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A New Method to Avoid the Heat Dissipation Problem

Abdullah Shawan Alotaibi
Department of Computer Science, Shaqra University, Saudi Arabia

Abstract: This study presents a novel scheme of video coding structure called Localized Video Coding (LVC) infrastructure. Not at all like the current video coding principles, LVC is a video coding structure that is parallel-accommodating. LVC will isolate a video grouping into a few sub-arrangements and procedure them independently. LVC is a non-traditional method to parallelize video coding process, planned for taking care of the current issues of heat dissipation in chips. Each sub-sequence can be coded or decoded in an alternate processing unit and LVC can control a processing unit to rest or work. Thus, we can without much of a stretch exchange the assignments from an overheated processing unit to an ordinary one. In this study, we will present the LVC structure and show the outcomes. At that point, we will give a case of an improved technique that shows an enormous decrease in the processing time of an entire video sequence too an empowering video coding performance compared with the HEVC Tiles (Sullivan *et al*., 2012). The coding effectiveness of the proposed strategy. There is an average of 3.35% coding losses, in light of the fact that the proposed strategy just uses neighbourhood data. The processing time of LVC is not exactly 50% of the stay on an ordinary quad-core processor in a general CPU. In addition, the turn procedure in the proposed calculation can be hardware quickened effectively which means we can further reduce the processing time.

Key words: Localized video coding, LVC, parallelization, heat dissipation, fractal coding

INTRODUCTION

The Financial expert in spring twelfth 2016 declaimed the finish of Moore's law that creation transistors littler will never again ensure that they will be less expensive or quicker. The eventual fate of processing lies in software, "cloud" calculation and specialized chips.

The (figuring intensity) computing power of one single CPU coreis restricted by its clock speed. Yu (1996) 20 years back, estimate that the CPU clock speed would arrive at 4GHz in 2006. Notwithstanding, the 4GHz CPU in the end showed up in 2011 and has not improved much from that point forward. Furthermore, it is practically difficult to continue to build clock speed to arrive at 5GHz in one CPU core as said. The key issues behind the end of Moore's law are essentially because of intensity utilization and heat dissipation.

A typical comprehension is that as clock speed builds, control utilization increments exponentially and consequently the warmth scattering turns into a significant issue. So, as to secure the chips and offset performance with heat scattering, restricting the clock speed and expanding CPU cores have been as of late utilized in CPU plans. That is really a stage for parallel processing.

As a common accepted solution, in a committed framework on a chip, the numerous processing unit structure enables a few units to rest and a few units to work. This structure can control the units to switch among dozing and working status to determine heat scattering.

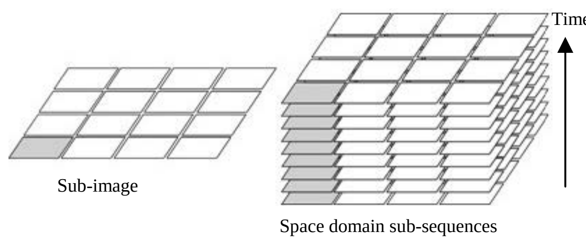

Fig. 1: Discussion of sub-images and space domain sub-sequences. Gray areas denote a sub-picture or a space domain sub-sequence

The rest of the issues are the manner by which to parcel the data and how to process the data all together, to arrive at the average generally framework performance.

In this study, we will indicate two sorts of parallelisms, processing parallelism and data parallelism. Video coding and unravelling require an enormous measure of data getting to and high processing velocity. The processing and data parallelisms are important for superior and effectiveness. H.265/HEVC, the most up to date video coding standard declared in 2013 by ISO/IEC JTC1 and ITU-T are completely thought or pseudo parallel. The completely focused engineering uses best assets for the processing speed and the data get to. The pseudo parallel design utilizes an autonomous processing unit yet uses shared data since it has no data parallelism. To accepted solution both processing and data parallelism, first we should discover a system that can expand the general coding effectiveness. The exhibition ought to in any event approach that of the pseudo parallel engineering. Second, structuring circuits to understand the strategy in light of coding performance and processing multifaceted nature is our future work.

