International Journal of Engineering & Technology, 7 (2.33) (2018) 245-251

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Encoding time optimization for intra-frame reconstruction schemes for H.264

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Abstract

The area of transmission compression is gaining a quick momentum by evolving with completely different varieties of compression protocols and coding method. However, majority of the prevailing communication devices still uses H.264 as a customary compression protocol. we tend to reviewed a number of the prevailing system touching on usage of H.264 in video compression to explore it doesn't supply process effectiveness though it's going to supply higher reconstructed knowledge on the receiver finish. This paper introduces A distinctive optimisation mechanism to optimize the coding time by introducing a value perform formulation. The bestowed design runs over typical H.264 and supply worth additional advantage by creating it additional resource friendly. The rule made uses MPEG file as AN input that endure the method of optimisation of coding time used for coding I and P frame. The study outcome of the projected system is found to supply a much better reduction in coding time as compared to existing mechanism of Lagrangian price perform. As a contribution, our outcome shows a much better equilibrium between the info quality of reconstructed signal and therefore the coding time.

Keywords: *Video Coding; Intra-Frame Prediction; Multimedia Files; Encoder; H.264; Bit Stream; Encoding Time.*

1. Introduction

In last 20 years, there are multi-directional technological enhancements that are witnessed within the field of communication [1]. fashionable applications that has been conceptualized in varied domains of business applications like cooperative communication, visual sensors primarily based applications, advanced medical applications, recreation, etc that runs on a synchronal heterogeneous devices and platform right from desktop, laptops, good phones, custom devices until cloud travelling design extended to web of things ar image, transmission and video. The sequential growth of expectations of higher Quality-of-Services (QoS) with general accepted visual quality in real time basis continuously poses an exchange between availableness of information measure, storage, communication, computation and transmission [2] [3] [4]. This can be a core reason for evolution of style of video compression as video codec. The art movement aim is to cope up with the demand of wealthy visual dimension of video streaming application [5] [6]. Traditionally, the essential of the look of video codec were encircled across a bespoke hardware to beat the constraints of restricted process capability by optimizing the machine capability as Associate in nursing objective perform. The inventions of the advanced processor have helped to beat these problems Associate in Nursingd provided an improvement in performance during a reliable manner similarly as they were rate successful and had wider availableness. As a result, the "software solely approaches" of video codec become practicable [seven] [8].

The joint development of ITU-T and MPEG has suggested H.264/AVC as associate trade normal for video compression within the year 2003[9], that delivers five hundredth a lot of compression potency as compared to previous standards also because it supports terribly high video quality over channels of lower bit rates. This improved potency of H.264/AVC paves the inspiration of the many promising and potential applications and services on mobile devices over wireless networks with simple secret writing, transmission and error resilience [10].The gain in high performance on such devices with H.264/AVC is obtained at the terribly high value of computation because the overhead of process for power constraint mobile devices may be a major trade-off as a lot of process needs a lot of power consumption. Therefore, it's associate open analysis drawback to gestate, style and device a mechanism involves into H.264/AVC secret writing processes to attain higher performance with least procedure overhead by low complicated implementations [11] [12]. Typically, an H.264/AVC secret writing method involves removal of abstraction, temporal and applied math redundancy of video signal. The transformation of macro blocks, (a basic secret writing unit of sixteen X sixteen block of displayed pixel) by quantisation of rework domain (spatial frequency components/ co-efficient) from abstraction domain provides the sizable quantity of compression. The complexness of the method is reduces within the H.264/AVC as compared to alternative such process or computation performs by means that of economical implementation of number function and lowest transformation of the block size during this case.

A novel and effective theme to decrease the encoded time intra-frames reconstruction exploitation completely different schemes is projected during this paper. Section a pair of discusses concerning the present techniques of H.264 on the reconstruction of intra-frames followed by discussion of the

analysis drawback in Section three. In Section four a transparent method of the projected methodology is bestowed in conjunction with the discussion of the algorithmic rule. Section five outlines the results obtained from the simulation of the algorithmic rule of the value perform implementation. Finally, in Section half dozen conclusion of this paper in conjunction with the longer term analysis direction is mentioned. ensuing section discusses concerning existing techniques.

