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A Comparative Analysis of Edge Detection Techniques for Processing of a Video Signal

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ABSTRACT

In recent technology Edge detection technique is essential to image or video processing, which is The process of extract the structural information from digitized data. It involves various steps like object counting, feature extraction and classification. The goal of this study is to conduct a comparative examination of Edge Detection approaches used in video processing, with a greater emphasis on drastically reducing the dimensionality of image/video processing techniques. Edge detection techniques such as Sobel, Prewitt, Roberts, Laplacian, Canny, Krisch, and Robinson were compared. The evaluation of various edge detection approaches is based on characteristics such as PSNR, SNR, MSE, Entropy, and Execution time. Many video or image processing applications demand a quick processing response.

Keywords - **Canny edge,Image and video processing, Krisch, Laplacian,Prewitt, Roberts, sobel operators**

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I. INTRODUCTION

A digital revolution is been witnessed in last few decades and is in progress. Digital data and voice communications have been around for a long time. In any personal computers (PC's) or work stations , HiFi digital audio with CD-quality sound has recently been widely available in practically[1]. The technology is now ready to provide full motion digital video to the desktop. Aside from making the digital signal more durable, the major importance of digital representation and transmission is that it makes it possible to deliver a broad variety of services over the similar network. Computers and communications are brought together in a genuinely innovative way by digital video on the desktop. A single workstation may function as a computer, a high-definition television, a videophone, and a fax machine. It is possible to capture live video, perform digital processing, and/or print still frames at a nearby printer with the addition of a reasonably modest board. This section defines digital video as a kind of computer data.

The color signal is almost often represented as a component in digital video systems. The RGB outputs of most color video cameras are independently digitized. Component representation eliminates the artifacts caused by composite encoding, as long as the input RGB signal has not already been composite-encoded. Even if the incoming video is a composite analogue signal, such as The brightness and chrominance are then isolated on account of composite video[4]. S-Video sources do not require this. The chrominance is then demodulated to give colour distinction video information. At this stage, the information might be modify to change the brightness, from a videotape, it is normally transformed to componentanalogue video before being individually digitized. The combined signal can also be digitized

2. METHODOLOGY

A standard database video is taken as the input which may be GAIT video which are acquired from the respective databases. These video are set to undergo some linear operation like framing, key framing [2] and noise is added. Noises like Gaussian noise, Salt & Pepper noise are the general types of noises that affect the frames of the video file or video stream.These noises degrade the original frames causing difficult to study the particular area of the frame for processing. So after applying median filtering to the noisy frames, different edge detection techniques are applied to the frames.

2.1 Video Acquisition

The process of transferring an analogue video signal, such as that produced by a video camera or DVD player, to digital video is known as video capture. The resultant computerized information are PC records known as an advanced video transfer, or basically a video transfer[3].

A few handling processes are engaged with the video capturinginteraction. An analog to digital converter first converts the analog sign to a raw computerized stream.

contrast, saturation, and hue. At last, the information is changed by a colour space converter to give information that adjusts to any of different shading space guidelines, including RGB and YCbCr. These methods were alluded

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to as video encoding since they "encoded" a simple video standard like NTSC or PAL.

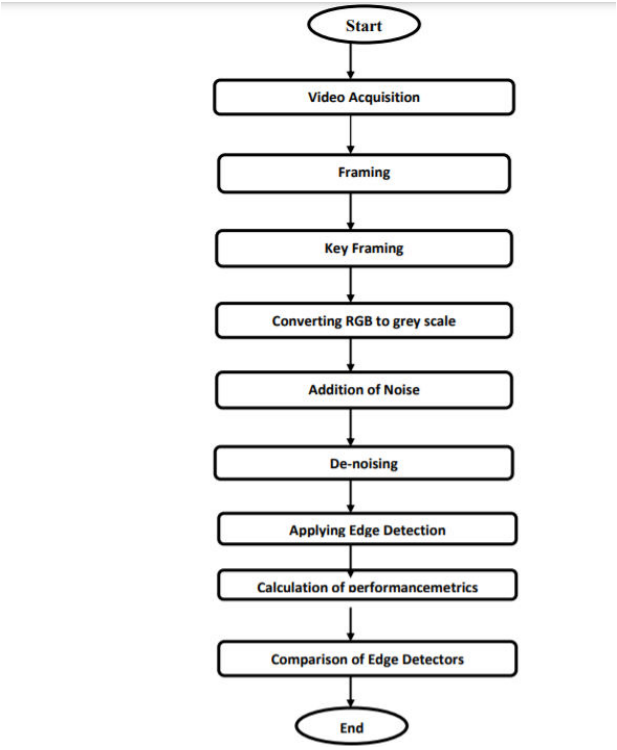

Fig.1 Flow Chart for applying Edge Detection

Capturing video from analogue video sources necessitates the use of specialized electrical equipment. This function is often accomplished at the system level by a specialized video capture card. Video decoder integrated circuits are frequently used in such cards to execute the video decoding operation [4].