H.265/HEVC included many coding apparatuses, for example, square size-versatile Motion Estimation (ME), new in-circle channels, new de-blocking and SAO. Despite the fact that these tools have altogether improved performance over the past H.264/AVC, they have brought tremendous additional figuring unpredictability. Additionally, video codecs now should bolster increasingly elevated goals, for example, UHD, 8 K and 16 K and considerably higher for VR recordings. As goals rises, the hazardous development of calculation in video disentangling makes it hard to be constant decoded and far more atrocious for encoding.

We propose in this study, a Localized Video Coding (LVC) foundation to parallelize the video coding/decoding process. LVC can collaborate with a numerous processing unit structure and its working procedure (Fig. 1). LVC is a genuine parallel video coding scheme for both (processing parallelism and data parallelism) both processing parallelism and data parallelism. A local tool must influence different sections in both encoding and decoding process, without data overlapping.

MATERIALS AND METHODS

Video codec parallelization tools: A few tools created by specialists in JCT-VC of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, like slice, Tiles and wavefront parallel processing (WPP) (Henry and Pateux, 2011), intend to parallelize the disentangling procedure. These tools separate a video arrangement into sub-sequences in a space area, however we accept that none of those devices procedure the sub-sequences absolutely independently, so they are not data parallel. For functional use, one sub-grouping requires data from other sub-arrangements. Such the exeSliceives for the coding and disentangling procedure is progressively suitable for a universally useful PC rather than specific chips.

Slice mode in H.264/AVC partitions a video into sub-sequences by fixing the quantity of macro blocks (mb) for a Slice. The number, decided in an encoder, is generally enormous so that there won't be an excessive number of Slices. On the off chance that the quantity of Slices is huge, it will prompt prejudiced misfortune in performance. A deblocking channel can cross the Slice limit, prompting another defect of Slices in parallel processing. Having the option to cross the Slice limit implies a later Slice needs to hold up until its past Slice is reconstructed. Here and there, a Slice is progressively similar to an apparatus going for heartiness rather than parallelism.

To replace slice in HEVC, Tiles make a superior showing in rate control than slices. Tiles draws vertical and even boundaries along the biggest coding unit (LCU) for the present image and change the sweep request in both the coding and the interpreting procedure (Fig. 2). In any case, when the present coding square picks a between forecast mode, the motion vectors can cross Tile limits in their reference picture (Chi *et al*., 2012). It implies one Tile needs data from another Tile's district, so, Tiles is a non-neighbourhood tool. The reference data for the forecast can spread spatially with time which is an issue for data parallelism.

The motion vector threads from one Tile in frame F_i to Frame F_{i-1} at that point to Frame F_{i-2} which means the reference data for bury forecast may cross the Tiles' limits. Such a reference data district can develop and in the long run spread the entire picture spatially (Fig. 3).

In HEVC WPP, each LCU row is a thread, so WPP doesn't break the horizontal dependency in a video. To protect Motion Vector (MV) dependency and procured probabilities, after the second LCU of the upper LCU row is handled, another LCU row can instate its own setting by taking data from an upper LCU push (Fig. 4). One

1	2	3	7	8	11	12	13
4	5	6	9	10	14	15	16
17	18	19	26	27	32	33	34
20	21	22	28	29	35	36	37
23	24	25	30	31	38	39	40

