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A STATISTICAL FILTERS BASED BLOCK TYPE DECISION ALGORITHM FOR H.264 INTRA PREDICTION

Umamaheshwari[1], Dr. N Manja Naik[2]
Electronics & Communication Engineering, University BDT College of Engineering, Davanagere, India

Abstract: A video is defined as action of sequence formed by a series of images, and each image in the series follows the previous one in the sequence of events .These still images are called video .These Video signals have different characteristics compare to image signals. The most important is that the video signals bare having a camera frame rate of 15 to 60 frames/s, and provides the smooth deception to the displayed signal. Another one is that the video has the ability to reduce transient repetition as well as spatial repetition in video compression methods. Presently, Videos will be of high definition and high quality, hence there is a need for large bandwidth for sending or receiving a video and also large space for storage. Various methods are employed to reduce the redundant data in the video that does not affect on the frame quality but information is compressed. The objective of the video compression is to compress efficiently and along with that distortion introduced during the compression process should be minimized. A digitized video signal is a sequence of still images (frame). Every frame has array of pixels. Three colour components blue, Green and red (RGB) are present in each pixel. But pixels in RGB will be converted to another color space YCbCr. In YCbCr Y represents luma component and Cb, Cr represents chroma components.
Keywords: block type decision; intra prediction; H.2641A Vc.

I. INTRODUCTION

The goal of video coding is to diminish the measure of video information for putting away or transmission purposes without influencing the visual quality. The coveted video achievement rely on upon applications necessities, as far as quality, disks limit and transmission capacity. It is required for compact advanced video applications, exceptionally incorporated ongoing video pressure and decompression arrangements. Really, movement estimation a based encoders are the most generally utilized as a part of video pressure. Such encoders decrease complementary relationship to give more effective pressure. A sequence of still images or frames which represents scenes in motion is called as Digital video. The process which involves the compression and decompression of a digital video signal is termed as video coding.

Presently, Videos will be of high definition and high quality, hence there is a need for large bandwidth for sending or receiving a video and also large space for storage. Various methods are employed to reduce the redundant data in the video that does not affect on the frame quality but information is compressed. Among these strategies some are lossy and some are lossless. In lossless compression, no data is lost during compression. In lossy compression, information is lost and it cannot be retrieved. When comparing, series of frames in a video, usually there will be less or very much less difference among the spatial arrangement of objects. Hence, it is beneficial to send and store only the differences which are found in between successive frames instead of sending and storing the complete picture. This difference frame can be used as residuals frame or sometimes it is referred as differential frame. And the residual frame contains less details than the original frame. Therefore compression is achieved due to this minimization of details in the residual frame.

There are numerous video coding methods propoesd and numerous other researches are as yet going on. Several research papers are distributed each year for depicting new and innovatory compression methods. Be that as it may, the business video coding applications tend to utilize a finite number of institutionalized strategies for video e-compression. Institutionalized video coding designs have a many advantages like:

• Standards simplify the interaction between encoders and decoders from different manufacturers.

• Models make it conceivable to manufacture stages that consolidate video, in which a wide range of uses, for example, video codecs, sound codecs, transport conventions, security and rights administration, cooperate in all around characterized and predictable ways.

•. Numerous video coding frameworks are authorized and thusly there is a hazard that a particular video codec utilization may seize patent(s). The strategies and counts required to complete a standard are particularly described and the cost of allowing licenses that cover these frameworks, i.e., approving the benefit to use the advancement resemblance in the licenses, can be clearly characterized.

A. H.261 Standard:

H.261 was the main video codec with the broad reasonable accomplishment (as far as item support in noteworthy amounts). The primary outline of this ITU-T video coding standard was in 1988 hand was the principal individual from the H.26x family. H.261 was initially intended for transmission over ISDN (Integrated Services Digital Network) lines on which information rates are integer multiples of 64 kbps. The coding calculation utilizes a hybrid of motion compensated between inter picture prediction and spatial change coding with 16 × 16 macro-block motion compensation, 28×8 DCT (discrete cosine transform) , scalar quantization, crisscross scan and variable-length coding. All the consequent universal video coding principles have been constructed on the basis of the H.261 plan.