2.2 Video Framing

- Each video or animation we watch on television, computer, phone, tablet, or even at the movies is composed of a series of static pictures.
- Most movies and television shows are shot at a rate of 24-30 frames per second; each individual picture is referred to as a frame, which is where the phrase frames per second (FPS) comes from.

Framing

- Each video or animation we watch on television, computer, phone, tablet, or even at the movies is composed of a series of static pictures.
- Most movies and television shows are shot at a rate of 24-30 frames per second; each individual picture is referred to as a frame, which is where the phrase frames per second (FPS) comes from.
- The simulation of the MATLAB programme may be used to extract a sequence, range, or even all frames from a short video clip.

Key Framing

- An extraction of key frame [5-8] approach dependent on the variations of histograms obtained for the consecutive image frames.
- Framing of key is a two-phased approach. The first phases uses mean and standard deviation parameters for computing the threshold value for the successive picture frames.
- The second phase is to obtain the most important frames by comparing to the threshold values to the absolute difference among the frames in the picture.
- Preprocessing of the images is performed and the difference of histogram among the consecutive frames is identified for every video frame.
- The threshold is state using the combination of mean and standard deviation and is shown in eqn 1.

$$T = \mu_{adh} + \sigma_{adh} \quad (1)$$

Where by using Eq.(1), μ states the mean of absolute difference and the standard deviation of absolute difference

2.4. Addition of Noise

The random fluctuation which is observed in the intensity of picture and which is originated inside the image sensors is known as noise. When noise is impacted in an image, the pixels in the image exhibit varied intensity values rather than genuine pixel values. Noise can be introduced into a picture during accusation and transmission. Eq(2) can be used to model the noisy picture and is shown below,

$$g(x,y) = f(x,y) + n(x,y) \quad (2)$$

In this paper, different noises like Salt and Pepper Noise Gaussian noise, Poisson Noise and Speckle Noise, Quantum Noise have been studied.

2.5. Denoising noise

There are several approaches for recovering a picture from noise distortions. Choosing the right procedure is critical to achieving the desired look. Denoising procedures are often problem-specific and can be accomplished by calculating filter coefficients[9,10]. That is, it is utilized a median filter to recover the picture from noisy circumstances.

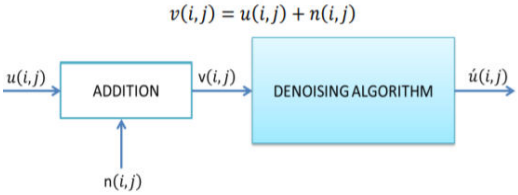

Fig.2 Model of Denoising Alogoritham

2.5.1 Median filter

A median filter is a type of nonlinear filter that uses the moving window concept, which is a 3× 3, 5× 5, or 7× 7 kernel of pixels applied across the full image's pixel matrix. The median of the pixel values in the window is

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calculated, and the obtained median is substituted with the window's centre pixel [11].

3 EDGE DETECTION TECHNIQUES

The technique of recognizing sharp discontinuities in a picture, where the discontinuities are the abrupt changes in pixel intensity that characterize the borders of the objects in the scene, is known as edge detection[9,10]. To extract video characteristics, multiple edge detection algorithms have been developed [12-14].

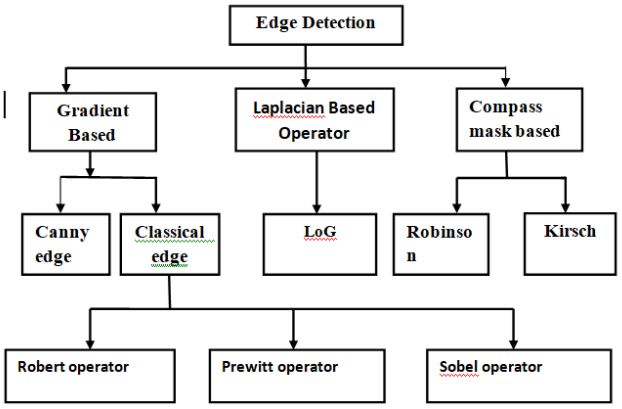

Fig.3 Classification of edge detection techniques

3.1 Sobel operator

Sobel edge detection functions similarly to a 2D filter in that it convolved an input picture with a kernel to determine the gradient of magnitude and gradient of direction for each pixel in an image. The magnitude of the vector is denoted by:

$$\Delta f = mag(\Delta f) = [\, G_x^2 + G_y^2 \,]\, 1/2 \qquad (3)$$

$$\begin{pmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{pmatrix} \text{Gx} \qquad \begin{pmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{pmatrix} \text{Gy}$$

Sobel 3x3 Kernel

In the equation 3, Gx shows horizontal direction and Gy show the vertical direction, separately. For the directions of x and y the Sobel utilizes two sets of kernals with a size of 3x3. One kernel is merely a 90° rotation of the others.

