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Research Inferences In Video Compression Domain

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Abstract:- Video Compression (VC) is a painstaking investigation area in the modernization of digital existence because of more evolution being emerged in web relevance. In this direction, video compression is grown-up rapdily and confirmed by the large number of myriad applications in Video streaming, Computer Vision like Video Tampering Detection, Video Surveillance and Camera Moving etc., which collectively use of this compression technology. This paper attributes / opens-up / endeavours the whole possible and recent research directions and its challenges by focusing the potential investigations on compression domain of MPEG, H.264, H.265 compression coding standard with latest computing techniques in learning videos via Machine Learning.

Keywords: Video Compression, Computer Vision, Applications, Human Actions, Video Indexing & Retrieval, Object Tracking, Moving Object Detection & Segmentation, Dominant Flow & Face Detection, Next-gen VC

I. INTRODUCTION

Diverse video analysis techniques were introduced in the yester years towards various compression standards. As far as computer vision applications are concerned, it comprises a long list like; entity moving segmentation, human being action recognition, video capture indexing, video recovery, face revealing, recorded visual media categorization, video tracking, video summarization, and picture change revealing in compressed videos. Paper intended to explore the promising power of compressed domain approaches utilized in research areas by using MPEG, H.264 and H.265 compression. In recent video applications, VP9 used, is an open and complimentary codec by Google.

In 2013, the innovative creature, called H.265 came in the market, popularly called as HEVC. It was developed by ITU-T and widely used in video applications. H.265 supports hihg resolutions including 8K Ultra HD (UHD) and provides high compression performance. To achieve video compresson, schemes of inter and intra-frames are used in a video flow, are detailed by the Group of Pictures (GOP). In coded flow of videos, a sequence of GOP will exists.

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The Frames (I, P, B) are classified into individual piece and each piece is sub-divided into elements called, Macro Blocks (MB). In compressed videos, three types of Picture Types (Frames) are available such as Intra (I), Predicted (P) and Bi-directive (B). A very challenging research area in computer vision is recognizing human actions in videos. Recorded media observations / scrutiny, examination of sports episodes, and disease suffering people monitoring at the hospitals are the key applications of Human action recognition. Key issues in appreciation of human activities are; size, look, enlightenment, directions dissimilarity, occulsions, surroundings disorder and camera movements. More robust algorithms are to be exlpored to meet these challenges in a larger degree. Weizmann , KTH for simpler actions, HMDB and UCF101 for complex datasets which are video datasets being used by the researchers.

II. REVIEW OF LITERATURE

This section deals and highlights the detailed investigation studies on each sub-domains of video compression towards MPEG and H.264/AVC standards as well. In this section, Table 1 to 6 summarizes the variant applications in the line of video compression are neatly tabulated with reference number, target pplications, approaches / techniques used and features adopted.

2.1 Background studies on Human Activity Recognition in MPEG Compression domain

An approach proposed by Ozer et al. [1] in MPEG domain based on video sequences. Parts of human body were segmented first and PCA segmentation method was performed prior to classification. For action recognition, representation of creating eigenspace obtained from AC-DCT coefficients [2]. Person independent action classification work proposed [3], based on three extraction techniques called projected 1-D, 2-D polar, and 2-D cartesian features. For classification of actions, attribute vectors were fed into HMM. Moving events were trained with distinct HMM and performances were compared, where high recognition results of accuracy achieved. Features were used to train the well-known classifiers like KNN, NN, support vector machince and naïve bayesian were utilized to identify a group of 07 persons' actions.

Motion History Image (MHI) concept proposed [4] in action recognition analyzed via Motion Flow History (MFH) and MHI constructed using MVs. DCT coefficients employed [5] with MVs for localization and action.