B. H.262 Standard:

H.262/MPEG-2t coding standard was together created by ITU-T Video Coding Experts Group and ISO/IEC Moving Picture Experts Group in 1994. MPEG-2 video is like MPEG-1, additionally offers help for intertwined video (the arrangement utilized by simple communicate TV frameworks). MPEG-2 video is not advanced for low bit rates (under 1 Mbps), however beats MPEG-1 at 3 Mbps or more. For the consistency of the measures, MPEG-2 is likewise perfect with MPEG-1, which implies MPEG-2 player can play back MPEG-1 video with no change.

C. H.263 Standard

H.263 video coding overtook H.261 as the most dominant video conferencing codec. H.263 has a superior video quality compared to its prior standards at all bit rates, by a factor of two. H.263 Version 1 was developed by ITU-T in 1995. Features which beat H.261 are:

• Variable length coding of 3D-DCT coefficients
• Prediction with median motion vector
• Prediction is Bi-directional
• Arithmetic is the entropy coding.

H.263+ or Version 2 was developed in the late 1997 and early 1998, which has the lot of one features like error resilience, custom and flexible video formats, additional enhancement information and also there is an improved compression efficiency over H.263v1, H.263++ or Version 3, developed in 2000 with having a significant improvement in picture quality, packet loss and error resilience and additional enhancement information.

D. H.264 Standard

H.264/AVC (advanced video coding) standard is the international video encoding and decoding standard. It is used in the transmission of SD and HD TV signals via cables or satellites. H.264 is also used in DVDs to store high quality video signals.

Features of H.264

- Block's variable sizes: when compared to any other previous standards, H.264 standard allows enough flexibility in the choice of block's variable sizes and different shapes used for motion estimation and compensation.
- Multiple p reference frames: the new standard H.264 supports encoder for selection of reference frames from a large number of frames stored in the decoder after decoding.
- Small block size transform: H.264 uses 4x4 transform, whereas 8x8 transform was used by all major previous standards. This helps in representation of the video signal with reduced artifacts.
- YCbCr: YCbCr is the color space used by H.264. In which component Y represents brightness and is called as Luma. Component Cb shows to what extent the color deviates from gray towards blue. Component Cr shows to what extent the color deviates from gray towards red. The sensitivity of human visual system is more towards luma compared to chroma. Therefore, sampling structure in the H.264 will be in the form such that component chroma has quarter of the samples in the luma a component.

II. RELATED WORK

Comparative study of video compression techniques-H.264/Avc, by lMamatha .R.B and Dr. Keshaveni N, In this paper proposed the ITU-T and ISO-MPEG standard developed a video compression standard calledkH.264/Avc. It is more popular with high compression than other earlier standards this paper summarizes the new coding features and overview of the H.264 features. This H.264 improves the coding efficiency, latency, complexity and robustness and also new possibilities to create a better video encoders and decoders with high quality video streams with high bit rates and conversely, the same quality video at lower bit rate. So that appropriate video techniques to meet video application requirements have to be selected.

[2] Selection of prediction modes for intra frame coding in advance video coding standard by Manjanaik N, Manjunath R, In this paper proposes intra prediction modes for intra frame coding using advanced video coding standard in matlab. There are nine prediction modes in intra prediction but all the prediction modes are not required for all the applications intra prediction macro block refers all the previous blocks for prediction to reduce spatial redundancy but it is more complex to use all the prediction modes for computation at the encoder. In this proposed algorithm there are (0-8) modes but only mode 0 tmode1 mode 2 mode 4 and mode 6 are having good PSNR ,high compression ratio and low bit rate and results are obtained using matlab and further PSNR ,bit rate and compression ratio are achieved for different quantization parameters and different video frames.

[3] Efficient block type decision algorithm for H.264/ A VC intra-prediction by Zhou Qiya-in this method The latest video coding standard H.264/AVC significantly increases video compression efficiency but also incurs high computation complexity. In order to reducing the rate-distortion optimization computational cost, a model fitting based block edge pattern detection method is used to conduct the block type decision in H.264/AVC intra-prediction.