Fig. 2: Tiles partitioning strategy and new process order

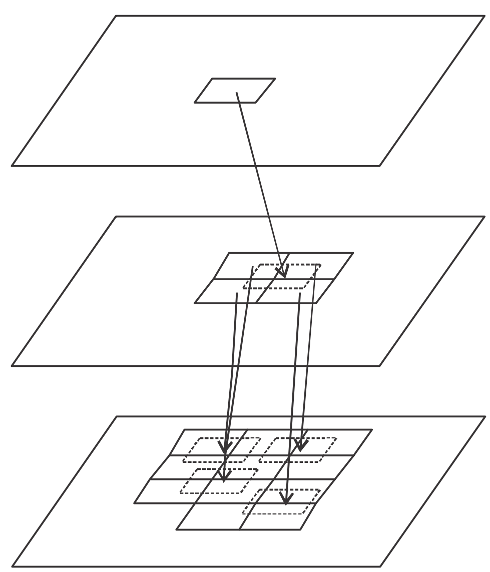

Fig. 3: Motion Vector threads and reference data positions

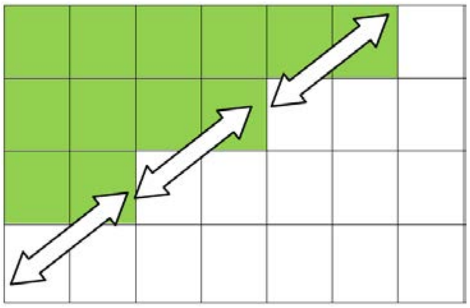

Fig. 4: WPP starts each LCU row

advantage that makes WPP remarkable is the fixed encoding and interpreting partitioning plan; each segment is one LCU push. Also, WPP can con-sider both performance and parallelism. However, the deficiencies are additionally clear that each thread can't start simultaneously and the upper LCU column must process two LCUs quicker than the LCU push beneath to ensure dependency crosswise over LCU rows. Clearly, WPP shares data crosswise over LCU pushes, so, it can't be applied crosswise over PCs/units; in this way, it is a non-neighbourhood strategy.

A few researchers have proposed parallel encoding work where a two dimensional Particular Worth Decay for video is utilized (Cao and He, 2014; Mahfoodh and Radha, 2013) proposed 3D tensor video coding. The previously mentioned techniques performed well yet they are not yet down to earth on the grounds that the calculation intricacy is huge to such an extent that clients can't endure it.

Considering hardware/software co-structure (Van der Tol *et al*., 2013) raised two dividing techniques in H.264, practical partitioning and data segmenting. Utilitarian dividing dismantles codec into processing modules as per its capacity which averagely fits with hardware performances. Data partitioning dismantles pictures without changing software. However, because the data dependency constrains the coding scan order, the data partitioning needs to be carefully considered.

A trail in coding the sub-sequence: Since, the advantage of multi-core (or multi-processing unit) must be extremely effective when the parallelism can be abused by Amdahl's law, Figure 4 WPP starts each LCU row after the second LCU of the row above finishes.

Extent of parallel calculation ought to be as huge as conceivable to acquire better parallel proficiency and reduce processing time (Amdahl, 1967). In any case, the current institutionalized video codec calculations are not parallel accommodating. They have to process data in huge scale and have profound impedance in data.

We propose a novel scheme of LVC for high processing and data parallelisms. Above all else, we partition a video sequence into a few sub-sequences of a similar size N×N in a space area for a present picture and furthermore for each reference picture (Fig. 1). In this study, we give a case of N equivalents to 128 pixels which not just flawlessly fits the square parceling structure of current codecs, yet in addition shows the predominance in parallelism of the proposed calculation. Not at all like the Tiles ought adaptable segment size have we stressed that all sub-sequences to have ought a similar size and all sub-pictures in a sub-arrangement to have the equivalent spatial outskirts.

Each sub-sequence will be prepared in one particular chip-processing unit. It is unequivocally pushed again that, the size of each segment must be the equivalent. Just in the event that they have a similar size can we effectively move the data starting with one processing unit then onto the next when the first processing unit is overheated.

This plan can apply to all goals and is especially appropriate for high goals recordings that is, filling N×N squares to a huge estimated video spatially. The main concern is the quantity of the N×N segment s.

At the point when we settle the LVC infrastructure, the accompanying issue is the way to raise the coding effectiveness for each sub-sequence.

After the sub-sequenceapsegmenting, we process the sub-arrangements by conventional strategies. This trial is directed on HEVC reference software HM, version16.9, arbitrary access setting. We use HM as aanchor to encode the full sequence. The tried is a straightforward LVC that we use HM to encode each 128×128 sub-arrangement and ascertain the BD-rate and BD-PSNR for the entire sequence. Under the exploratory conditions appeared in Table 1, we get the outcome appeared in Table 2.

Table 2 presents the coding performance drops 7.25% in the BD-rate overall. Particularly at the parcel limits, the nature of remade picture is unsatisfactory. The explanation is that the residuals vitality near limits is a lot higher than the centrals which can be found in Fig. 5 (white pixels speak to high vitality or a huge forecast error). Thus, we have to reduce the debasement of the limit performance.

The changing technique utilized in Fig. 5 is that we separate the remaining data and scale every single lingering an incentive with a steady to make them detectable.