A high speed algorithm developed on motion correlation measure in MPEG streams. Approach based on a coarse approximation & assurance map of optical stream dependent applied by having motion vector, discrete cosine transform coefficients as well. Here, KTH dataset was used. Movement of entities depends on the concept of uncertainty judgment (FL) [6] developed in order to supervise noise intrinsic in the compressed domain. Motion of lingusitc blobs modeled and its behaviour recognized via the traffic videos with QVGA resolution. Diiferent actions like stopping and turning from object vehicles utilized.

2.2 Background studies on Human Action Recognition in H.264 (MPEG-4 Part 10) compression domain

Less number of investigations was carried out in H.264 videos. A well-defined procedure pronounced by Tom et al. [7] that utilizes the motion vector, then fetched from the visual media series and 07 actions based (like walking, runnig etc.,) classification done by using SVM. It extracts QGI and MV to form a feature vector and shown the 85% accuracy by SVM classifier. Approach using QGI and MV again used and proposed a classifier PBL-McRBFN, instead of SVM. Performance was shown in good results with the same features. By using MV magnitudes, Biswas et al. [8] attempted to identify irregularities in the motion prototype.

2.3 Background studies on Video Indexing technique in MPEG Series towardsIdeal Video-Retrieval System

In a large number of video libray (video database), visual media indexing, salvage are directly associated to cummulating of single viual shot, footnote and indexing. To extract motion trajectory, video indexing technique in MPEG launched [9]. Here, entity division pursued by monitoring of each segmented dynamic entity performed to acquire well motion information. NASM filter developed to eliminate noisy MVs. A method of UFC routine used to recognize real number of clusters by tracing the location of every MV in the clusters.

Algorithm proposed [10] to estimate pan, tilt and zoom kind camera movements to determine the uniqueness of things being used in the low-level category. Further, it was tested on four basketball test cycles. Video analysis and indexing system [11] developed for Air Traffic Service (ATS) survelliance and sports videos.

Present approach able to supply sturdiness aligned with illumination changes and distractor. Image of DC, motion vectors, touch, color & border were considered in the formation of feature. Real-time and unsupervised segmentation procedure applied [12] in video indexing and retrieval scheme, where moving objects are segmented to find a pathway using a step-by-step MB rejection method.

2.4 Background study on Information Retrieval on Contents in H.26 (Video Histograms for Large Scale Video Classification)

Color histogram discrete cosine features were taken by the authors [13] for content based recovery in the domain of H.264. Approach has also provided higher computational merits.

2.5 Background studies on Visual (Object/ Entity) Tracking in MPEG Series

Precision, processing speed are the major exchange in Visual tracking. In robust tracking, some of the challenges are; range changes, sudden elucidation variations, incomplete occulsion, pose modifications, and view point modifications. In object tracking, a robust tracking provides a research gap and a vital confront for computing

researchers, where some of tracking algorithms are explored in MPEG compressed domain features.

Visual tracking method coined in MPEG-2 series domain by the authors [14]. It tracks the entity via the video autonomously by using MVs alongwith MBs. Method is uncomplicated and painless to employ in order to track objects. In MPEG, segmentation free detection based tracking strategy adopted [15] in connecting micro blocks in spatial adjancency property and temporal domain as wwll. Noisy paths are generated after a trimming and merging steps computed. Algorithm cannot handle moving camera situations but can track multiple objects.

Achanta et al. [16] utilized color information for color based tracking to spot an entity to be tracked. Values of Cr and Cb incorporate color based tracking as to identify the finest picture area which suits with actual entity. Velocity, simplicity, robustness against occulsion and camera movements was extended considerably by the system.

Robust tracking system presented [17] using MVs. Also residuals, spatial and textual confidence measures are fetched from video domain of MPEG-2. Real-time entity tracking in compressed domain proposed [18], untainted dependent on movement and color indications.

2.6 Background studies on Object Tracking in MPEG-4 Part 10 (H.264)

Segmentation / Detection algorithm devised to classify a pixel either as an entity or as background. It can organize greater than one group as a target. In object tracking of H.264, Thilak et al. employed a segmentation method [19] to segment a binary picture, best possible pixel categorization & clustering. A method of probabilistic spatio-temporal microblocks cleaning algorithm [20] employed which will slice and tracks manifold entities in H.264 bitstream.

