International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 04 | Apr -2017 www.irjet.net p-ISSN: 2395-0072

Improvement in HEVC For Reducing Time Complexity With The Help Of SVM Classifier

Ankita S Sawalkar, Prof. Vinay Keswani

Student, Dept. of Electronics and communication Engineering, Vidarbha Institute of Technology, Maharashtra, India
Professor, Dept. of Electronics and communication Engineering, Vidarbha Institute of Technology, Maharashtra, India

---

Abstract - *High efficiency video coding (HEVC) is the latest video coding standard which has been developed by JCT-VC. It consists of efficient coding algorithms. The performance of the latest video coding standard, HEVC, has been improved significantly compared with that of previous standards like H.264/AVC. However the rate-distortion optimization process (RDO) increases computational complexity in HEVC in intra coding as well as inter coding. Here, the goal is to reduce the computational complexity and, at the same time achieving comparable compression efficiency as conventional HEVC using Support Vector Machine (SVM) technique. In this paper, a fast intra CU depth decision algorithm based on support vector machine (SVM) is proposed.*

Key Words: HEVC, AVC, SVM, Coding Unit, CODEC

1. INTRODUCTION

High Efficiency Video Coding (HEVC) is a new generation video compression standard, which provides higher compression capability as compared to the existing video coding standard and provides higher coding performance improvements. HEVC is designed with the goal of allowing video content to have a data compression ratio of up to 1000:1. HEVC encoders can use for reducing computational complexity and for minimizing errors. There are Two key features by which HEVC improved compared to H.264/MPEG-4 AVC was for high resolution video and improved parallel processing methods. HEVC is basically designed to reduce bit rate by half with comparable image quality, but at the same time it increases computational complexity. These computations are mainly because of appropriate Coding Units (CU) in order to view the video content without compromising on quality. So ultimately the timing complexity increases when comparing with its previous standard. In this paper, an improvement in HEVC is proposed to reduce timing complexity with the help of Support Vector Machine (SVM).

1.1 Proposed work

For reducing the timing complexity in HEVC, a support vector machine (SVM) technique is used with the help of MATLAB coding. MATLAB is a machine learning toolbox that includes SVMs. The Support Vector Machine (SVM) is a new and promising technique for classification and regression, developed at AT&T Bell Labs. The technique can be used as a new training algorithm by which various parameters can be adjusted. In this paper we focus on SVM for classification for reducing its runtime complexity. Machine learning algorithm is an effective solution for coding unit selection due to its ability to analyze patterns from extracted features in any given data set. In this paper, an algorithm which is machining learning based is proposed using Support Vector Machine (SVM) to select the proper coding units and to avoid unnecessary computations.

2. HIGH EFFICIENCY VIDEO CODING

HEVC is the newest form of video coding standard developed by the ITU-T Video Coding Experts Group (VCEG) and it can be said that is a next version of the popular H.264/MPEG-4 AVC (Advanced Video Coding) standard. The first version of the H.265/HEVC standard was approved in January, 2013. HEVC uses a prediction method to avoid errors in the signal and thus achieves

highly compressive efficiency. Figure 1 shows the block diagram of the basic HEVC with encoder and decoder design.

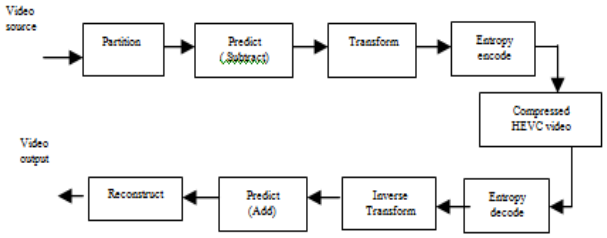

Fig -1: Block diagram of HEVC encoder and decoder

2.1 Working of HEVC:

Video content generates large amounts of data, which is impractical to handle if it not compressed. For example, current Internet throughput rates cannot handle raw uncompressed video at low frame rates or small frame size. Due to this reason video content is firstly compressed by an encoder and then decoded by a decoder that recreates the video data or original data. Digital Video Coding is used to compress the information so it can be stored or transmitted by providing less space. A video Encoder is used for this process and the main goal of this is to optimize coding efficiency. Coding efficiency is the ability to minimize the bit rate which is necessary for representing a video content and maintaining the video quality at a required level. HEVC uses a CODEC for this purpose. A CODEC is an encoder-decoder pair. Most video codec are based on a scheme called as the hybrid model.

In this model, the signal is processed both in the spatial and frequency domain. A video encoder of hybrid model first takes a sequence of video frames from the video source then partitioning each picture into multiple blocks that are processed *i*ndependently. Using inter or intra prediction method, each block is first predicted in the spatial domain and then the difference between the original picture and the prediction called the Residual signal is transformed into another domain in which the samples are represented by transform coefficients .These coefficients are then quantized for removing insignificant values. And finally, the information is compressed by the entropy encoder .A video Encoder performs these steps sequentially and thus a compressed video bit-stream is created. This bit-stream is then transmitted. On the other hand, in the video decoder, this transmitted bit-stream is decompressed to create an exact replica of the source sequence which is nothing but decoded frames. The coefficients and prediction parameters are decoded by which the transform output is regenerated and inverted for obtaining the residual frame.

2.2 Features of HEVC:

The main key features of the latest version of HEVC can be described as follows:

- Achieves wide adoption from the open source community, leading web video services, broadcast encoder developers, independent software developers, video hardware as well as software developers.
- Has a Wide-range variable block-size prediction, with block sizes ranging from 8x8 up to 64x64 pixels and the size of prediction blocks can be adaptively chosen by using a method called recursive quad-tree partitioning .
- Significantly Improved mechanisms for supporting parallel encoding and decoding.
- More intra prediction modes, which can be of several block sizes.