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Table 1: Shows experiment conditions for Table 2

Deblocking	SAO	ALF	Fast search	Frames per sequence
On	On	On	TZ search	150

Table 2: Bitrate (In KB/S) and Weighted PSNR (In DB) for all tested video sequences

Sequence	Resolution	Frame rate	QP	Reference bitrate	BD- PSNR	Tested bitrate	BD- PSNR	BD-rate (%)
Traffic	4 K	30	22	99,881	43.32	102,420	43.30	5.7
			27	56,385	40.11	58,688	40.10	
			32	32,226	37.05	34,259	37.02	
			37	18,229	34.02	19,875	33.98	
Kimono	1080 p	24	22	17,207	43.02	17,796	43.18	8.7
			27	9886	41.66	10,427	41.86	
			32	5928	39.8	6443	40.16	
			37	3512	37.36	3984.6	37.77	
Cactus	1080 p	50	22	105,087	40.57	105,680	40.51	5.1
			27	49,156	37.85	50,946	37.84	
			32	26,923	35.55	28,617	35.56	
			37	14,702	33.05	16,127	33.08	
BasketballD-rive	1080 p	50	22	52,276	41.13	54,109	41.10	9.4
			27	22,262	39.12	24,346	39.20	
			32	12,012	37.58	13,889	37.68	
			37	6808	35.68	8385.5	35.82	
Four People	720 p	60	22	25,653	43.46	26,416	43.44	9.0
			27	11,836	40.46	12,646	40.48	
			32	5793	38.11	6522.4	38.13	
			37	2997	35.92	3606.3	35.95	
BasketballDrill	WVGA	50	22	15,822	41.79	16,342	41.78	5.6
			27	8724	38.38	9139	38.40	
			32	4779	35.4	5114.7	35.41	
			37	2678	32.67	2945.5	32.69	

arbitrary access setting. We use HM as aanchor to encode the full sequence. The tried is a straightforward LVC that we use HM to encode each 128×128 sub-arrangement and ascertain the BD-rate and BD-PSNR for the entire sequence. Under the exploratory conditions appeared in Table 1, we get the outcome appeared in Table 2.

Table 2 presents the coding performance drops 7.25% in the BD-rate overall. Particularly at the parcel limits, the nature of remade picture is unsatisfactory. The explanation is that the residuals vitality near limits is a lot higher than the centrals which can be found in Fig. 5 (white pixels speak to high vitality or a huge forecast error). Thus, we have to reduce the debasement of the limit performance.

The changing technique utilized in Fig. 5 is that we separate the remaining data and scale every single lingering an incentive with a steady to make them detectable.

The loss of the straightforward LVC in performance is because of the severe constraint of the hunt run which is the N×N sub-grouping limit. No motion vector can cross the limit. So, one arrangement is that we can recover the exhibition by some neighbourhood procedure. For instance, we utilize the re-developed 128×128 square.

Since, we cannot utilize any data from other sub-sequences, we have to completely misuse the connection inside one sub-arrangement, the N×N area. We turn the pixels inside the square to create more reference square competitors. At the end of the day, we grow the reference square pool by pivoting current reference squares geometrically.

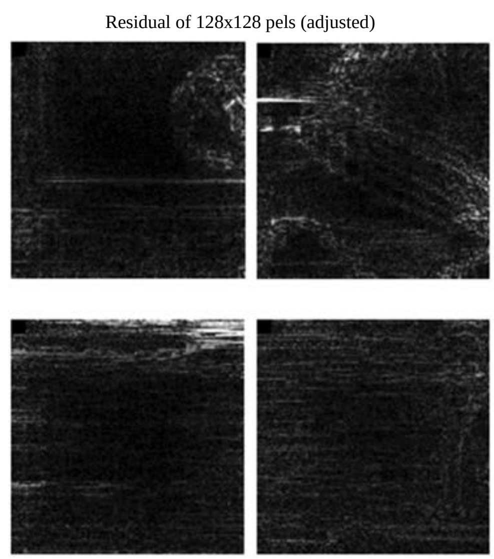

Fig. 5: Residual of 128×128 blocks, adjusted to brighter area, white pixels mean large residuals