In H.264, a trajectory appraisal approach proposed for dynamic entities [21], where a Global Motion Estimation (GME) performed. Object Histroy Images (OHI) applied to stabilize and COG trajectories were also represented to fetch soft splines. This approach can compete with dynamic camera environments. Real-time object tracking approach was developed by Mehmood et al. [22] in H.264. From the video sequence, MVs were fetched to keep informed the tracking model. To integrate spatial and temporal aspects of object's motion, ST-MRF model used [23] in object tracking. Pre-processing method has done through Polar Vector Median (PVM) introduced.

2.7 Background studies on Moving Video Entity Detection and Segmentation in MPEG

Due to extensive applications in Intelligent Video Surveillance, video storage browsing, HCI,

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and image-based video coding takes the more significance by the researchers in the line of object detection and segmentation. To trigger alarms, motion detection serves a core component in video analysis systems and to establish video sequences to be stored.

In MPEG-2, a preliminary work was carried out [24] in video division and author [25] proposed an algorithm by using color components of chrominance. Also, it was an opening work for video entity segmentation. Detection of intra-frame has executed by using leading color descriptor [26]. For moving object extraction, authors [27] computed HOS on inter-frame dissimilarities of partially deciphered image from DC image compression area. Authors did not use the MVs, rather DC image.

Yu et al. [28] gained knowledge in developing a strong moving entity segmentation to produce a motion cover for thedynamic boundaries; a clustering of MVs was done. A real-time object segmentation approach developed [29], which combines both motion and frequency information as well. To exploit the block and GOP structure in MPEG, an automatic segmentation method [30] employed. Segmentation can be reached using the level of extension of the video crossways of each and compound frames.

Qiya et al. [31] paid attention in a coarse to fine strategy. Projection performed by fetching an entity at a common level, a blend of contour-feature (DC+2 AC images of I frame) entettained. Block of intra based frames was incompletely dechiphered to distill the pierce correctness. Three different styles of back ground modeling approaches presented for background subtraction in MPEG-2 domain. Foreground blocks pixels classified in the spatial sphere. Accuracy of pixels achieved with competent efficiency and lesser total processing time towards segmentation procedure.

2.8 Background studies on Moving Video Object (Group) Detection and Segmentation in H.264 (MPEG-4 Part 10)

In deep literature survey, it was found that the majority of the procedures use MV to sense active entity in the video. A segmentation method [32] used the size of MBs (in bits) analysis with the restriction to P frames and a effortless outburst practice was employed to lever Intra (I) frames. Segmentation precision at the boundary foreground MBs was improved. This rapid dispensation method evaluated to other practices (which are limited to motionless camera environments for video surveillance relevance).

Consistency of action vectors estimated [33] to produce movement resemblance measures in H.264 from neighboring frames, where action vectors scale used to slice the forefront entities from backdrop. Here, a fuzzy logic approach [34] applied to detect the active entities. Temporal and spatial relations used [35], to produce a probability based assurance level for each motion vector computed. To represent final segmentation, final binary motion mask extracted based on spatio-temporal confidence array. For moving object segmentation, an ant colony clustering algorithm used [36].

A technique of fold-modal proposed [37] for rapid stirring entity slice action in H.264 area, where authors integrated to construct an adaptive environment prototypes. Unsupervised segmentation algorithm offered by Chen et al. [38]. Vehicle and human being identification in H.264 framework examined [39] to identify the outline and individuality of entity division. Movement study applied to obtain the directions from extracted features so as to distinguish human being and vehicle items, where Bayesian classifier used for object categorization on cars and humans. Tom et al. [40] suggested a method to sector the forefront entities depends on micro-blocks range and QGI.

