fig. 5 Intra Frame Prediction

Decoding process is working as follows: First from the Bit stream decoding the bit stream from that encoded file Bit stream is used to find the Encoded Image's width, height; quantization Parameter. A video decoder receives the compressed H.264 bit stream, decodes each of the syntax elements and extracts

the information described above. This information is then used to reverse the coding process and recreate a sequence of video images. In Rescaling and inverse transform the quantized transform coefficients are re-scaled. Each coefficient is multiplied by an integer value to restore its original scale. Then the last step of the decoder is Reconstruction in this for each macro block, the decoder forms an identical prediction to the one created by the encoder. The decoder adds the prediction to the decoded residual to reconstruct a decoded macro block which can then be displayed as part of a video frame. Finally we are decoding I & P frames from Encoded File. Result of this process we can get the files with without loss and also have the high compression ratio. The PSNR ratio value is up to 40 db.

V. CONCLUSION

In this paper, we presented a pre-processing and pattern matching for all our multiple inputs named as multi document coding. AVC is very effective for compound documents. The reason why we decided to use H.264/AVC tools means to enhance our proposed method. Because in interframe prediction scheme is combined with RDO grow an efficient pattern matching algorithm. And also improve the encoding efficiency by combing the methods are intra frame prediction, DCT transform and the CABAC coding.

In this essence of our work to be giving the multiple inputs. Then the inputs are divided into block of data's. If it's a document means split into many pages, video means divide into frames and then given the output to AVC. So the performance of our process is unrivalled. The gain of PSNR ratio value is higher comparable to previous standards. Using the same bit rate also AVC can give the best result for all the inputs. The improved compression performance of H.264 comes at the price of greater computational cost. H.264 is more sophisticated than earlier compression methods and this means that it can take significantly more processing power to compress and decompress H.264 video. In addition the encoder and the decoder outputs are without loss and highly reconstructed quality. Future work is considered to replacing H.264/AVC by the newly developed codec. It should give the better performance compared to other existing codec.

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