HEVC/H.265 is a standard for video compression with approximately 50% lower bit rates of video quality standards. Over the few decades, MPEG and H.264/Advanced Video Coding were standards used for compression widely used in various multimedia applications. It supports for a variety of image and video resolutions with comfortable compression standards. But, with the increasing demand for high quality video resolutions like High Definition/Ultra High Definition (HD/UHD) these standards are not able to provide comparable compression efficiency. Complexity of HEVC is a major barrier for adopting it on mobile devices and it was necessary to develop a method for reducing computational complexity. So a system is needed to overcome this problem, and can be resolve with the technique called Support Vector Machine algorithm.

3. SUPPORT VECTOR MACHINE

SVM is a supervised machine learning algorithm which can be used for classification. It uses a technique called the kernel trick to transform the data and then based on these

transformations it finds an optimal boundary between the possible outputs. Simply, it can be said that, it does some extremely complex data transformations, and then figures out how to separate the data based on the labels or outputs which are defined. The main goal of support vector machine is to find the optimal separating hyperplane which can maximize the margin of training data. SVM is a supervised learning algorithm. Basically it is a classification algorithm. It can be used to predict if something belongs to a particular class. Fig below shows how it classifies the data.

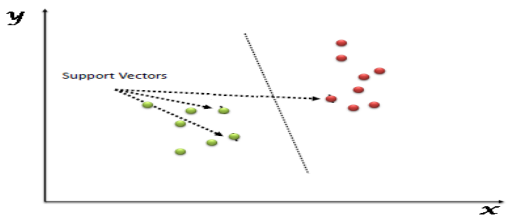

Fig -2: Representation of a Hyperplane

In this algorithm, we plot each data item as a point in n-dimensional space (where n is number of features you have) with the value of each feature being the value of a particular coordinate. Then, it performs classification by finding the hyper-plane that differentiates the two classes very well.

3.1 Working of SVM

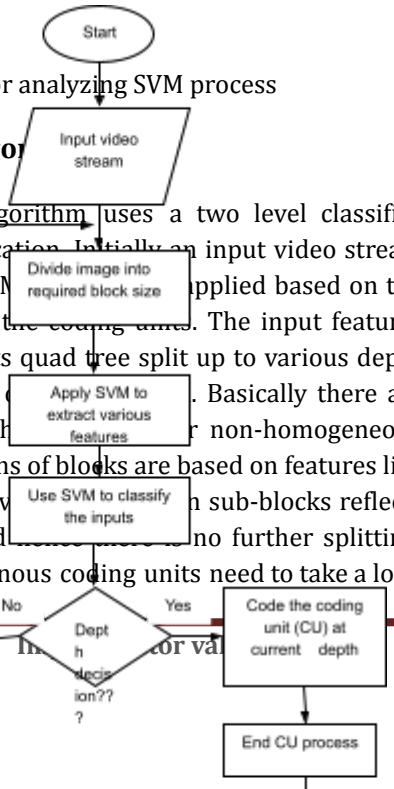

Fig -3: Flowchart for analyzing SVM process

3.2 Working of Algor

The proposed algorithm uses a two level classifier performing a classification. Initially an input video stream is taken and then SVM applied based on the features and selects the coding units. The input features are classified here. Its quad tree split up to various depth levels which depend . Basically there are two sections called h r non-homogeneous sections. Classifications of blocks are based on features like variance where zero v n sub-blocks reflects no active regions and no further splitting. But, the non-homogenous coding units need to take a look for further depths. After exploration, the selected homogenous blocks are skipped from next exploration and then coded. The non-homogenous blocks are further explored which is done recursively for all those coding units for the next depth level 1. This will continue till depth level up to 3 and till all the coding units at all levels for the current frame get classified into homogeneous or non-homogeneous sections. In this way the algorithm works for SVM.

4. REFERENCES

[1] Yen-Chun Liu*, Zong-Yi Chen*, Jiunn-Tsair Fang+ and Pao-Chi Chang*.“ SVM-Based Fast Intra CU Depth Decision for HEVC”2015, IEEE Transaction on Data Compression Conference.

[2] RyeongHee Gweon, Yung-Lyul Lee, "N- Level Quantization in HEVC," IEEE

[3] International Symposium on Broadband Multimedia Systems and Broadcasting (BMSB 2012), pp.1-5, Jun. 2012.

[4] Daxin Guang, Pin Tao, Lixin Feng, Jiangtao Wen, Shiqiang Yang “Prediction Estimation Based H.264 to HEVC Intra Transcoding” 2014, IEEE Transaction on Data Compression Conference.

[5] O. Fajardo, I. Taboada and F. Liberal, "Quality assessment for mobile mediaenriched services: impact of video lengths," Communications in Mobile Computing 2012; http://www.comcjournal.com/content/1/1/2, vol.1, issue.2, Jan.2012.

[6] Xiaolin Shenand, Lu Yu, “CU splitting early termination based on weighted SVM”, EURASIP Journal on Image and Video Processing 2013, 2013:4.

[7] Rashad Jillani and Hari Kalva, “Low Complexity Intra MB Encoding in AVC/H.264”, IEEE Transactions on Co

[8] Yun Zhang, Sam Kwong, Xu Wang, Hui Yuan, Zhaoqing Pan and Long Xu, “Machine Learning-Based Coding Unit Depth Decisions for Flexible Complexity Allocation In High Efficiency Video Coding”, IEEE Transactions On Image Processing, VOL. 24, NO. 7, July 2015.

[9] Iain Richardson. HEVC: An introduction to High Efficiency Video Coding. Vcodex Video compression. 2013