Such a rotation procedure is motivated by the fractal coding created by Barnsley (1993) and applied to picture coding by Jacquin (1992). There are seven distinct methods for geometric revolution to the square reference squares which are appeared in equations, including pivot and their transposed structures (Zhang and Sze, 2015). The revolution equations are given in Eq. 1-7:

$$\tau_1 x_{i,j} = x_{B-j,i} \quad (1)$$

$$\tau_2 x_{i,j} = x_{B-i,B-j} \quad (2)$$

$$\tau_3 x_{i,j} = x_{j,B-i} \quad (3)$$

$$\tau_4 x_{i,j} = x_{j,i} \quad (4)$$

$$\tau_5 x_{i,j} = x_{i,B-j} \quad (5)$$

$$\tau_6 x_{i,j} = x_{B-j,B-i} \quad (6)$$

$$\tau_7 x_{i,j} = x_{B-i,j} \quad (7)$$

The rotated reference squares will join the RDO in the between forecast mode choice procedure. Profiting by the improved reference square pool, the remaining coefficients should be coded after the HM change and the quantization procedure will be a lot littler. In spite of the fact that the revolutions need extra calculation, they can be effectively quickened with hardware.

RESULTS AND DISCUSSION

Experiment: The heat dissipation issue can be solved through LVC's structure by turning the processing units on and off. The massive calculation will be distributed to a few sub-sequences because of the LVC's parallelism. Along these rows, the exhibition in each sub-arrangement is the main thing we have to test. So as to exhibit the benefits of LVC, we have to pick atool to be the stay for correlation. Considering every aspect, we pick HEVC Tiles as a source of perspective tool for LVC.

To begin with, Tiles is a developed, time-tested technology in the most definitive video codec standard H.265/HEVC. Its exhibition moves toward the first H.265/HEVC. Second, Tiles' goal is parallel processing with a similar objective as LVC.

Tiles partitions the present picture into independent rectangular (districts) areas. Nonetheless, Tiles share the cross-segment data of the reference picture while LVC does not utilize any data from different sections. From the two-parallelism perspective we referenced in section 1, LVC is a right parallel-accommodating plan, yet Tiles is not.

The contrasts among Tiles and LVC are appeared in Table 3. Tiles have adaptable segment sizes while LVC has a fixed segment size which is focused more than once.

Table 3: Shows comparison between Tiles and LVC

Properties	Tiles	LVC
Segment size	Flexible	Fixed
Processing parallelism	Yes	Yes
Data parallelism	No	Yes
Reference picture memory	Shared	Independent
Work on independent processing unit	No	Yes

Table 4: Shows experiment conditions for Table 5

De-blocking	SAO	ALF	Fast search	Frames per sequence
On	On	On	Full search	150

For the present picture, the two Tiles and LVC can process each segment autonomously, so, we think about that the two of them have processing parallelism. In bury expectation, Tiles utilizes data from different segment s in the reference pictures, so tiles does not have data parallelism. Each Tile section can share the entire reference pictures while each LVC segment has its very own reference pictures. LVC can chip away at various processing units without interfering with different units, yet Tiles cannot.

To make the outcomes progressively tractable and persuading, the examinations are directed on HEVC reference software HM, version 16.9, random access setting, with the SAO (channel) filter and ALF on and the deblocking channel off (Table 4). The anchor is Tiles and the Tiles' size in this investigation is fixed, 256×128 pixels which is twice as huge as we set for LVC partitions. The tried is LVC with rotations.

Table 5 shows the coding effectiveness of the proposed strategy and the anchor. There is an average of 3.35% coding losses, in light of the fact that the proposed strategy just uses neighbourhood data. The processing time of LVC is not exactly 50% of the stay on an ordinary quad-core processor in a general CPU. From our perception, emotional characteristics of the LVC's remade pictures are nearly equivalent to the stay strategy.

By analyzing down the consequence of the tried technique for all sequences, Fig. 6 shows the prosegment of area that uses the proposed (turns) rotations; e.g., about 2% of the zone utilizes revolution (d) and every one of the seven rotations are similarly significant. About 14% of the all-out zone uses pivoted obstructs as its reference squares.

