

## Scene Change Detection: A Survey on Surveillance Video Techniques

Anas Abdullahi<sup>1\*</sup>, Adamu Ismail Bashir<sup>2</sup>, Abdulaziz Abdullahi Bena<sup>3</sup>, Muhammad Abdullahi Bakale<sup>4</sup>, Ma'ruf-Sogeyinbo, Aminah Adeola<sup>5</sup>

<sup>1</sup>Department of Computer Science, Faculty of Computing, Sokoto State University, Sokoto, Nigeria.

<sup>2</sup>Department of Computer Science, Faculty of Sciences, Umaru Ali Shinkafi Polytechnic, Sokoto, Nigeria.

<sup>3</sup>Department of Computer Science, Faculty of Sciences, Waziri Umaru Federal Polytechnic, Birnin Kebbi, Nigeria.

<sup>4</sup>Department Department General Studies, Collage of agriculture and animal science, wurno Sokoto, Nigeria.

<sup>5</sup>Department of Computer Science, Faculty of Science, Federal College of Education, Abeokuta, Nigeria

\*Corresponding Author's Email & Phone No.: [anas.abdullahi2@ssu.edu.ng](mailto:anas.abdullahi2@ssu.edu.ng), +234 8032208176.

Received on: October, 2025

Revised and Accepted on: November, 2025

Published on: December, 2025

### ABSTRACT

A scene is an important segment of a video which is an assemblage of shots into a meaningful unit. It is breakpoint where video can be segmented into useful sub-segments which can be indexed or tagged for easy access in archives or online. Scene change detection is a technique used to identify the transition of one scene to another. This paper explores the existing related scene detection techniques present their strengths, weakness, highlights general problems related to scene detection and future trend of scene change.

**Keywords:** Scene Change, Moving Vectors (MVs), Frame Rate Up Conversion (FRUC), Histogram Based and Block Based.

### 1.0 INTRODUCTION

Digital data is the most widely used means of communication due its reliability, acceptability and ease of exchange. As a type of digital data, videos are the most widely accepted means of communication. Videos contents are rich online. For effective retrieval of desired archived data, annotations or tags which described a particular content is needed. To create such tags, indexed video databases requires segmentation of videos into scenes. The segmentation process is referred to as scene change detection (Zou *et al.*, 2025). With the availability of video data and its wide acceptability, video analysis, indexing, segmentation as well as editing grows rapidly making it important and inevitable. Scene Change Detection (SCD) is a requisite in video processing as it is the means on which longer videos sequences are segmented into smaller units called shots. A video consist of one or more scene. As a series of adjoining frames, scene is a part of a motion picture in a particular location and continuous time. A scene is a lucid assemblage of shots into a meaningful unit. A shot is an array of frames captured in a single continuous action by a single camera. Gradual and abrupt scene changes are the two types of scene change. An abrupt scene change is when two successive frames have large visual content difference. Gradual scene change has small difference between successive frames. (Cho and Kang, 2019; Lee and Cho, 2022). The aim of this research work is to explore the existing related scene detection techniques present their strengths, weakness, highlights general problems related to scene detection and future trend of scene change.

### 2.0 REVIEW OF LITERATURE ON SCENE CHANGE DETECTION

Various research works contributed in finding solution to the problems of scene change detection in video sequences. These works can be broadly categorized into two categories. These are Histogram Based and Block Based Histogram. Prior to this categorization, a concise review of some important related literature is shown in Tables 1 and 2.

Chau and Shu (2022) proposed a scene change detection scheme using moving vector differences, the scheme calculate the MV difference of two consecutive frames and make decision based on the calculated results. In 2019, Ding and Yang proposed a scene change detection scheme by incorporating motion residual ration to improve the accuracy of finding MVs in consecutive frame. Kim *et al.*, (2021); Dolley & Manisha (2024) utilize the statistical properties of optical flow-based scene change detection scheme, the scheme analyses the differences in optical flow in video frames effectively and rapidly detect scene change. However, all these aforementioned schemes utilizes the histogram shapes differences making them considering only global scene change without considering local scene change.