2.9 Background studies on Crowd Flow Segmentation / Dominant Flow Detection

To slice the overriding mass flows present in the view (in a video picture), a concept of governing (presence) flow detection introduced. To segment flows, an approach conceived by Ali et al. [41] in pixel-domain. Praveen et al. [42] handled this problem via invoking an EM algorithm. In a collective representation of compressed video series, research contributions made by the authors [43], to attain the stream division.

2.10 Background studies on Face Detection

All humans have spectacular capability to identify diverse faces than machines. Hence, face discovery plays a main role in face recognition, facial look credit, head-pose inference, human-computer interaction, activities analysis, video scrutiny etc. Face discovery is a computer technology that determines the place and dimension of human features in arbitrary image. Face detection is one of the smallest amounts of investigated areas towards Computer Vision. Minimum works have been reported on MPEG domain and much works have to be investigated or keen to concentrate towards the variant and wealthy attributes present in the standards like H.264 in a larger scale. To find out any faces present or not in the video, a research on Face Detection plays a key role. Challenges involved in facial detections are; camera-related pose variations, appearances, elucidation adjustments, picture situations, occurrence or non-existence of attributes.

Gradient energy representation based on frontal face detection method used by Chua et al. [44]. It fetches color and gray level imagery from the video of MPEG. A routine [45] introduced by means of Haar parameters to human being face expressions tracking construction.

Abdul Kader Nihal [46] highlighted that the insights in next-gen video coding, inevitability of VC in Mobile environments, approaches, and standards from its evolution, file formats, compression techniques, recently evolved performance metrics, bright avenues in VC and its future research gaps towards Machine Learning methods and compression via Hadoop MapReduce.

Table 1: Human Action Recognition - Applications

Name of Video Standard	Ref. No.	Target Applications [Human Action Recognition]	Approach / Techniques	Facets (Features)
MPEG	1	Human Activity Detection	Graph Matching, Super Ellipse Fitting	MV, DCT
	2	Action Recognition	Processing of Partial Spatial domain	MV, DCT
	3	Independent Action classification	HMM	MV based 2D cartesian and polar
	4	Action Recognition	1D, 2D polar projection	MHI, MFH
	5	Action Recognition and Localization	Confidence Map of Optical flow	MV, DCT
	6	Motion of Objects (Difference Actions)	Fuzzy Logic	MV
H.264/AVC (MPEG-4 Part 10)	7	Actions & Feature Extraction	SVM – Actions Classification	MV, QGI
	49	Action Recognition	PBL-McRBFN (Radial Basis Function)	MV, QGI
	8	Motion Pattern	GMM, Hierarchical computation	MV

Table 2: Video Indexing / Video Retrieval system - Applications

Name of Video Standard	Ref. No.	Target Applications [Video Indexing / Video Retrieval System]	Approach / Techniques	Facets (Features)
MPEG-1/2/4 Part 2	9	Motion Trajectory	NASM Filter, UFC	MV
	10	Pan, Tilt & Zoom type - Camera Motions	Camera Motion Estimation	MV
	11	Indexing system – ATS Survelliance & Sports Videos	Partial Pixel Domain computations	MV, DC image, Texture, color & EI
	12	Video Indexing and Retrieval (Image Sequences)	Motion and color information, MB Rejection	MV, DCT
H.264/ AVC	13	Content Based Information Retrieval	Color Histogram	DCT