[4] A novel fast intra mode decision algorithm using histogram for h.264 video coding by yingzhe liu, jinxiang wang, fangfa fu-in order to achieve compression efficiency, the rate distortion cost (rdo) technique and full checking strategy are used to select the optimal intra prediction mode in the latest video coding standard h.264/avc. as a result, the computational complexity increases drastically. in this paper, a novel fast mode decision algorithm for intra prediction is proposed to improve the coding efficiency. in this algorithm, the histogram of each prediction mode is directly calculated based on the relationship between the pixels and coding modes. then, the several most possible coding modes are

selected from all prediction modes by using histogram.
[5] Enhanced hierarchical intra mode decision for h.264/avc by hao zhang, fengfeng tan and zhan ma-fast intra mode decision algorithms in h.264/avc reduce the encoder computational complexity significantly by eliminating some unlikely prediction modes. however, the encoder speedup typically comes with the sacrifice of the quality loss while such degradation is not negligible in many scenarios. to maintain the encoder speedup enabled by the fast intra mode decision without noticeable quality degradation, a method that estimates the reliability of these fast algorithms based on the rate-distortion (r-d) cost ranking is proposed in this paper.

III. PROPOSED MODEL

The Video compression has a significant part in many in various platforms and it is inevitable to use compression of video in apps like youtube, Netflix, etc. These websites require very huge amount of space for storing. That can be reduced using video compression. It is also helpful during transmission. Compression of video aims at lessening the repeated data in the frames and hence reducing the size of data that can be used for transmission and storage.
L H.264/AVC is accepted as international video coding standard in world wide. It is approved as b recommendation by ITU-T and as International standard AVC by ISO/IEC. It is used for many applications such as standard definition (SD) and high definition (HD) signal transmission over satellite, terrestrial emission, cable and storing of video signals of high quality SD onto DVDs. The demand for higher coding efficiency is created by increase in the services and high definition TV is growing its popularity. The transmission Medias like xDSL (Digital Subscriber Line), cable modem and UMTS (Universal Mobile Telecommunications System) offers very low data rates which is less than broadcast channels, and number of video channels with high quality can be transmitted by enhanced coding efficiency. A number of frames with images as a motion and forms discrete video. Two dimensional sequence of images form video signal by projecting images from dynamic three dimensional (3D) scenes on the video camera’s plane. The video process of compression and decompression is called as video coding. Video coding is performed frame by frame. Every frame which is to be coded is divided into the slices first. Each slice is coded individually and independently. The hierarchy of codec process is as follows: frames – slices – macro blocks – sub macro blocks-blocks – pixels.
The H.264 which is designed to overcome many weaknesses present in earlier standards of video compression has following supporting goals:

- The implementation delivers bit rate reduction to be average i.e., 50% where video quality is fixed when compared to other standard videos.
- Robustness in error. Hence transmission errors are tolerated over different networks.
- Capable at low latency and at higher latency quality is better.
- Implementation is simplified as syntax is straight forward.
- Defines how numerical calculations are made exactly in encoder and decode in order to avoid accumulation of errors.

A video frame which is expressed with relation of one or more neigh boring frames is called to be an inter frame. Inter frame prediction has advantage from temporal redundancy between neighbouring frames where high compression rate is enabled.

Intra frame prediction
In instances where motion estimation cannot be exploited, intra estimation is used to eliminate spatial redundancies. Intra estimation attempts to predict the current block by extrapolating the neighbouring pixels from adjacent blocks in a defined set of different directions. The difference between the predicted block and the actual block is then coded. This approach, unique to H.264/MPEG-4 AVC, is particularly useful in flat backgrounds where spatial redundancies often exist.

Inter frame prediction
Frame need to be encoded is participated into blocks. Video coding format supporting inters frame coding. A particular block of suitable size is considered in the present frame and a similar block of same size is searched in the frame which is considered as reference. This can be achieved by blocks matching d algorithm. If the similar block is found in the process next step is to find out the vectors. Vectors define how much the current block should be moved to reach the position of similar block in the reference picture. This step in the coding process is defined as motion estimation.
The comparison between frames are used to find the similar block in most of the cases success in the coding process is observed. But in some cases there may be error in the matching of block process. These residual values can be identified as error of prediction. Prediction error must also be sent to the decoder. At the decoder side, using the information of vectors and prediction error, the original frame can be recovered accurately