To detect local scene change, which cannot be detected by Histogram Based methods, a Block Based Histogram method is considered. Lovi *et al.*, (2021) proposed a block based method which generates block region to each frames, calculate the difference between the blocks, thus detecting the local scene change. However, different

value between the two regions is not easily calculated. King *et al.* (2022) proposed a method that calculates the difference value between two regions utilize the work of Stockman and Shapiro (2021) which is popularly known as Otsu method. However, the iteration of the method makes the scheme computationally intensive. In extracted histogram shape, point distances provide vital information about scene change. Cho and Kang (2019) explore a method which extract previous and current histogram shapes and calculate the distance. The scheme merges and smooth blocks which increases the accuracy. However, the scheme is not is not effective in the presence of rapid movement and camera motion, as it accumulated the luminance value of the same position of

the position of previous and current frames. Lee and Cho (2022) proposed a luminance level of histogram based scene change detection scheme. For each block, the scheme extracts the luminance level features using histogram luminance level due to its non-iterative process, the scheme effectively scene change without minimal computation. However, some definitive value of the parameters is based on assumption in which has impact on the overall performance and accuracy of the scheme. The overview of histogram based scene change detection algorithms and block based histogram scene change detection algorithms are shown in Table 1 and Table 2 below:

**Table 1: Shows Histogram Based Scene Change Detection algorithms**

S/ N	Authors	Title	Methodology	Strength(s)	Weakness(s)
1	Wei & Tse, Panchanathan (2019)	A Scene Change Detection Algorithm for MPEG Compressed Video Sequences	Uses motion vectors and DCT coefficients in MPEG	Detects gradual scene changes swiftly and requires less space	As a MV based, it suffers intrinsic MVs problems
2	Hassan, Kwok-Tung & Jian (2019)	Scene Change Detection Algorithm for MPEG Video Sequence.	Bit-rate information at macro blocks level.	Method is very simple.	Algorithm is only effective in detecting abrupt scene change.
3	Ralph <i>et al.</i> , (2019).	Metrics for Scene Change Detection in Digital Video Sequences	A new content-based scene change detection method	Provides metrics for detection of scene change	Metrics do not perform well for gradual transitions. GOP have abrupt scene change detection problem
4	Taehwan <i>et al.</i> , (2020).	Hierarchical Scene Change Detection In An Mpeg-2 Compressed Video Sequence	Group of Pictures (GOP) decision	Detects scene change fast with significant reduction in processing time.	compressed video is not supported
5	Bull & Canagarajah & Fernando (2020).	Wipe Scene Change Detection in Video Sequences	statistical feature based approach for wipe detection	Scheme is very sensitive to the type of the video sequence.	Equations are mathematically complex
6	Nagasaka <i>et al.</i> , (2020).	Fast Scene Change Detection using Direct Feature Extraction from MPEG Compressed Videos	a fast scene change detection algorithm	More than 5 times faster than the feature-based method	

7	Fernando <i>et al.</i> , (2020).	A Unified Approach To Scene Change Detection In Uncompressed And Compressed Video	A real-time algorithm/ a novel algorithm /sudden scene change detection	Fade and dissolve scene change detection in video sequences. Accurately identifies effects.	To identify large local and global motion, it requires a lot of work.
8	Asha & Wensheng (2021).	On-line Scene Change Detection of Multicast Video	Frame sampling decompression with luminance histograms.	Supports live video processing on the network. And ]Capable of satisfying on-line annotation needs	The variation of online and offline video properties (latency) makes it complicated to compare them at the same time. Traded originality for efficiency
9	Smoliar, Kankanhalli & Zhang, (2022).	Statistical Sequential Analysis for Real Time Video Scene Change Detection on Compressed Multimedia Bit stream	statistical sequential analysis theory	Detects real time scene change	Traded originality for efficiency
10	Shu & Chau (2022)	A new scene change feature for video transcoding	The scheme used moving vector differences.	The scheme calculates the moving vector of two consecutive frames and makes decision based on the calculated results.	The scheme consider only local scheme change