Figure 7 shows the extent of the zone of various square measures that utilization the revolution; e.g., about 15% of the proposed rotations utilize a 8×8 square size. An enormous bit of the area utilizes turns with a medium square size (32×32, 16×16). A 64×64 square for the most part arranges in a smooth area which isn't touchy to remaining coefficients. Littler size squares have less impact in high goals recordings.

Table 5: Bitrate (In KB/S) and Weighted PSNR (In DB) for all tested videos sequences

Sequence	Resolution	Frame rate	QP	Bitrate	BD-PSNR	Bitrate	BD- PSNR	Rate (%)
Traffic	4 K	30	22	101,436	43.31	106,890	43.47	5.1
		27	57,737	40.10	61,919	40.29		
		32	33,304	37.03	37,026	37.28		
		37	19,032	33.97	21,553	34.19		
Parkscene	1080 p	24	22	49,525	41.59	52,568	41.79	2.1
		27	26,932	38.59	28,890	38.83		
		32	14,114	35.65	15,712	36.02		
		37	7023	32.82	7962	33.25		
BasketballD-rive	1080 p	50	22	105,291	40.53	111,320	40.69	4.8
		27	50,207	37.84	53,866	37.97		
		32	27,836	35.54	30,961	35.73		
		37	15,419	33.03	17,471	33.23		
BQTerrace	1080 p	60	22	170,914	42.67	177,450	42.84	4.2
		27	89,205	37.75	94,272	37.89		
		32	48,739	34.53	53,179	34.70		
		37	27,098	31.60	30,126	31.74		
PartyScene	WVGA	50	22	34,830	41.11	35,787	41.22	3.6
		27	22,077	38.83	23,017	36.95		
		32	13,541	32.89	14,423	33.05		
		37	7542	29.04	8142	29.18		
RaceHorses	WVGA	30	22	12,582	42.15	13,202	42.63	0.3
		27	7719	38.53	8212	39.14		
		32	4523	34.88	4963	35.77		
		37	2389	31.29	2646	32.69		

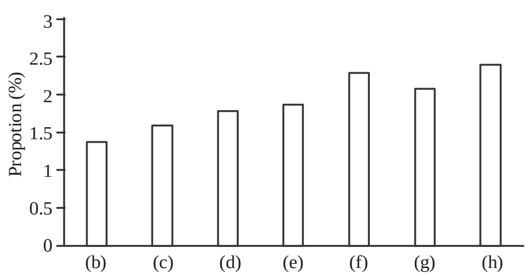

Fig. 6: Prosegment of (b:h) (Fig. 4) rotations

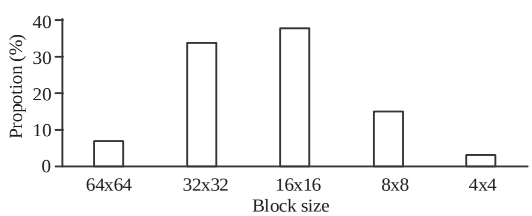

Fig. 7: Prosegment of different block sizes used in rotation (area)

CONCLUSION

As the heat dissipation issue and the difficult measurement issues are explained by LVC structure, the coding effectiveness results appeared above are as expected. In spite of the fact that there is no cross sub-sequence data, the proposed LVC's coding performance (a 3.35% drop on average) shows a propensity approaching the non-nearby strategy. Moreover, the LVC section size is just 50% of the stay technique in intra mode. In entomb forecast, Tiles can utilize data from the entire reference picture. In spite of the fact that the complete calculation increments marginally (by including the rotations), the genuine processing time reduces drastically on the present PC. In addition, the turn procedure in the proposed calculation can be hardware quickened effectively which means we can further reduce the processing time.

This study focuses around a novel parallel-friendly structure that can maintain a heat dissipation issue by sending assignments to various CPU cores or to separate processing units in devoted chips. At the point when a unit over-heats, we can move the undertakings from the overheated unit to an inactive unit. In the event that one unit doesn't work or a blunder happens, we can rapidly locate another prepared unit in the framework to supplant it when different areas are as yet working. There is no compelling reason to suspend the entire framework for a solitary mistake unit and we do not need to stress over the error leaking to different areason the grounds that eacharea is independent.

Extra study themes incorporate how to adjust cross-segment subjective quality, how to further increase the compression efficiency for one sub-sequence and circuit designs to understand the LVC structure.

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