Working of H.264 codec
The H.264 encoder carries out the prediction process, transformation process and encoding process so that compressed bit stream of H.264p is produced. H.264 decoder will perform decoding process, such as inverse transform and reconstruction to obtain decoded video sequence. In the figure 3.1.2, the original video frames are shown which are encoded into H.264, video is represented as series of bits indicated as

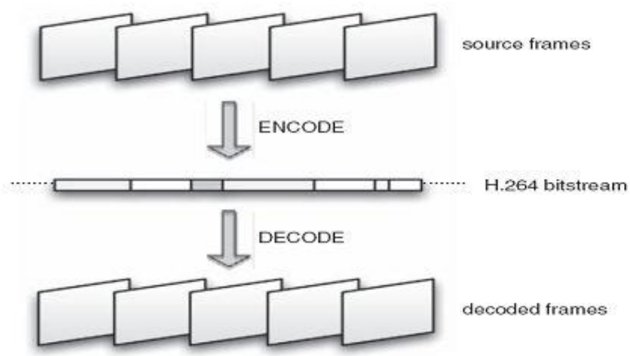


Figure 1 Encoding and Decoding process of video frames

compressed form. The compressed bitstream is used to store or transmit and is decoded to reconstruct the video again. As H.264 is lossy compression, the decoded version is exactly as the original sequence, in lossy compression, small amount of image quality is lost.

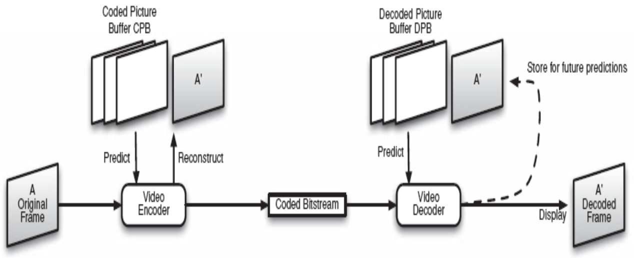


Figure 2 High level video coding process

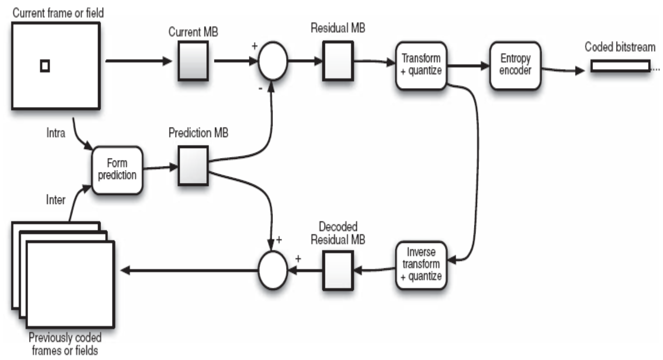


Figure 3 Standard H.264 encoder

A frame is coded using H.264 compatible video encoder as shown in figure 3.3.2. As a part of bits stream code, coding and sending the frame, the frame is reconstructed using encoder i.e. a decoded copy of framed A is created that produced by the decoder eventually. This decoded reconstructed copy is stored in coded picture buffer (CPBi), and it utilized for encoding next coming frames. The coded bitstream is received by the decoder and it decodes frame to display and process further. The decode may save a frame A copy in decoded picture buffer at the same time which is used at the time of decoding the next frames. The figure 3.3.3 shows standard H.264 encoder. Data is processed in terms of blocks corresponding to the size of 16 × 16 referred as macro block. In the encoder, we generate predicted macro block and subtract it from current macro block to reconstruct coded frame and is stored for later prediction. While in decoder, we decode the macro block, rescale and inverse transformation is applied to obtain the residual decoded macro block. The same prediction as at encoder is created by decoder and this residual is added to obtain the decoded macro block.

Encoder processes

Prediction

The current macroblock is predicted by the encoder by using previously encoded data either by using intra prediction from current frame or other frames that are coded and transmitted by using inter prediction. The residual pixels are obtained by subtracting prediction from the current macroblock.