**Table 2: Block Based Histogram Scene Change Detection algorithms**

S/N	Authors	Title	Methodology	Strength(s)	Weakness(s)
1	Cho & kang (2019)	Histogram shape-based scene-change detection algorithm	The scheme extracts frames histogram shapes and calculate the distance	Increased accuracy as a result merge and smooth procedure	In the presence of rapid movement and camera motion, the scheme ineffective



2	Jianho, Yujen , & Shih-Fu. (2020).	Efficient Scene Change Detection in MPEG Compressed Video Using Composite Block Averaged Luminance Image Sequence	DC Composite Image Sequence Motion Adaptive Filter Gradual Transition Model	The algorithm have lower complexity as compared to the existing schemes	DC composite image alone is insufficient for scene change detection
3	Nam & Xiaoquan (2020).	Fast Pixel-Based Video Scene Change Detection	Mean Absolute Frame Difference (MAFD) for detection and refining of frames.	Refined frames require low computational overhead. Thus making it fast and robust	Poor performance in the presence of flicker
4	Qin, Gao, Jiang, Liang, Wang, & Yang (2020).	PCA-based approach for video scene change detection on compressed video	principal component analysis	It detects both abrupt and gradual transitions. And also have automatic, real-time detection approach	The scheme is not tested data that depicts real life scenario.
5	Man-Hee, Hun-Woo, Dong-Sik. (2021).	Video scene change detection using neural network: Improved ART2	local minimum detection algorithm	Extracts constant scene.	When big object moves within a frame, the scheme has false detection.
6	John, Ding & Yang (2021).	Adaptive group-of-pictures and scene change detection methods based on existing H.264 advanced video coding information	Adaptive Group of Picture Detection(AGOPD) algorithms	High detection accuracy of 98%. With significant increase of PSNR	Fails to incorporate s adaptive search window.
7	Zhang, Feng , Hui, Gang. (2022).	An Effective Error Concealment Framework For H.264 Decoder Based on Video Scene Change Detection	Weighted Forward Motion Tracking (WFMT)	High robustness with improved PSNR of more 1dB PSNR increase	It gives more emphasis on moving objects.
8	Jens, Rand & Trozky. (2022).	Fast Frame-Based Scene Change Detection in the Compressed Domain for MPEG-4 Video	The scheme used Fast frame-based algorithm	Detects a high number of scene changes and movements.	Highly statistical nature of the scene change detection results design cannot be

					absolutely correct
9	Ding and Yang (2022)	Adaptive group-of-pictures and scene change detection methods based on existing H.264 advanced video coding information.	Motion Residual ratio	Presents a method that improves the accuracy of finding moving vector difference.	The scheme failed to consider the global scene change.
10	Hakan & Shishir (2022)	Video scene detection using graph-based representations	Graph-based video scene boundary detection method	Lower complexity and robustness	High computational overhead as a result of hops in graphs
11	Hakan & Shishir (2022)	Disparity Map Refinement for Video Based Scene Change Detection Using a Mobile Stereo Camera Platform	A novel disparity map refinement method	Minimizes false positive detection	The assumptions on temporal alignment are too rigid and the spatial registration module needs to be improved.
12	Kim, Jee, & Lee (2022)	Effective scene change detection by using statistical analysis of optical flows.	Statistical optical flow-based.	Rapid response as it take advantage of the optical flow differences	The scheme fails to detect global scene change.
13	Ankita, Chauhan, & Chauhan (2022).	Hybrid Approach for Video Compression Based on Scene Change Detection	Hybrid Approach	Reduced computational complexity	No significant difference when comparing the hybrid and diamond search in terms of PSNR
14	Hong et al., (2023).	Adaptive Thresholding for Scene Change Detection	a novel adaptive threshold decision method	Stability in terms of detection	Recalculation of mean and variance every time adds computatio