Merits:

- One of the benefits with this operator is its simplicity. The Sobel approach approximates the magnitude of the gradient.
- It is capable of detecting edges and their orientations. Because of the approximation of the gradient magnitude, the identification of edges and their orientations in this cross operator is said to be simple.

Fig.4 visualization of sobel Edge method

Demerits:

- It is prone to noise. The magnitude of the edges diminishes as the amount of noise in the image increases. When a result, as the size of the edges diminishes, Sobel operator accuracy declines.
- Overall, the Sobel technique cannot detect edges with thin and smooth edges accurately.

3.2 Prewitt operator

The Prewitt administrator is like the Sobel Edge location approach. It is a first subsidiary that distinguishes edges in the horizontal level Gx and vertical Gy directions and is utilized to work out the distinction in picture pixel intensities on the edge locale.The Gx and Gy for the said operator are defined as follows:

$$\begin{pmatrix} -1 & -1 & -1 \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{pmatrix} \text{Gx} \qquad \begin{pmatrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{pmatrix} \text{Gy}$$

Prewitt 3x3 Kernel

It is seen here that in the direction of x and y with two 3x3 networks, the center parts contain zero, demonstrating that they won't be remembered for the values that are original of the picture's edges.

Fig.5 Visualisation of Prewitt operator

Merits:

- Simpler level of computation.
- Detection of edges is sharp.

Demerits:

- Sharp edges are not been produced.
- In case of noise image the performance of the operator is weak.

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3.3 Robert's cross (RC) Edge Detection

Edge detection by Roberts is a fast approach for estimating the gradient strength in discrete separation, which is calculated by adding the squares of differences between the pixels that are diagonally adjacent with each other. It makes use of a pair of 2x2 twisted kernels, similar to the approach of sobel edge operator.

+1	0
0	-1

Gx

0	-1
1	0

Table.1 Roberts 2x2 Kernel

The design of kernels responds maximally to the edges in the pixel grid with an angle of 450 degrees. For every two perpendicular orientations there exists a kernel. To create independent gradient measurements in vertical and horizontal direction an individual kernel is applied to the input image.

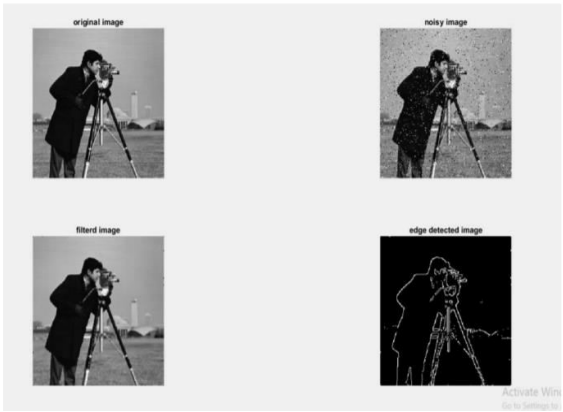

Fig.6Visualization of Robert's cross Edge Detection

Merits:

- The key advantage of utilizing the RC operator is that it is extremely fast to compute.
- To compute the value of each output pixel, just four input pixels must be inspected, and only subtractions and additions are employed in the computation. Furthermore, there are no parameters to configure.

Demerits:

- It is extremely susceptible to noise as the operator is employed to a little kernel.
- The operator do not identify moderate edges, it can only identify sharp edges.

3.4 Laplacian of Gaussian (LoG) Edge Method

The Laplacian of Gaussian (LoG) edge method, which belongs to an image's second spatial derivative, is also known as the MarrHilderath edge method. The preprocessing step is initiated in which the image f(x, y) contain noise and the noise is removed using Gaussian filter and then Laplacian filter is used to detect the edges perfectly. After removing noise the edges are investigated by seeing zero intersection. Again the filteration process is performed using laplacian of Gaussian filter.