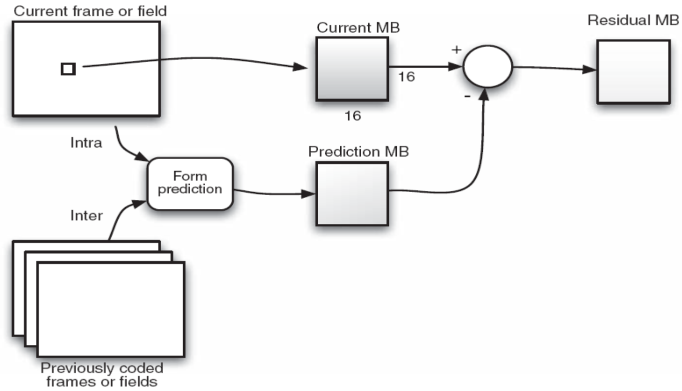


Figure 4 Prediction: flow diagram

The H.264 uses more flexible prediction methods than those used in previous standards. Thus efficient video compression is obtained by enabling accurate predictions. Intra prediction uses block size of 16 × 16 and 4 × 4 for macroblock prediction within same frame considering surrounding and previously coded pixels as shown in a figure 3.2.2.

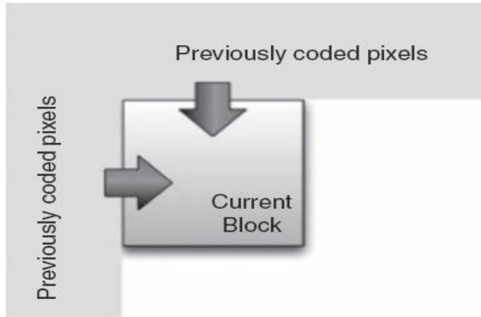


Figure 5 Intra prediction

The current macroblock prediction is formed by extrapolating thep previous coded neighbouring pixels values. Its example is shown in figure 3.2.3. A prediction block of size 16 × 16 is formed which is original macroblock's approximation. The residual block is obtained by subtracting the prediction from the original macroblock.

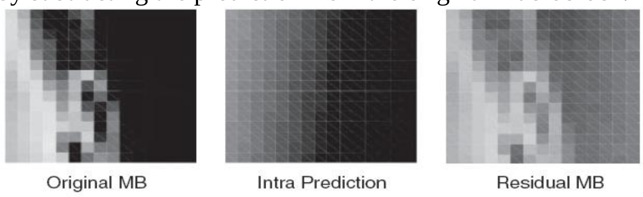


Figure 6 Original macroblock intra prediction and residual

The block size is ranges from 16 × 16 down to 4 × 4 inter prediction to predict pixels in current frame based on similar regions found in previous coded frames. These coded frames might displayed prior to or after the current frame. The current frame's macroblock 1 (MB1) is predicted in most recent frames of size 16 × 16 region. The second macro block (MB2) is predicted using last two coded frames. The upper partition, samples, i.e, the 8 × 16 samples is predicted from previous frames and lower partition 8 × 16 is predicted from next future frames.

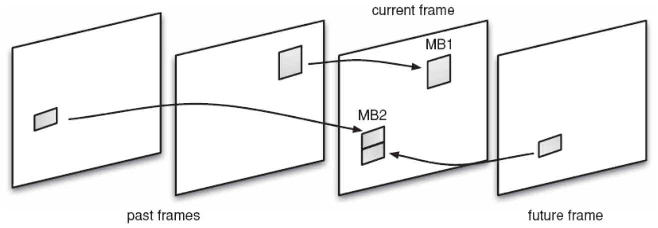


Figure 7 Inter prediction

The original macroblock, its predicted block from previous frame is shown in figure 3.2.5. The prediction macroblock of size 16×16 is appropriate matched macroblock for the current macroblock and the residual macroblock has values near to zero.