					nal overhead.
15	Chhasatia, Trivedi & Shah (2023).	Performance Evaluation of Localized Person Based Scene Detection and Retrieval in Video	Block Based Chi-Square histogram Comparison Method	Increased robustness of human computer interface applications.	Specific application dependent i.e HCI applications
16	Rupachandra, Manglem, & Sudipta (2023).	Video watermarking scheme based on visual cryptography and scene change detection	Discrete wavelet transform domain	Security & Robustness	Requires additional computational overhead for the cryptographic part
17	Fuad, Ernawan & Hui (2021).	Video scene change detection based on histogram analysis for hiding message	DCT coefficients modification in video frames	Captures hidden location as part of scene change detection inputs	The dataset used in testing the scheme is too small and biased.
18	Lee & Cho (2022)	Luminance Level of Histogram-Based Scene-Change Detection for Frame Rate Up-Conversion	The scheme extracts the luminance features using Histogram luminance level.	The scheme effectively detects scene change with minimal computation.	Some definitive values within the parameters are based on assumption which affects the overall performance of the scheme.
19	Anas, Zaharadeen, Bagiwa, & Muhammad (2023)	Scene Change aware Inter-Frame Forgeries Detection Technique for Surveillance Videos Based on Similarities Analysis	The scheme mitigates the effect of scene change on inter-frame forgery detection with low average computational time.	The scheme improves the overall performance of the inter-frame forgery detection at the expense of high average computational time.	The scheme require a lot of computational overhead
20	Song, Guo, Zhang, Li, Bai, Liu,	On Learning Multi-Modal Forgery Representation for	Multi-Modal Detection (MM-Det) for detecting	The scheme leverages an In-and-Across Frame	The scheme depends only on

	Zhai, & Liu (2024)	Diffusion Generated Video Detection	diffusion-generated videos.	Attention (IAFA) mechanism for feature augmentation in the spatio-temporal domain.	established dataset for diffusion generative videos.
21	Zou, Yu, Zhan, Lyu & Ma. (2025)	Semantic Contextualization of Face Forgery: A New Definition, Dataset, and Detection Method	Semantics-oriented face forgery detection that captures label relations and prioritizes the primary task (i.e., real or fake face detection).	The scheme creates face forgery image dataset in large size, where every image is associated with a set of labels organized in a hierarchical graph.	Dataset exposes the weaknesses of current detectors as the test set and consistently need to improve the generalizability as the training set.

### 3.0 GENERAL PROBLEMS RELATED TO SCENE DETECTION

With increase in the demand of video indexing, scene browsing and retrievals in digital forensic, scene change detection still have challenges that need to be addressed. These include the following;

i. Standard dataset;

There is no any dataset which contains videos in different formats that contains numerous scene changes that can be used by research to test their schemes. Everyone develops dataset of interest. Both trained and untrained datasets are required.

ii. Benchmark values for evaluation parameters

There are no threshold values for acceptance of performance evaluation parameters. This affects the genuity of results. A particular threshold needs to be set.

### 4.0 CONCLUSION AND FUTURE TREND OF SCENE CHANGE

Lots of researchers had proposed schemes for scene change detection; each scheme has strengths, weaknesses as a result different methods used in development of the schemes. The methods can be broadly categorized into histogram based and block based histogram methods. However even with this classification, there are challenges that both methods faces as discussed above. Work needs to be done to address these problems for better performance of scene change detection schemes in digital forensic and computer vision as whole.