The Laplacian(x, y) of an image with pixel intensity values I(x, y) is given as:

$$L(x,y) = \frac{\partial^2 I}{\partial x^2} + \frac{\partial^2 I}{\partial Y^2} \quad (4)$$

The Gaussian function i.e. 2D is given in eqn (5)

$$h(x,y) = -e\,\frac{x^2+y^2}{2\sigma^2} \quad (5)$$

Table.2 discrete approximations to the Laplacian filter

1	1	1
1	-8	1
1	1	1

-1	2	-1
2	-4	2
-1	2	-1

Fig.7 Visualization of LOG edge technique

Merits:

- Edges and their orientations are easily noticeable.
- The identification of gradient magnitude is very simple as the detection of edges and their orientations are said to be

Demerits:

- It is extremely sensitive to noise.
- In recognizing the edges and their directions, the noise to the picture is expanded, which in the end corrupts the magnitude of the edges.
- Some of the existing edges in the noisy image distort the procedure.
- False edges are produced as a result of strong intensity changes at corners and curves with poor edge alignment.

3.5 Canny Edge Detection Algorithm

Canny introduced an optimal edge locator, which is said to be a computational approach for detection of edges.The Canny's aims were to improve on the several edge detectors that were previously available when he began his study. This algorithm consists of six phases.

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- Smoothing of image
- Finding of vertical gradients
- Finding of horizontal gradients
- Non max suppression
- Doubling of the thresholdingEdges
- tracking of edges based on hysteresis

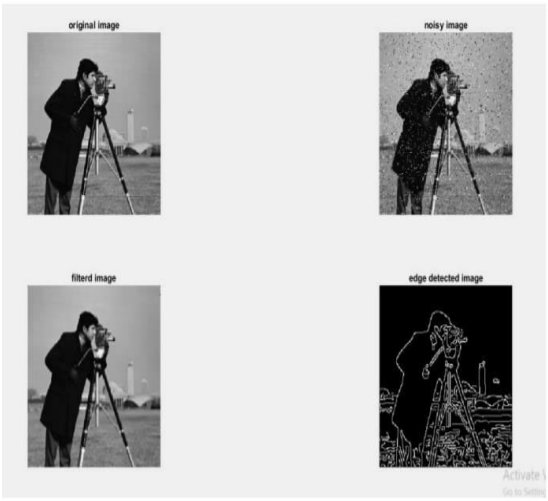

Fig.8 visualization of cany's Method

Merits:

- The removal of noise in an image is done using Gaussian filter.
- The improvement of the image is shown in terms of noise ratio, which helps in producing pixel wise edges using a non-maxima suppression method.
- The efficiency of the method can be evaluated using the noise parameter.
- The method is very much responsive and good resistant to noise

Demerits:

- The real drawback of employing the Canny edge detector is that it takes a long time to compute owing to its sophisticated processing.
- To achieve real-time reaction, it is tough to implement.

3.6 Kirsch Edge Detection

Kirsch edge detection is a technique developed by Kirsch (1971). This approach defines masks by taking a single mask and spinning it across all the directions that are available in compass .The masks differ as follows:

The largest value determined by convolution of each mask with the picture is known as the edge magnitude. The direction is defined based on the magnitude which is greater provided by the mask

$$E=\begin{bmatrix}-3&-3&5\\-3&0&5\\-3&-3&5\end{bmatrix}\ NE=\begin{bmatrix}-3&5&5\\-3&0&5\\-3&-3&-3\end{bmatrix}\ N=\begin{bmatrix}5&5&5\\-3&0&-3\\-3&-3&-3\end{bmatrix}\ NW=\begin{bmatrix}5&5&-3\\5&0&-3\\-3&-3&-3\end{bmatrix}$$

$$W=\begin{bmatrix}5&-3&-3\\5&0&-3\\5&-3&-3\end{bmatrix}\ SW=\begin{bmatrix}-3&-3&-3\\5&0&-3\\5&5&-3\end{bmatrix}\ S=\begin{bmatrix}-3&-3&-3\\-3&0&-3\\5&5&5\end{bmatrix}\ SE=\begin{bmatrix}-3&-3&5\\-3&0&5\\-3&5&5\end{bmatrix}$$

Mask k0, for example, corresponds to the vertical edge, whereas mask k5 relates to a diagonal edge. The mask gets similar and turns around the central axis. Among 8 mask 1st four and last four will be similar to each other.

3.7 Robinson Edge detection

In 1977 Robinson introduced Robinson technique which is related to Kirsch masks technique. This technique is simpler to build as it need the coefficients of 0,1 and 2.The masks are even with regards to their directional axis, which has zeros on it. It is simply important to figure the outcome on four masks, and the outcome from the other four might be inferred by negating the outcome from the initial four. The following are the masks:

$$E=\begin{bmatrix}-1&0&1\\-2&0&2\\-1&0&1\end{bmatrix}\ NE=\begin{bmatrix}0&1&2\\-1&0&1\\-2&-1&0\end{bmatrix}\ N=\begin{bmatrix}1&2&1\\0&0&0\\-1&-2&-1\end{bmatrix}\ NW=\begin{bmatrix}2&1&0\\1&0&-1\\0&-1&-2\end{bmatrix}$$

$$W=\begin{bmatrix}1&0&-1\\2&0&-2\\1&0&-1\end{bmatrix}\ SW=\begin{bmatrix}0&-1&-2\\1&0&-1\\2&1&0\end{bmatrix}\ S=\begin{bmatrix}-1&-2&-1\\0&0&0\\1&2&1\end{bmatrix}\ SE=\begin{bmatrix}-2&-1&0\\-1&0&1\\0&1&2\end{bmatrix}$$

By applying the above shown eights masks the larger gradient value is obtained. The inclination's point might be assessed as the point of the line of zeroes in the mask delivering the best reaction.