2. Existing techniques

This section of document closely investigates associate degreed writes an reasoning regarding intra-frame prediction and a reconstructing mode call of video input signals. Our previous work has already reviewed existing literatures towards H.264 [13]. This section we have a tendency to any update regarding the connected works. Qual et al. [14] within the year 2010 in their paper has classified quick intro postulation mode call into 3 classes supported block options, mode feature, and edge or directional info. for every kind, associate degree algorithmic rule is planned. associate degree algorithmic rule supported mode feature victimisation associate degree unconditional DC mode is being simulated, and it's been discovered that roughly eighty two.13 maximize the encryption time is saved as compared to H.264 reference package, whereas terribly marginal PSNR price is reduced at slight higher bitrates. important Improvement in H.264/AVC cryptography performance might be attainable with full search theme, however there'll be associate degree overhead of machine quality. Song et al. [15] have given associate degree approach of stratified intra-prediction methodology for video application for mobile supported orientation gradient based mostly discretization of total variation. In their methodology, they shrink the candidate mode set within the Rate-Distortion optimisation (RDO) method. it's been discovered that there was low power consumption by the encoder associate degreed an algorithmic rule with less machine quality. the upper compression objective functions of H.264/AVC is achieved by Rate-Distortion optimisation (RDO) technique, there attainable combos of modes has got to be explored to attenuate the rate-distortion value in restricted machine quality. Lim et.al [16] introduces 2 mechanism 1) quick block size call (FBSD) and 2) quick mode call (FMD) by considering a metric referred to as similarity of the upper position pixels and left position pixels severally, that ends up in a discount of machine quality. The simulation fallout shows maxima of seventy nine and seventy seven common instance investments with digressive value in PSNR and bitrates. The cryptography performance of H.264/AVC will improve as per its operative conditions of styles of modes likewise the economical optimisation of the speed distortion so as to pick the for optimum mode. This approach introduces a further overhead to the encoder because it needs reckon Rate-Distortion (RD) worth for the cryptography mechanisms. Jin et al. [17] have planned a way for fast mode assessment particularly for the lay to rest image small block (MB), that minimizes the price for RDO. This methodology approaches to correlate spatial-temporal homogeneity for estimating the price of the motion in each Intra and lay to rest modes. a big cryptography potency is maintained with comparatively lower encryption time. Significance of edge feature is additionally arranged by numerous analysis papers towards economical cryptography theme.

Li et al. [18] has adopted Haar rework Associate in Nursingd conferred an economical technique to reason the block edge characteristics. The results of the coaching was found to considerably minimize the amount of process operations within the edge model determination. so as to confirm optimum video compression technique, it's additionally essential to bear the study of transcoding procedure to ascertain the acceptableness of the compatibility problems victimisation H.264. Study during this direction was dispensed by Liu et al. [19] wherever the authors have thought-about mobile transcoding of MPEG-2 video to H.264/AVC format. the end result of the study shows that energy trend of DCT of macro-blocks of MPEG-2 is probably correlate to the intra-prediction modes of H.264/AVC. Study towards quick intro-coding theme was stressed by Wu et al. [20], wherever the authors have mentioned regarding the prevailing outcomes of the study and showed vital reduction within the encryption time, however, there exist quality video whereas reconstruction. Similar work is conferred by Shen et al. [21], wherever quad tree structured committal to writing Unit (QTS-CU) is employed for provisioning the algorithmic ripping method into N- equal sized block, where N=4. The mechanism exhibits effective correlation among the 3 particularly 1) prediction mode, 2) Motion Vector and 3) Rate distortion value for diverse depth levels and spatially-temporally committal to writing units with overall diminution of forty ninth to fifty two the concerns process complexities on multiple forms of video sequences for various committal to writing mechanisms. Studies toward adoption of orthogonal modes elimination strategy was seen within the work of Peiman et al. [22]. The authors have used RD theory and elite only 1 of the orthogonal modes. Studies towards fast the mode call method is additionally witnessed in literatures for the target of minimizing the amount of ways obligatory to be tested for every macro blocks.