Table 3: Object Tracking - Applications

Name of Video Standard	Ref. No.	Target Applications [Video (Object) Tracking]	Approach / Techniques	Facets (Features)
MPEG -2	14	Tracking of Object/Region	Tracking of MBs	MV
MPEG-2	15	Tracking Multiple objects via Segmentation Free Detection	Linking MBs	MV, DCT
MPEG-1/2	16	Color based Tracking	Chrominance	MV (P & B frames), DCT values of Cr & Cb
MPEG-2	17	Robust Tracking	Outstanding, Spatial and Textual assurance measures	MV
MPEG-1/2	18	Real-time Object Tracking	I-Frames process	DCT in I-Frames
H.264/ AVC	19	Object Tracking	Binary Image, Optimal Pixel categorization & Grouping for segmentation	MV
	–	Adaptive Object Tracking	Feature based Dissimilarity Energy Minimization	MV, Luminance Signals
	20	Segment and Tracking Multiple Objects	Probabilistic Spatio-Temporal MB Filtering	MB Size
	21	Trajectory Estimation for Moving Objects	Global Motion Estimation (GME)	MV, OHI, COG trajectories
	22	Real-time Object Tracking	Motion Information (Kalman Filter)	MV
	23	Object's Motion	ST-MRF model, Intra-coded block movment approximation & Global motion reimbursement	MV

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Table 4: Moving Video Object Detection and Segmentation – Applications

Name of Video Standard	Ref. No.	Target Applications [Moving Video Object Detection and Segmentation]	Approach / Techniques	Facets (Features)
MPEG-1/2	25	Video Object Segmentation	Boudery unite	MV, DCT
MPEG-1/2	26	Detection of Intra-frame	DCD, MB Grouping	MV
MPEG-1/2	27	Moving Object Extraction	HOS	Only DCT
MPEG-1/2	28	Robust Moving Object Segmentation	Motion Clustering	MV, DCT
MPEG -1/2	29	Object Segmentation	Object Segmentation (both Motion and Frequency information)	MV, DCT
MPEG-1/2	30	Segmentaion – Exlpoiting Block and GOP Structure -MPEG	Quantity growth of visual stream	MV, DCT
MPEG-2	31	Real-time Moving Object Extraction	Fusion of Contour-Features	MV, DCT
		For refining Segmentation	Iterative Movement opinion and Temporal monitoring at Pixel Level	MV, DCT
H.264/ AVC	47	Object Segmentation	MRF Classification	MV, MB size
	32	Segmentation- Static camera (Video Surveillance)	Range - MB & Coefficients' Transform	MB Size, DCT
	33	Generation of Motion Similarity	Neigboring - Noisy curbs	MV
	34	To Detect Moving Objects	Fuzzy Logic	Linguistic MVs
	35	Segmentation	Motion Vector, Temporal & Spatial relations	MV
	36	Moving Object Segmentation	Ant Colony Clustering	MV
	37	Fast Moving Object Segmentation	Multi-model background subtraction (Integrated GMM & VUM)	MB size
	38	Unsupervised Segmentation	Global Movement inference and MRF categorization	MV
	39	Homogneity and Shape Analysis of Segmented items for Car and Human recognition	Bayesian classifier, MRF	dMVD (MVs direction), MBs (nMB)
	40	Segment the Foreground Objects	QGI, MB size	MB size, QGI

Table 5: Crowd Flow Segmentation - Applications

Ref. No.	Target Applications [Crowd Flow Segmentation / Dominant Flow Detection]	Approach / Techniques
2	Segment the Flows	In Pixel Domain
26	Foremost prototype of Movement Vectors	EM algorithm
12	Determination of stream Segmentation	Grouping the Movement Vectors (motion super pixels)

Table 6: Face Detection (Video Suveillance) - Applications

Name of Video Standard	Ref. No.	Target Applications – Video Surviellance [Face Detection]	Approach / Techniques	Facets (Features)
MPEG	44	Face Detection	Gradient Energy Representation & Rule based classifier, Skin color verification	-
-	45	Face Recognition and Tracking in Videos	Kalman Filter	Haar Features, Gabor feature extraction.

III. IMPLEMENTATION STRATEGIES & RESULTS

To employ or execute the video compression strategy, two kinds of techniques are broadly classified such as : hardware-based and software-based implementation [48].

3.1 Hardware Implementation Idea

A very large scale integrated circuit to be designed in a conventional video compression technique, where programmable processors are flexible to execute the same based on algorithms without making any changes in the redesign. Moreover, manifold procedures can be implemented in the similar hardware and its computational outcome can be evaluated easily.