4 PERFORMANCE METRICS AND TOOLS USED

The identification of actual edges, time for processing, ratio of error, and level of noise, among other metrics, are used to assess the efficacy of edge detection algorithms. In this research, we evaluate several edge detectors based on MSE, PSNR, SNR, Entropy, and Execution time. First, detection of edges for test images is conducted using MATLAB programme and all recommended techniques. The second stage is to use the MATLAB Program to compute the performance metrics between the ground truth image and image with edge detection[15-17].

a. Mean Squared Error(MSE)

The MSE is a measure of average squared difference between the estimate and the parameter. MSE is the average difference between the pixels in the original ground truth picture and the pixels in the image of edge detection.

The bigger the MSE greater is the disparity between the original image and processed image.

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$$MSE = \frac{\sum_{M,N}[I_1(m,n) - I_2\ (m,n)\ ]^2}{M,N} \quad (6)$$

b. Peak Signal to Noise Ratio(PSNR)

PSNR is the ratio of peak signal to the amount of noise that is present in the image which degrades the quality of image. Although a greater PSNR typically suggests that the reconstruction in image compression is of higher quality, which is represented in terms of DB scale.

$$PSNR = 10\log_{10}\left(\frac{R^2}{MSE}\right) \quad (7)$$

The maximum variance in the supplied picture data is denoted by R. R is 255 if it is an 8-bit unsigned integer data type.

c. Signal to Noise Ratio

The measure of physical sensitivity of an image is termed as signal to noise ration.

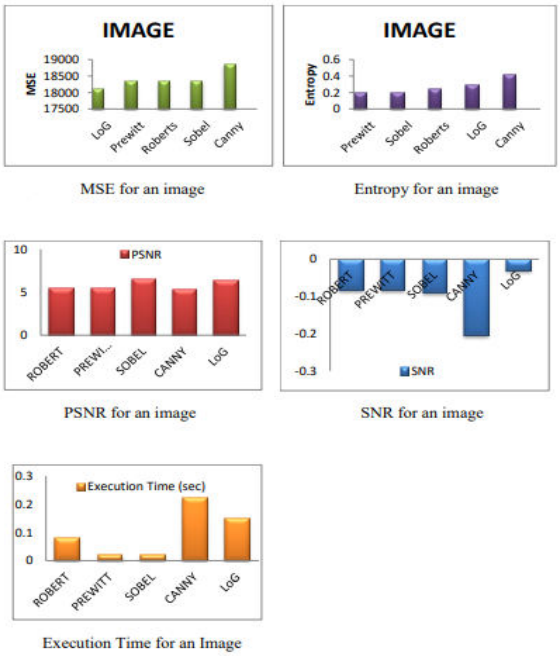
- Compute as the average of the pixel values.
- Compute the pixel's and standard deviation or error value.

$$SNR=10\log_{10}\left(\frac{P_{signal}}{P_{noise}}\right) \quad (8)$$

This is the ratio to express the result in decibel.

d. Entropy

Entropy is a measure of picture information content that may be understood as the average uncertainty of a source of information. Entropy is defined in images as the equivalent states of intensity level to which individual pixels may adapt. The entropy value is employed in quantitative analysis and assessment of picture features since it enables a better comparison of the image.



MSE for an image

Entropy for an image

PSNR for an image

SNR for an image

Execution Time for an Image

Fig.9 Bar Graphs of The parameters

Table.3 Comparision of Attributes

Type of Tech used	PSNR	SNR	MSE	ENTROPY	EXECUTION TIME(Sec)
Sobel	5.5002	-0.0822	18325.5202	0.2037	0.1884
Robert	5.5016	-0.0808	18319.6604	0.2279	0.2252
Prewitt	5.4973	-0.0852	18338.1115	0.2022	0.2074
Canny	5.3790	-0.2035	18844.3956	0.4290	0.2795
LOG	5.5565	-0.0260	18089.80012887	0.2887	0.2189