You et al. [23] have used RD theory within the H.264 encoder to reinforce committal to writing performance by considering the accuracy of intra-prediction for successive blocks throughout the mode-decision method of gift blocks. So, the process complexness still exists during this system in spite of increased committal to writing potency. There exist several literatures that witnessed a hardware approach or realization of compression techniques for video as Associate in Nursing FPGA implementation. For higher committal to writing potency, it's needed to furnish higher committal to writing ability. Study in such direction was dispensed by Su et al. [24] to produce the ability between MPEG-2 and H.264/AVC. The investigational outcomes disclose that typical eighty fifth of computation time (a speed-up issue of seven) will be reduced compared to the encryption schemes. however one in every of such vital study for guaranteeing low complexness was discovered within the work dispensed by Bharanitharan et al.[25] that adopts the adopts distinct cross variations for minimizing the unlikely candidate modes within the RDO calculation. The study includes each the vertical furthermore as horizontal distinction among multiple locations victimisation edge options vector. The results of the reading was tested on VLSI style showing the resultant as fifty six reduction in encryption time. it's essential the video compression technique ought to be additionally tested on artistic movement video file formats like UHD format. Studies during this direction has been carried by Lin et al. [26], within which the authors illustrates Associate in Nursing reticulate block rearrangement scheme(IBRS) with a preliminary mode call methodology to resolve the information dependency between intra-mode call and reconstruction method in their encryption mechanism with seventy seven diminution of process complexness, any additional studies on rule potency on video compression was conceded by Lin et al. [27], wherever the authors proposes Associate in Nursing economical cascaded mode call MPEG to

H.264 I-frame encryption. the end result of the study shows economical PSNR, bitrates and reduced computation complexness performance. Therefore, there square measure varied techniques towards encryption system conferred in existing system.

3. Research issues

With the high degree of compression and very well seeing in resource constraints heterogeneous systems area unit expected, a search approach driven by specific modality or service wants is unlikely to guide to coherent subject field solutions for the general drawback of superior video compression. analysis investigation should be structured around broad queries that apply to wide areas of the planning house. There area unit many major areas of study in superior video compression. These area unit Mode call, Mode Prediction, Motion Estimation, adaptive Transmission and Quality-of-Service (QoS) optimisation, committal to writing and Transcoding and at last the safety.

Various problems with video compression known in planned system area unit as follows:-

- Existing video compression standards e.g. H.264 guarantees superior compression however doesn't ensure best quality of the video.
- Existing video compression algorithms encounters challenges of compatibility problems in varied resolutions on completely different mobile devices.
- Existing video compression algorithms involves expensive mode call method creating time period encryption tougher.
- The Higher process complexness of existing de-blocking filter not supported by existing H.264.
- The statement of the matter goes as" to style a framework to perform a quick intra prediction mode call to balance the trade-off among signal quality and price effectiveness in computation."

4. Proposed methodology

This work is Associate in Nursing extension of our previous work wherever we've got given a completely unique intra-frame prediction technique victimisation multi-mode theme with compression [28] [29]. The planned mechanism principally incorporates novel characteristics of intra frame prediction mode by dominant the cryptography time. The prime contribution of this paper is to get a cardinality of coded entropy bits directly once the division operation over remodel constant is perform employing a novel price perform. the prevailing system uses Lagrangian price perform [30] so as to get the elite prognostic mode with least price of rate distortion. the traditional technique of computing price is to feature up total of square distinction (block-reconstructed block) with product of division parameter's exponential and original information in type of bits needed for playing cryptography operation. so as to include novelty in existing H.264/AVC a particular modification incorporation employing a best price perform is completed by computing the aggregation of the distinction is taken same with Associate in Nursing alteration of the second parameter within the price perform considering the merchandise of exponential and x times the division parameter to save lots of procedure cryptography time whereas bit-streams thought. The prime contribution for the minimisation of the cryptography time is that our planned method of price perform computation is disbursed considering distinction between foreseen block and supply block. Therefore, the conception is totally freelance of any reconstructed block whereas computing the total of distinction. Therefore, it's important conservation of procedure resources yet as cryptography time. The schematic diagram of the planned system is exhibited in Fig.1.