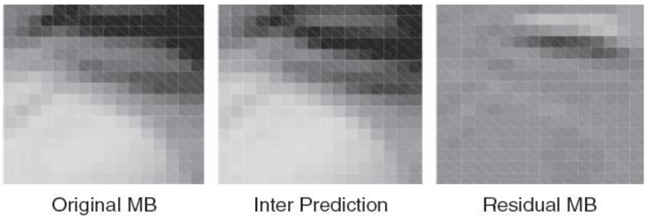
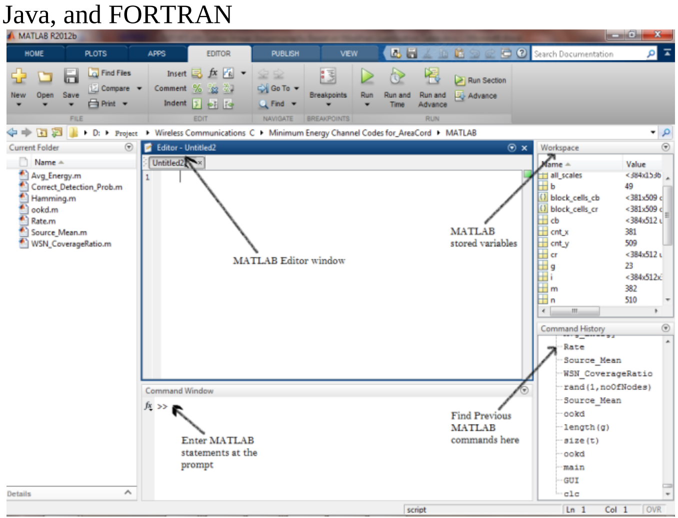


Figure 8 Original macroblock, inter prediction and residual

IV. SIMULATION SETUP

MATLAB (MATrix LABoratory) is a numerical computing environment and fourth-generation programming language. Developed by Math Works, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, Java, and FORTRAN



In 2004, MATLAB had around one million users across industry and academia. MATLAB users come from various backgrounds of engineering, science, and economics. MATLAB is widely used in academic and research institutions as well as industrial enterprises. The main parts are –

- Desktop Tools and Development Environment
- The MATLAB Mathematical Function Library
- The MATLAB Language
- Graphics
- MATLAB External Interfaces