5 EXPERIMENTATION RESULTS

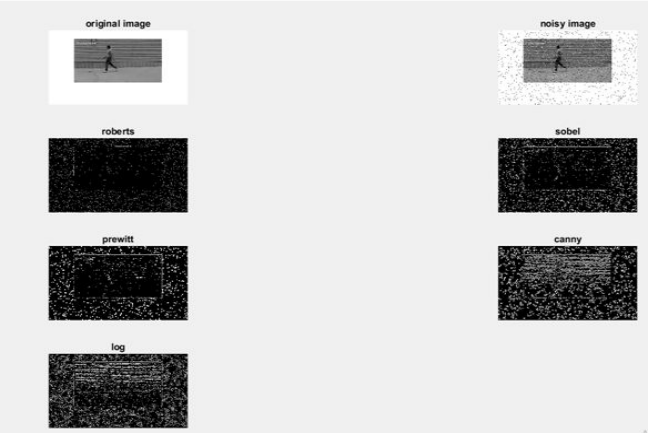


Fig.10 Results of all Edge Detection techniques without filtering

A standard video of a walking person is taken and frames are extracted from the video. The video is of AVI format and is of two seconds duration and is a gray scale video frames are extracted using MATLAB.

Kirsch operator detects the edges in all 8 directions. It takes a single mask and spins it through all eight compass directions in 45 degree increments. For each direction it uses a different mask i.e. a filter. The outputs of all the masks are shown in the above Fig.11

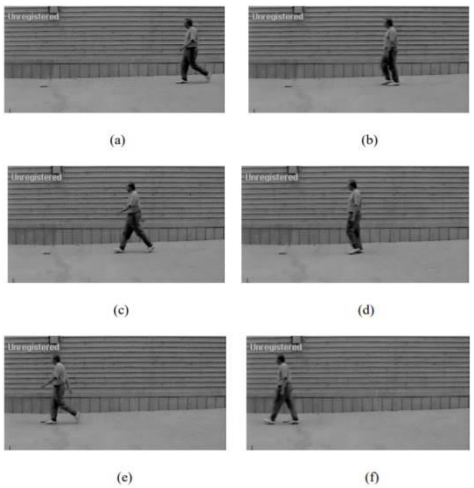


Fig.11Frmaes obtained from the video

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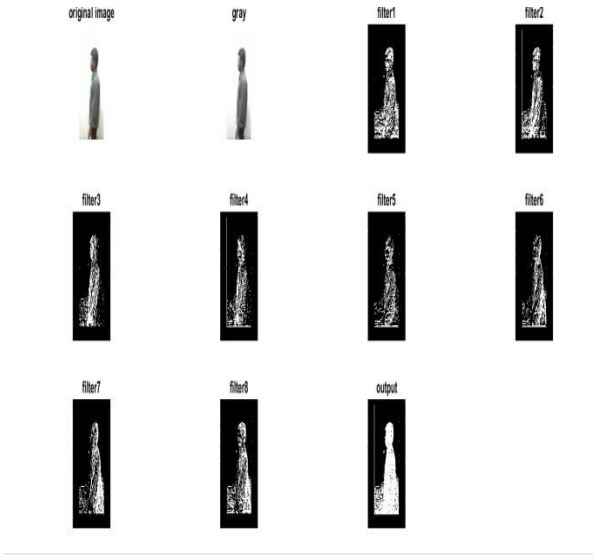

Fig.12Results of Kirsch Operator

The Robinson operator is similar to Kirsch but the coefficients in the mask are different. It detects the edges in all 8 directions. Single mask is considered and the image is rotated in 45 degrees in all the eight directions of the compass. For each direction it uses a different mask i.e. a filter. The outputs of all the masks are shown in the above Fig.12. The maximum gradient in the 8 directions is shown as output.

From Table 4, some of the frames extracted from the videos. The performance evaluation of various Edge detection techniques are show in the below table. The performance metrics are calculated for image, frame and keyframe In the presence of noise. Robert and Sobel showed better performance with low PSNR, SNR, high MSE for key frame and image respectively. Entropy is always high for Canny. When compared with execution time Sobel operator performs well with less execution time.