3.2 Software Implementation Idea

Methods of software implementation so attractive and well-liked, hence these are based on general-purpose processors, are now rising rapidly. Emerging multimedia standards shown-up a higher-level interactivity, extensibility and flexibility that can exhibit worthy potentials towards software dependent solutions. The intrinsic nature of different video compression algorithms allows experimenting and augmenting a variety of parts of the encoder independently. The key benefit of software implementation idea will permit us by incorporating new research ideas by developing right algorithms to achieve an improved portrait eminence in a reduced fragment or on given fragment. This approach is also elastic which allows in tuning of diverse attributes for several levels of optimization.

3.3. Key Research Gaps

Tampering of video revealing is a unique relevance research area in the visual media, where higher possibility is open to find existence of distortion of video. Also, more research focus to be rendered and conceiving different algorithms in H.265, VP9 compression visual shots, since it is a better standard having much compression capabilities.

IV. CONCLUSION

Video compression is twisting up more well-known in glow of the storage and system transmission bandwidth capacity that supplies can be decreased by compression. This research exploration gap clarifies the more requisite components of video compression in the current enviroment scenario. The elemental intention of constant resourceful video coding research is to achieve high compression productivity, high transmission adaptability, and low multifaceted environment. Video benefit developers need to prefer the suitable & adaptable video coding plan to meet up target expertise and adaptability with sensible cost towards the development of any target/ future applications by prefering latest tecchniques and performance measures.