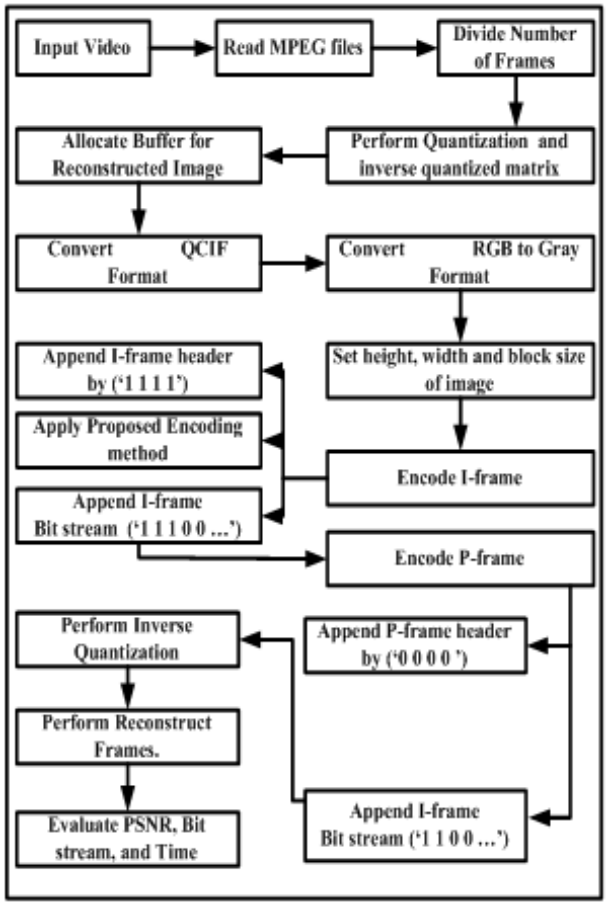


Fig. 1: System Architecture of the Projected Technique.

The planned study adopts analytical techniqueology that applies a typical reconstruction method for info stream. The planned framework considers Associate in Nursing info define with Associate in Nursing finish goal of coding, wherever all packet is subjected to handling victimization below mode prediction technique. within the planned technique of H.264 encoder arrange, the anticipated macro block is created relying upon the recently created reconstructed image. Here, the input video is split into variety of frames, then every frame is subjected to division. The encoded I-frame is appended by the I-frame header by '111 1'. The signal is append with I-frame bit stream by 11100. Similarly, the P-frame is encoded by appending P-frame header by '0000'. The planned system then apply inverse division theme. The planned framework in addition performs totally different numerical operations like division, and backward operation. By receiving scalar division procedure within the planned framework, the analysis is finished. ensuing section discusses regarding the formula being enforced for this purpose.

5. Algorithm implementation

The algorithmic rule description for the minimizing the secret writing time throughout intra prediction mode call is represented during this section. The algorithmic rule takes the input of the video go into order to scan and restore the digitized

knowledge within the type of matrix. The steps of the projected below frame prediction is as follows:-

Algorithm for Intra-Frame Prediction

Input: n (number of frames), I (I-frame), b_s (size of macroblock), h/w (height and width of frame), H (Header), QP (Quality Parameter)

Output: I_{rec} (Reconstructed Image)

Start

1) init *n*, I, b_s, QP
2) [*h w*] size (I)
3) extract H
4) bitstream [H '1111']
5) For all seq
6) Seq=cost_func (seq, QP)
7) End
8) Frec Seq
9) Encode P-Frame
10) Extract Irec