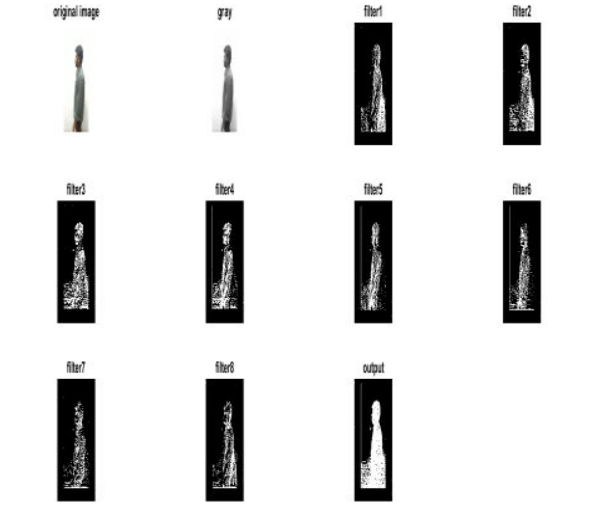

Fig.13Results of Robinson Operator

Table 4: Performance analysis of different Edge Detection techniques without applying Median Filter

Techniques	Input	PSNR	SNR	MSE	Entropy	Execution Time(Sec)
Robert	Frame	6.4821	-0.0940	14617.4526	0.1557	0.0708
	Key Frame	1.6535	0.1748	44435.0245	0.2170	0.0727
	Image	5.4688	-0.1136	18458.4832	0.2048	0.2565
Sobel	Frame	6.4227	-0.1534	14818.6037	0.2580	0.0174
	Key Frame	1.8328	-0.3541	42638.1826	0.3774	0.0191
	Image	5.2686	-0.3138	19329.4466	0.3218	0.0185
Prewitt	Frame	6.4418	-0.1343	14753.6186	0.2554	0.0175
	Key Frame	1.8393	0.3606	42574.3116	0.3816	0.0187
	Image	5.2912	-0.2913	19229.3041	0.3120	0.1415
Log	Frame	6.4420	-0.1341	14752.9213	0.6447	0.0981
	Key Frame	2.088	0.6101	40197.7562	0.6274	0.1037
	Image	5.4498	-0.1326	18539.4859	0.4604	1.2640
Canny	Frame	6.1718	-0.4043	15699.9475	0.7686	0.2158
	Key Frame	1.9189	0.4402	41801.1635	0.6404	0.3142
	Image	5.3610	-0.2215	18922.7057	0.6695	0.3818

When Edge detection techniques are applied on de-noised image Canny operator performs well for image, keyframe and frame with low PSNR, SNR, high MSE, and Entropy. Execution time is high for Canny and LoG as in Table 5.

Table 5: Performance analysis of different Edge Detection techniques after applying Median Filter

Techniques	Input	PSNR	SNR	MSE	Entropy	Execution Time(Sec)
Robert	Frame	6.619	-0.0142	14351.4308	0.2565	0.0661
	Key Frame	1.4999	0.0212	46035.4191	0.1628	0.0719
	Image	5.4986	-0.0839	18332.5163	0.2384	0.0791
Sobel	Frame	6.4633	-0.1128	0.2273	0.0234	0.0234
	Key Frame	1.4752	14680.8191	46297.2843	0.1396	0.0218
	Image	6.4633	-0.0035	18355.2980	0.2063	0.0200
Prewitt	Frame	6.4640	-0.0893	14678.5978	0.2292	0.0348
	Key Frame	1.4766	-0.1121	46282.7232	0.1419	0.0230
	Image	5.4988	-0.0021	18331.6525	0.2025	0.0199
Log	Frame	6.4197	-0.0837	14828.8984	0.5795	0.0899
	Key Frame	1.5039	-0.0309	45993.1868	0.3352	0.1070
	Image	6.4197	0.0252	18110.4263	0.2907	0.1520
Canny	Frame	6.3291	-0.0309	15141.4975	0.6067	0.1778
	Key Frame	1.4585	-0.02470	46476.0195	0.3625	0.1836
	Image	5.3794	-0.2031	18842.7225	0.4209	0.2231

6. CONCLUSION

The numerical results shown in the tables have the outcomes of the MATLAB program. In this paper we have done comparison between attributes of the performance matrices i.e., PSNR, SNR, MSE by different edge detection techniques.Lesser the PSNR value states that the results are proper and better. When looking at processing time Prewitt, Sobel operators gives much better performance when compared to Canny, it takes more time to execute and same is proved in earlier works [18-21].

Canny operator provides high entropy meanwhile it contains high information of image/keyframe/frame. In both cases i.e., in presence and absence of noise Canny operator has higher entropy which produces better image Encryption.The performance metrics of Kirsch and Robinson are almost similar. Execution time is less when compared to Canny and LoG.Kirsch and Robinson techniques calculate the edges in all 8 directions using 8 masks. The procedure for kirsch and Robinson is similar only the coefficients of the masks changes.

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When Edge detection techniques are applied on a noisy image, the outputs of Robert, Sobel and Prewitt doesnot contain noise. In this case they acted as filters. But, Canny and LoG operator outputs contain noise.Kirsch and Robinson techniques calculates the edges in all 8 directions using 8 masks. The procedure for kirsch and Robinson is similar only the coefficients of the masks changes. The performance metrics of Kirsch and Robinson are almost similar. Exection time is less when compared to Canny and LoG.