REFERENCES

1. Ozer B, Wolf W, Akansu A (2000),"Human activity detection in MPEG sequences". In: Proceedings workshop on human motion, pp 61–66.
2. Ozer I, Wolf W (2002),"Real-time posture and activity recognition", In: Workshop on motion and video computing, pp 133–138.
3. Babu RV, Anantharaman B, Ramakrishnan KR, Srinivasan SH (2002), "Compressed domain action classification using HMM", Pattern Recog Lett. 23(10):1203–1213.
4. Babu RV, Ramakrishnan KR (2004), "Recognition of human actions using motion history information extracted from the compressed video", Image Vis Comput 22(8):597–607.
5. Yeo C, Ahammad P, Ramchandran K, Sastry S (2008,) "High-speed action recognition and localization in compressed domain videos", IEEE Trans Circ Syst Video Technol 18(8):1006–1015.
6. Rodriguez-Benitez L, Moreno-Garcia J, Castro-Schez J, Albusac J, Jimenez-Linares L (2009), "Automatic objects behaviour recognition from compressed video domain", Image Vis Comput 27(6):648–657.
7. Tom M, Babu RV, Praveen R (2014) Tom M, Babu RV, Praveen R (2014), "Compressed domain human action recognition in H.264/AVC video streams", Multimed Tools Appl. DOI:10.1007/s11042-014-2083-2.
8. Biswas S, Babu RV (2013), "Real-time anomaly detection in H.264 compressed videos", In: National conference on computer vision, pattern recognition, image processing and graphics (NCVPRIPG), pp 1–4. doi:10.1109/NCVPRIPG.2013.6776164.
9. Eng HL, Ma KK (1999), "Motion trajectory extraction based on macroblock motion vectors for video indexing", In: International conference on image processing, vol 3, pp 284–288.
10. Tan YP, Saur D, Kulkarni S, Ramadge P (2000), "Rapid estimation of camera motion from compressed video with application to video annotation", IEEE Trans Circ Syst Video Technol 10(1):133–146.
11. Yu DL (2003), "Video analysis and indexing in compressed domain", Master of Science Thesis, Institute for Infocomm Research, National University of Singapore.
12. Mezaris V, Kompatsiaris I, Boulgouris N, StrintzisM (2004), "Real-time compressed-domain spatiotemporal segmentation and ontologies for video indexing and retrieval", IEEE Trans Circ Syst Video Technol 14(5):606–621.
13. Mehrabi M, Zargari F, Ghanbari M (2012), "Compressed domain content based retrieval using H.264 DC-pictures", Multimed Tools Appln. 60(2):443–453.
14. Favalli L, Mecocci A, Moschetti F (2000) , "Object tracking for retrieval applications in MPEG-2", IEEE Trans Circ Syst Video Technol 10(3):427–432.
15. Lie WN, Chen RL (2001), "Tracking moving objects in MPEG-compressed videos", In: IEEE international conference on multimedia and expo, pp 965–968
16. Achanta R, Kankanhalli M, Mulhem P (2002), "Compressed domain object tracking for automatic indexing of objects in MPEG home video", In: IEEE international conference on multimedia and expo, vol 2, pp 61–64.
17. Dong L, Zoghlami I, Schwartz S (2006), "Object tracking in compressed video with confidence measure",. In: IEEE International conference on multimedia and expo, pp 753–756.
18. Dong L, Schwartz S (2006), "DCT-based object tracking in compressed video", In: IEEE international conference on acoustics, speech and signal processing, vol 2, pp II–II. doi:10.1109/ICASSP. 2006.1660430.
19. Thilak V, Creusere CD (2004), "Tracking of extended size targets in H.264 compressed video using the probabilistic data association filter", In: EUSIPCO, pp 281–284
20. You W, Sabirin MSH, Kim M (2012), "Real-time detection and tracking of multiple objects with partial decoding in H.264/AVC bitstream domain", ArXiv:abs/1202.4743
21. K¨as C, Nicolas H (2008), "An Approach to trajectory estimation of moving objects in the H.264 compressed domain", In: Proceedings of the 3rd pacific rim symposium on advances in image and video technology, pp 318–329.
22. Mehmood K, Mrak M, Calic J, Kondoz A (2009), "Object tracking in surveillance videos using compressed domain features from scalable bit-streams",. Signal Process Image Commun 24(10):814–824.
23. Khatoonabadi S, Bajic I (2013), "Video object tracking in the compressed domain using spatio-temporal Markov random fields", IEEE Trans Image Process 22(1):300–313.
24. Mitsumoto S, Yuasa H, Zen H (1998), "Moving object detection from MPEG coded picture", In: MVA, pp 422–425.
25. Sukmarg O, Rao KR (2000), "Fast Object Detection and Segmentation in MPEG Compressed Domain", TENCON. Proceedings 3:364–368.
26. Manjunath B, Ohm JR, Vasudevan V, Yamada A (2001), "Color and texture descriptors", IEEE Transa Circ Syst Video Technol 11(6):703–715.
27. Zeng W, Gao W, Zhao D (2003), "Automatic moving object extraction in MPEG video", In: Proceedings of the international symposium on circuits and systems, vol 2, pp 524–527