### REFERENCES

- Anas, A., Zaharadeen Y.Y., Bagiwa, M. A. & Muhammad M. A. (2023). Scene Change aware Inter-Frame Forgeries Detection Technique for Surveillance Videos Based on Similarities Analysis! *SLU journal of science and technology*, 9(1a), 21-28, <https://dx.doi.org/10.4314/dujopas.v9i1a.3>.
- Ankita, P., Chauhan, R., Parmar, S., Parmar K., & shahida G. C. (2022) Hybrid Approach for Video Compression Based on Scene Change Detection. *Journal of Signal Processing, Computing and Control (ISPPC)*, 3(2). 1-5.
- Asha G. & Wensheng L. (2021). On-line Scene Change Detection of Multicast Video. *IEEE International Conference on Acoustic, Speech and Signal Processing (ICASSP)*, 4(9), 317-328.
- Bull D. R., Fernando, W. A., & Canagarajah, C.N., (2020) Wipe Scene Change Detection in Video Sequences. *Image Processing, IEEE*, 12(9), 292-308.
- Chhesatiya, Z. U., Li M, & Shiming G. (2023). Learning natural consistency rep presentation for face forgery video detection. *IEEE Transaction*, 3(7), 24-32.
- Cho S. I. & Kang S. J., (2019). Histogram shape-based scene-change detection algorithm," *IEEE Access*, 37(12), 27662-27667.
- Ding J. R., & Yang J. F. (2022). Adaptive group-of-pictures and scene change detection methods based on existing H.264 advanced video coding information. *International journal of Image Processing, (IJIP)*, 9(5), 85- 94.
- Dolley S. & Manisha S (2024). A novel video scene change detection using successive estimation of statistical measure and HiBiSLI method In:

- Proceedings of 7th EURASIP conference on speech and image processing, multimedia communications. 5(1a) 234- 244, <https://doi.org/10.1007/s41870-018-0146-8>.
- Fenando S. Y., Andreas R., Davide C., Luisa V., Christian R., Justus T. & Matthias N. (2019). Face forensics++: Learning to detect manipulated facial images. In ICCV, 1(11), 231-242.
- Hong R. M., Robson, C., Temple D. & Gerlach M (2007). Adaptive Thresh holding for Scene Change Detection. International Conference on Multimedia Computing and Systems IEEE, 8(2), 610 - 611.
- Fuad M., Ernawan F & Hui L. J. (2024). Video scene change detection based on histogram analysis for hiding message. Journal of Physics: Conference Series 9(4), <https://doi.org/10.1088/1742-6596/1918/4/042141>.
- Hakan H. & Shishir K. Shah (2022). Disparity Map Refinement for Video Based Scene Change Detection Using a Mobile Stereo Camera Platform. International Conference on Pattern Recognition, IEEE 6(7), 3890 - 3899.
- Adaptive Thresh holding for Scene Change Detection  
Ishwar K. S. & Nilesh P. (2024) A Statistical Approach to Scene Change Detection. IEEE Transaction on Communications. 3(2), 1201-1206.
- John M., Yujen J. & Shih-Fu C. (2021). Scene Change Detection in a MPEG Compressed Video Sequence. IEEE special issue, 9(3), 344-354.
- Jianjun L., Peiqi T., Yong W., Mian P., Zheng T. & Guobao H. (2020). Scene change detection: semantic and depth Information. Journal of Multimedia Tools and Applications, Springer Science & Business Media. 2(5), 111-125. <https://doi.org/10.1007/s11042-021-10793-4>.
- Kim, R., Jee, G. & Lee H. (2022). Effective scene change detection by using statistical analysis of optical flows. IEEE Transaction. 4(3). 11-16.
- Kim Y. H., Kang S. J., Yoo S., & Cho S. I. (2021). Scene change detection using multiple histograms for motion-compensated frame rate up-conversion," Journal of Display Technology, 8(3), 121-126.
- Lee & Cho (2021) Luminance Level of Histogram-Based Scene-Change Detection for Frame Rate Up-Conversion. IEEE! Transaction of Consumer Electronics, 52(3), 975-982, <https://doi.org/10.1109/ACCESS.2022.3146645>.
- Lee J. C, Kim S. J., & Lee C. S., (2012). Effective scene change detection by using statistical analysis of optical flows. Appl. Math. Inf. Sci., 6(1), 177-183.
- Lovi A. C., Manico J. A., & Fredlund J. R. (2021). Method for automatically organizing a digitized hardcopy media collection, IEEE Trans. Image Process., 19(11), 2924-2934.
- Nam L. & Xiaoquan Y. (2020). Fast Pixel-Based Video Scene Change Detection" in volume-4 Year-2005, IEEE Transaction, 3441-3449.
- Man H., Hun W. & Dong Sik. (2021). An efficient framework for high fidelity face swapping. Journal of Visual Communication and Image Representation (JVCIR), 4(6), 11-25.
- Neetrirajsinh C. J., Chhasatia, C. U. & Komal A. H. (2013). Performance Evaluation of Localized Person Based Scene Detection and Retrieval in Video Image Information Processing (ICIIP). IEEE Second International Conference 6(9), 78-85.
- Nagasaka T. S., Jiankang D., Jia G., Yuxiang Z., Jinke Y., Irene K., & Stefanos Zafeiriou. (2020). Retinaface: Single stage dense face localisation in the wild. ACM Conference, 7(4), 422-437. arXiv preprint arXiv:1905.00641,
- Qin Y., Jiang, J. Liang, S. Wang, S. Yang & Gao, L. (2020). PCA-based approach for video scene change detection on compressed video. International Journal of Science And Research (IJSR), 2(10), 1389 - 1390 .
- Qingjie C. & Minkai D (2021) Detection and Adaptive Video Processing of Hyperopia Scene in Sports Video. International Journal of Multimedia and Ubiquitous Engineering, vol. 3(1), 83-92. <https://doi.org/10.1155/2021/6610760>.
- Ralp Y. K., Kevin O, & James J Clark (2019). To see or not to see: The need for attention to perceive changes in scenes. Psychological Science, 8(5), 368-373.
- Shapiro L. G., & Stockman G. C. (2021) Computer Vision. Upper Saddle River, NJ, USA: Prentice-Hall.
- Shu-Ching C., Mei-Ling S., Wenhui L. & Chengcui Z. (2022). Scene Change Detection By Audio And Video Clues. IEEE. 365-368.
- Chau, L. P. & Shu H. (2022). A new scene change feature for video transcoding. In Proc. IEEE Int. Symp. Circuits Syst., 14(7), 4582\_4585.
- Song, X., Guo, X., Zhang, J., Li, Q., Bai, L., Liu, X., Zhai, G. & Liu X. (2024). On Learning Multi-Modal Forgery Representation for Diffusion Generated Video Detection! 38th Conference on Neural Information Processing Systems, 4(17), 321-338.
- Taehwan, S., Jae-Gon, K., Hankyu L., & Jinwoong K. (2020). Hierarchical Scene Change Detection In An Mpeg-2 Compressed Video Sequence. IEEE in Circuits and Systems, 253-256.
- Zhang J, Liu Feng, Shao H. & Wang G. (2022). An Effective Error Concealment Framework for H.264 Decoder Based on Video Scene Change Detection. Fourth International Conference on Image and Graphics, IEEE, 7(5), 285-290.
- Zou, M., Yu, B., Zhan, Y., Lyu, S. & Ma, K. (2025). Semantic Contextualization of Face Forgery: A New Definition, Dataset, and Detection Method. IEEE



DOI: <https://doi.org/10.57233/ijsgs.v11i4.995>

ISSNp: 2488-9229; ISSNc: [3027-1118](https://doi.org/10.57233/ijsgs.v11i4.995)

**IJSGS FUGUSAU VOLXXX**

**WEBSITE: <https://fugus-ijsgs.com.ng>**

transactions on information forensics and security,  
3(9), 3404-3417, <https://arXiv:2405.08487v3>.