End

The casings, in particular I-outlines are separated by preparing the video information. The factors to the calculation incorporate 1) Number of Frames, I-outlines, 2) Size of the large scale hinders alongside the introduction of N-casings and Quality Parameter (QP). The way toward encoding setup starts by piece measure with figured tallness and width. The initial segment of the encoding procedure includes the utilization of header. The trustworthy parameters of header network are tallness 'h', width 'w', quality parameter, first and last casing. Every one of the components of header lattice are mapped in type of another grid called as bits. The second step is to complete encoding I outline. For this reason, I Frame header '1111' is annexed with the bit-stream took after by extraction of the I outline. We apply a novel cost capacity of intra-outline forecast mode choice that is in charge of getting lessened encoding time. The target work as a cost work likewise planned with input parameterization of casing of grouping and quality parameter of the video which at first concentrates the measure of the arrangement. The calculation for cost work peruses the line (m) and section (n) component of the casing with a distinction of 16 units took after by extraction of coded header. A restrictive develops C in framed with two variable I and j whose esteems compares with a progression of components begins with (m, n) and finishes with (m+15, n+15) with a distinction of 4. Henceforth, we consider the state of no expectation when both I and j esteem relates to 1. So also, we consider level expectation for I esteem comparing to 1 and vertical forecast if j esteem is relating to 1. We additionally apply encoding utilizing Golomb codes genc that figures the distinction of present and past edge. Another capacity of cost advancement is utilized which is for the most part in charge of limiting the coding blunder. It utilizes whole number based change took after by quantization and encoding. This capacity altogether control the reaction time of the calculation while performing encoding task. The means of the calculation are demonstrated as follows:-

Algorithm for Cost Function to Minimize Encoding Time

Input: Seq (Sequence), QP (Quality Parameter)

Output: Seqnew (new sequence), bf (bit frame)

Start

1) For 1<[(m, n)+16]<h
2) For (m, n)<[(i, j)+4]<((m, n)+15)
3) If predmode=C
4) apply genc(mode)
5) extract seqnew=bf→costopt
6) End
7) End

End

Subsequently, the calculation can altogether limit the encoding time and in addition possibly upgrade the flag quality. The critical strides of the total proposed strategy that is engaged with the procedure of cost enhancement amid the encoding procedure are as per the following:

Input: V (Video file)

Output: PSNR, Bit Steam, Time

Process

Vobj read (V)

Iframe Vobj . Iframe

Initialize, Q [] (Quantized), IQ [] (Inverse Quantized)

Irecons Irecons + Buffer

IQCIF Irecons

Igray ←IQCIF

Operation: quantization

Initialize, h, w, Block Size

I-frame, P-frame encoding

Irecons

Output: PSNR, Bitstream, and Time.

Accordingly, the proposed procedure is a multi-variation advancement issue to address both the computational cost minimization alongside the flag quality expansion, while performing quick intra forecast mode choice. The following segment talks about the outcomes acquired from the proposed calculation execution.

6. Result discussion

This area examines about the outcomes being expert from the proposed contemplate. A standard dataset of video has been utilized for this reason [31]. The execution investigation of the proposed cost work is benchmarked with the Lagrangian taken a toll work (LCF) [30] as examined into table 1,II and III. Table 1 highlights the videos being used for the experimental purpose to check the outcome.

Table.1: Input Samples Used in Study

Samples	Visuals	Width x Height	fps	Pixel Aspect Ratio	Frame Count
akiyo_qcif.y4m		174 x 144	29.9700	1.0940	300
stefan_qcif.y4m		352 x 240	29.9700	0.9116	300

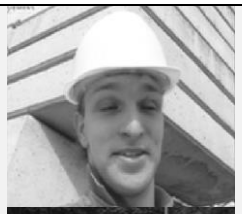
foreman_qcif.y4m		176 x 144	29.9700	1.0940	300
bus_qcif_15fps.y4m		176 x 144	15.000	1.0940	75
carphone_qcif.y4m		176 x 144	29.9700	1.0940	382
coastguard_qcif.y4m		176 x 144	29.9700	1.0940	300
football_qcif_15fps.y4m		176 x 144	15.000	1.0940	130
hall_monitor_qcif.y4m		176 x 144	29.9700	1.0940	300

Table.2: Numerical Outcome of Comparative Analysis

		PSNR (in Db)	Bit Rate	Time
QP=10	Existing System	51.309246	82449	1.405868
	Proposed	51.311807	81903	0.889985
QP=20	Existing System	44.036294	41261	1.160511
	Proposed	44.013944	40626	0.659345
QP=30	Existing System	36.988412	21396	1.016958
	Proposed	36.835525	20560	0.537038
QP=40	Existing System	30.690866	10900	0.951112
	Proposed	30.310959	9875	0.474535
QP=50	Existing System	25.207087	6607	0.937178
	Proposed	25.746159	5153	0.451811
QP=60	Existing System	18.492552	5072	0.935437
	Proposed	18.061154	4156	0.448822
QP=70	Existing System	6.862703	3325	0.928945
	Proposed	6.862703	3325	0.446361
QP=80	Existing System	6.862703	3325	0.932080
	Proposed	6.862703	3325	0.440141