28. [28] Yu XD, Duan LY, Tian Q (2003), "Robust ing video object segmentation in the MPEG compressed domain", In: IEEE international conference on image processing, vol 3. doi:10.1109/ICIP.2003.1247399.
29. Porikli F (2004), "Real-time video object segmentation for MPEG encoded video sequences", SPIE conference on Real-Time Imaging, Vol. 5297, pp 195–203.
30. Porikli F, Bashir F, Sun H (2010), "Compressed domain video object segmentation", IEEE Trans Circ. Syst Video Technol 20(1):2–14.
31. Qiya Z, Gaobo Y, Weiwei C, Zhaoyang Z (2007), "A fast and accurate moving object extraction scheme in the MPEG compressed domain", In: International conference on image and graphics, pp 592–597
32. [32] Poppe C, Bruyne SD, Paridaens T, Lambert P, de Walle RV (2009), "Moving object detection in the H.264/AVC compressed domain for video surveillance applications", J Vis Commun Image Represent 20(6):428–437.
33. De Bruyne S, Poppe C, Verstockt S, Lambert P, Van De Walle R (2009), " Estimating motion reliability to improve moving object detection in the H.264/AVC domain", In: IEEE international conference on multimedia and expo, pp 330–333.
34. Solana-Cipres C, Fernandez-Escribano G, Rodriguez-Benitez L, Moreno-Garcia J, Jimenez-Linares L (2009) "Real-time moving object segmentation in H.264 compressed domain based on approximate reasoning", Int J Approx. Reas. 51(1):99–114.
35. Szczerba K, Forchhammer S, Stttrup-Andersen J, Eybye P (2009), "Fast compressed domain motion detection in H.264 video streams for video surveillance applications", In: Proceedings, AVSS, pp 478–483.
36. Pei W, Zhixia W (2010), "Moving object segmentation in H.264/AVC compressed domain using ant colony algorithm",. In: International conference on signal processing systems (ICSPS), vol 2, pp 716–719.
37. Vacavant A, Robinault L, Miguet S, Poppe C, de Walle RV (2011), "Adaptive background subtraction in H.264/AVC bitstreams based on macroblock sizes", In: VISAPP, pp 51–58.
38. Chen YM, Bajic I, Saeedi P (2011), "Moving region segmentation from compressed video using global motion estimation and Markov random fields", IEEE Trans Multimed 13(3):421–431.
39. Chen W, Yang QX, Lin KW, Wang SY, Huang CL (2011), "Human and car identification using motion vector in H.264 compressed video", In: Visual communications and image processing, pp 1–4. doi:10.1109/VCIP.2011.6115985
40. Tom M, Babu RV (2013), "Fast moving-object detection in H.264/AVC compressed domain for video surveillance", In: National conference on computer vision, pattern recognition, image processing and graphics (NCVPRIPG). doi:10.1109/NCVPRIPG.2013.6776202.
41. Ali S, Shah M (2007), "A Lagrangian particle dynamics approach for crowd flow segmentation and stability analysis", In: IEEE conference on computer vision and pattern recognition (CVPR), 2007, pp 1–6. doi:10.1109/CVPR.2007.382977.
42. Gnana Praveen R, Babu RV (2014), "Crowd flow segmentation based on motion vectors in H.264 compressed domain", In: 2014 IEEE international conference on electronics, computing and communication technologies (IEEE CONECCT), pp 1–5. doi:10.1109/CONECCT.2014.6740330.
43. Biswas S, Praveen RG, Babu RV (2014), "Super-pixel based crowd flow segmentation in H.264 compressed videos", In: International conference on image processing.
44. Chua TS, Zhao Y, Kankanhalli MS (2002), "Detection of human faces in compressed domain for video stratification", Vis Comput 18(2):121–133
45. Swapnil Vitthal Tathe, Abhilasha Sandipan Narote, Sandipan Pralhad Narote (2017), "Face recognition and tracking in videos", Advances in Science, Technology and Engineering Systems (ASTES) Journal, Special Issue on Recent Advances in Engineering Systems, Vol. 2, No. 3, 1238-1244, ISSN: 2415-6698, www.astesj.com.

46. Abdul Kader Nihal, K.N. (2019), "Insights of Next-Gen Video Compression – A Review", Journal of Applied Science and Computations, Vol. VI, Issue: V, pp: 2032-2040, May 2019, ISSN: 1076-5131. (UGC Approved Journal), www.j-asc.com
47. Zeng W, Du J, GaoW, Huang Q (2005), "Robust moving object segmentation on H.264/AVC compressed video using the block-based MRF model", Real-Time Imaging 11(4):290–299.
48. Rajeshwar Dass, Lalit Singh, Sandeep Kaushik (2012), "Video Compression Technique", International Journal of Scientific & Technology Research (ijstr), Volume 1, Issue 10, November 2012, pp:114-119, ISSN: 2277-8616.
49. Rangarajan B, Babu RV (2014), "Human action recognition in compressed domain using PBL-McRBFN approach", In: 2014 IEEE ninth international conference on intelligent sensors, sensor networks and information processing (ISSNIP), pp 1–6. doi:10.1109/ISSNIP.2014.6827622.