7. FUTURE WORK

Edge detection techniques are particularly important in image processing, machine vision, and computer vision; they may be utilized in feature identification and feature extraction of a digital picture.Further research and work should be carried out on real time application like a automated systems. This is can be extended to Industrial applications

REFERENCES

[1] R.C. Gonzalez and R.E. Woods, *"Digital Image Processing", Prentice Hall, Second Edition*, 2002.

[2] Zhonglan Wu and Pin Xu , " ***Research on the technology of Video key- frame extraction based on clustering",*** *IEEE Fourth international conference on Multimedia Information networking and security*, 2012, p.90-293.

[3] T.Arunachalam, *"An Efficient Color Image Segmentation using Edge Detection and Thresholding Methods, International Journal of Advanced Networking & Applications(IJANA)* Volume: 08, Issue: 05 Pages: 19 – 23 (2017)

[4] Fatemeh Soleimani Roozbahan, Reihaneh Azad "Security Solutions against Computer Networks Threats", Int. J. Advanced Networking and Applications, Volume: 07 Issue: 01 Pages: 2576-2581 (2015) ISSN: 0975-0290

[5] Mukhargee et al., *"Key-frame estimation in video using randomness measure of feature point pattern", IEEE transactions on circuits on systems for video technology*, vol.7,no.5, May 2007, p. 612-620.

[6] Zhao et al. *"Key-frame extraction and shot retrieval using nearest feature line", Proceedings of ACM Workshop on Multimedia*, 2000,p. 217220.

[7] Suresh C Raikwar, Charul Bhatnagar and Anand Singh Jalal, *"A frame work for key-frame extraction from surveillance Video", 5thInternational Conference on Computer and Communication Technology", IEEE*, 2014, p. 297-300.

[8] Li Liu, Ling Shao, Peter Rocket, "*Boosted key-frame and correlated pyramidal motion feature representation for human action recognition", Pattern Recognition* 45 (2013), p. 18101818.

[9] Chi Chang-yanab, Zhang Ji-xiana, Liu Zheng-juna" *Sudy on Methods of Noise Reduction In a Stripped Image", The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*. Vol. XXXVII. Part B6b. Beijing 2008

[10] Hameda Abd El-Fattah El-Sennary, Mohamed Eid Hussien, Abd El-Mgeid Amin Ali, Edge Detection of an Image Based on Extended Difference of Gaussian, *American Journal of Computer Science and Technology*. Vol. 2, No. 3, 2019, pp. 35-47. doi: 10.11648/j.ajcst.20190203.11

[11] D.Maheswari, Dr.V.Radha, *"Noise Removal In Compound Image Using Median Filter", International Journal on Computer Science and Engineering*, Vol. 02, No. 04, 2010, 1359-1362.

[12] Mohsen Sharifi, Mahmoud Fathy and Maryam Tayefeh Mahmoudi, *A Classified and Comparative Study of Edge Detection Algorithms, International Conference on Information Technology: Coding and Computing, IEEE,* 2002.

[13] Siwa Suwanmanee, Surapong Chatpun and Pedro Cabrales, *Comparison of Video Image Edge Detection Operators on Red Blood Cells in Microvasculatur, IEEE, Biomedical Engineering International Conference*, 2013.

[14] Tamanna Sahoo, Sandipan Pine, *"Design and Simulation Of Various Edge Detection Techniques Using Matlab Simulink", IEEE*, 2016.

[15] G. N.Sarage, Dr. Sagar S Jambhorkar, "*Noise Removal from Mammographic Image based on Mean and Median Filtering Techniques", International Journal of Advanced Resea arch in Computer Science,*Volume 2, No. 4, July-August 2011 498500.

[16] Y. Li et al. *Techniques for movie content analysis and skimming: tutorial and overview on video abstraction techniques, IEEE signal processing magazine 23(2)2006* p. 27-50.

[17] Pinaki Pratim Acharjya, Ritaban Das and Dibyendu Ghoshal, *''Study and Comparison of Different Edge Detectors for Image Segmentation'', Global Journals* Inc. (US), 2012.

[18] Naveed Ejaz et al. , *" Adaptive key-frame extraction for video summarization using an aggregation mechanism", Journal of Visual Communication 23 (2012*), p.1031-140.

[19] Shashidhar Ram Joshi, Roshankoju, *''Study and Comparison of Edge Detection Algorithms*", IEEE, 2012.

[20] Eric J.Wharton, Karen Panetta, S. Agaian, ''*Logarithmic Edge Detection with Applications'', IEEE,* 2007.

[21] Dunamis et al. *"A fuzzy video content representation for video summarization and content based retrieval", Journal of signal processing,* 2000, p.1049-1060.