V. RESULTS AND DISCUSSIONS

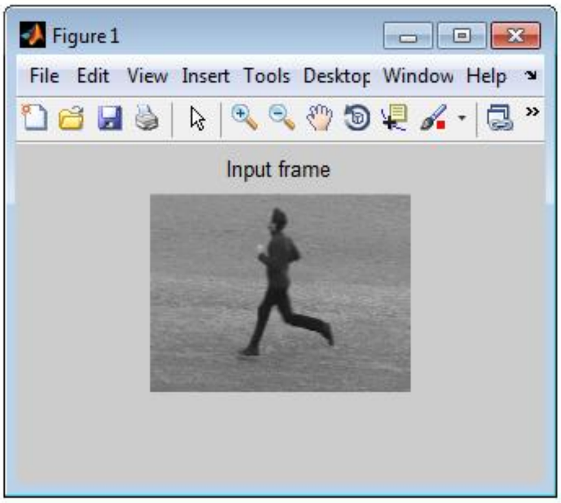


Fig 9 Input Frame

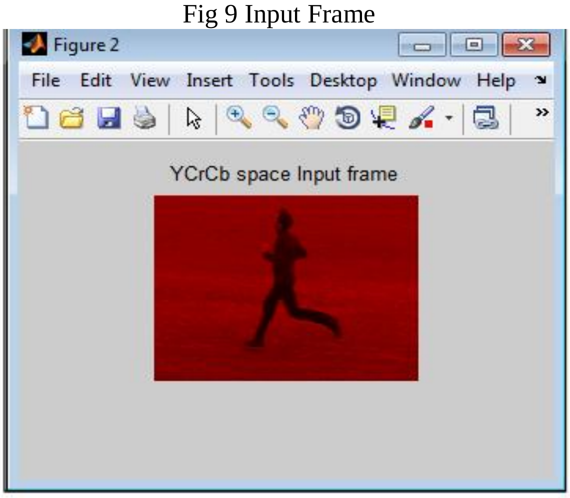


Fig 10-ycrcb space input frame

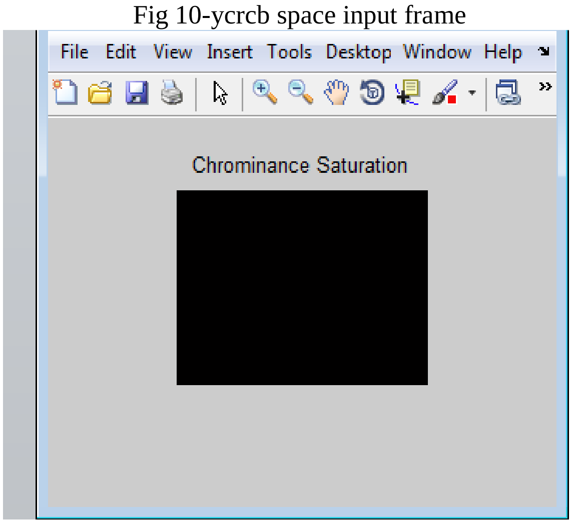


Fig 11-chrominance saturation

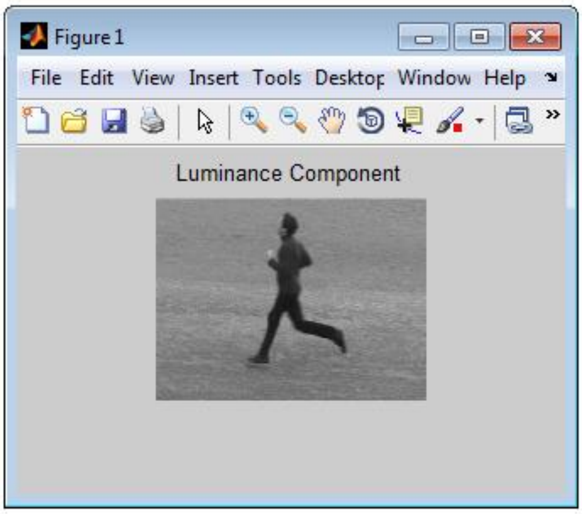


Fig 12-luminance component

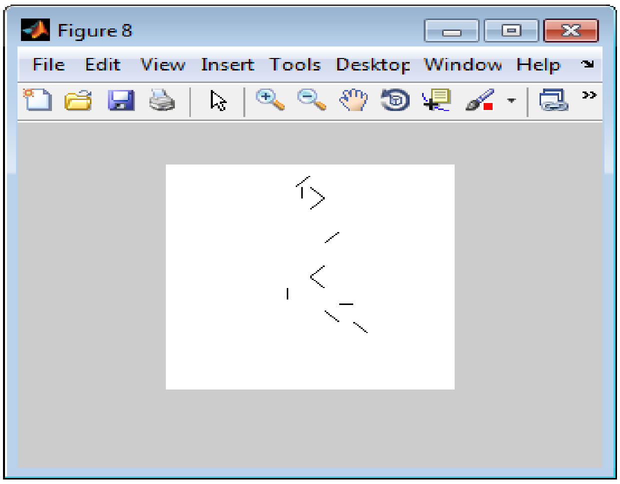


Fig 13-no edge

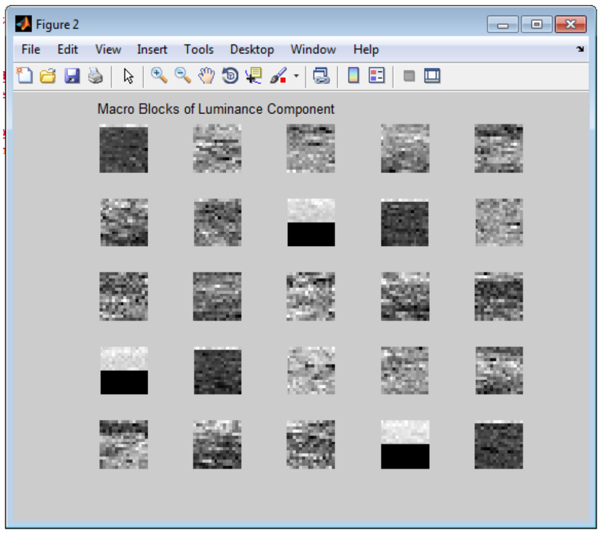


Fig 14-macro block of luminance component

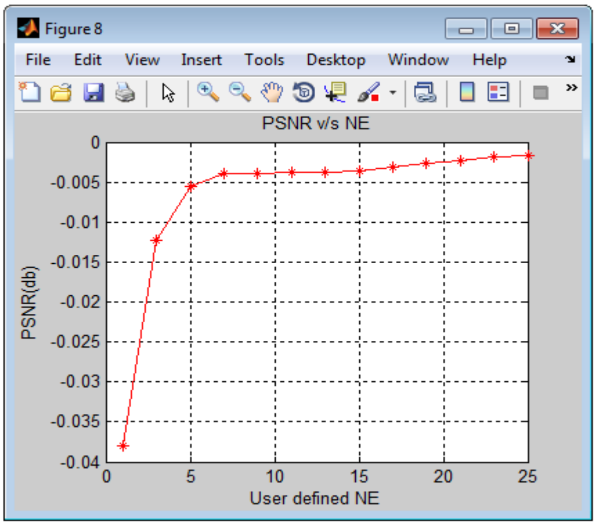


Fig 15-PSNR v/s user defined NE with averaging filter

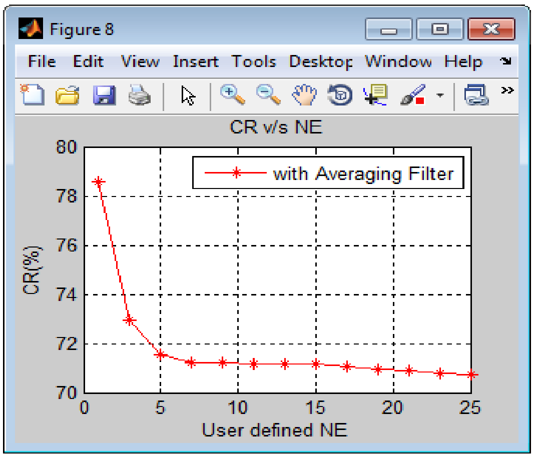


Fig 16-CR v/s NE with averaging filter

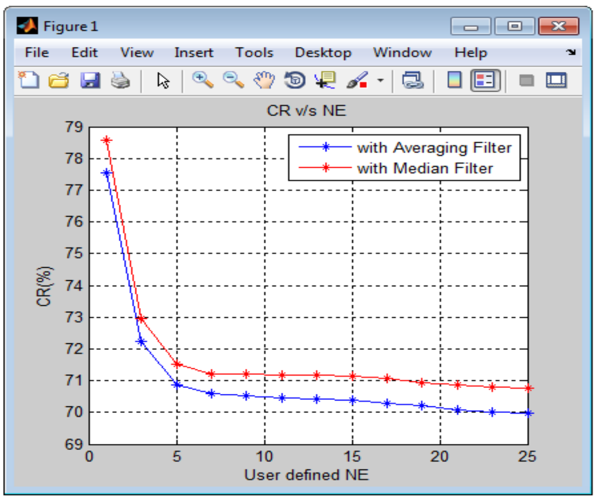


Fig 17-comparision of CR v/s NE with averaging and median filter

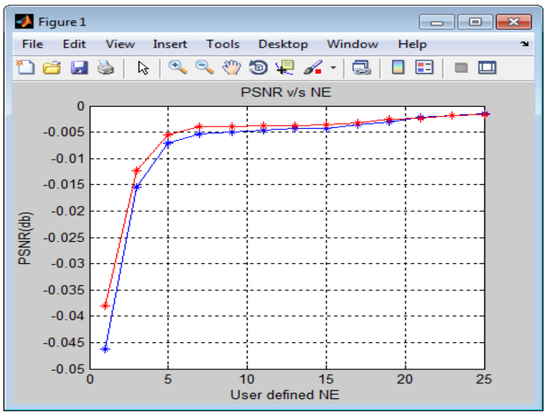


Fig 18- comparison of PSNR v/s NE with averaging filter and median filter.

VI. CONCLUSIONS

According this project we have to conclude the Intra-frame in video coding can be based on block type decision algorithm. Many number of reference pictures are supported by H.264. In This project also explains about getting highest compression using block based decision algorithm. In video coding, We get the highest compression ratio by using the averaging and median filters. The comparison between these two techniques helps to get the highest compression in video coding. And also get a improved PSNR value using only low bandwidth. which in tunrs says that lower noise components are present. and improved compression ratio which says that lesser bandwidth is required

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