Table.3: Extensive Numerical Outcome of Comparative Analysis

		Bit rate (bits)	PSNR(dB)	T (Sec)	Bit (%)	PSNR (%)	T (%)
Sample 1	Existing System	148977	36.5773	5.5236	2.7232	-0.18229	45.0325
	Proposed	144920	36.6439	3.0362			
Sample 2	Existing System	23017	37.6592	1.2842	2.9761	0.2181	47.7712
	Proposed	22332	37.5771	0.37072			
Sample 3	Existing System	30294	36.6865	1.3295	-12.4975	-0.092508	44.2588
	Proposed	34080	36.7204	0.74107			
Sample 4	Existing System	53596	35.0445	1.5938	3.5394	0.016188	42.7221

	Proposed	51699	35.0389	0.91288			
Sample 5	Existing System	29074	37.3363	1.3323	-0.08598	0.3379	46.5026
	Proposed	29099	37.2101	0.71272			
Sample 6	Existing System	41766	35.3225	1.4334	4.1325	-0.39421	45.6939
	Proposed	40040	35.4617	0.7784			
Sample 7	Existing System	57235	34.8141	1.5117	1.7489	-0.54609	41.4688
	Proposed	56234	35.0042	0.88483			
Sample 8	Existing System	27747	37.8041	1.2842	4.7969	0.0082311	48.0242
	Proposed	26416	37.7983	0.66748			

The investigation result demonstrates that proposed framework offers potential advantages with regards to execution parameters. Despite the fact that, the bit rate execution is almost comparative in both proposed framework and also the current framework relating to cost work, yet a huge result can be found in the estimation of the Peak Signal-to-Noise Ratio (PSNR) and encoding time for different utilize cases. The prime explanation for this predominant result of proposed framework when contrasted with existing framework is that current framework influences utilization of Lagrangian to cost work which isn't joined by any type of cost enhancement activity. Despite the fact that, it utilizes a scalar increase that definitely accelerates the procedure in existing framework, yet it does as such at the cost of flag quality. The prime intention of the proposed system is to limit the encoding time is acknowledged with potential lessening in encoding time while performing quick intra forecast mode choice. Aside from this, the computational handling time for both I and P outline encoding for existing framework is observed to be 6.32205 seconds while that of proposed cost work is observed to be just 0.23318 seconds. There is no putting away procedure of any type of transitional memory amid the execution procedure and each rationale of the proposed framework is composed to be executed in run time itself. Along these lines, there is capacity multifaceted nature either. Regardless of whether we have utilized littler picture measure, the execution for greater picture sizes are likewise led to see that proposed framework offers prevalent diminishment of encoding time when contrasted with the current cost Lagrangian cost work.

7. Conclusion

At exhibit, there are different video pressure plans with the developing usage of H.264 in video records. Our examinations demonstrate that just by receiving H.264, the pressure of MPEG record can be guaranteed, however it can't guarantee financially savvy intra-outline coding strategies. The prior writing have seen distinctive plans and techniques to update and notwithstanding analyzing the H.264 standard using diverse strategies. From this region, we can watch that there are entirely different research work focusing on H.264 to updating the standard by all the additionally focusing on the computational multifaceted nature, while not a lot of studies were seen with more highlight on enhancing the coding profitability. Therefore, consequently, it is critical to understand that intra-outline expectation and recreation completed utilizing traditional strategy isn't asset agreeable in spite of the fact that it might offer great flag nature of remade result. In any case, this issue is tended to in the proposed ponder by a novel cost work. The outcome acquired in this paper gives an examination of both the strategy, and it presumes that our proposed technique gives less encoding time to encode the intra outlines. Our future work will be toward additionally limiting the computational intricacy related with intra-expectation mode choice in H.264/AVC and outfit three unique calculations e.g. I) Algorithm for Intra-Frame Prediction Mode Decision, ii) Algorithm for Optimization utilizing De-blocking channel.

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