Video Steganography using Sobel Edge Detection Technique

Dipika Deshmukh, Gajanan Kurundkar

Abstract: Video Steganography is a procedure of hiding the message into video in such a way that no one can detect its presence. In proposed research work used two algorithms namely random scan and edge detection for hiding the data into video. Five edge operators are used for edge detection of selected frames namely Sobel, Canny, Prewitt, Log, Robert.

Keywords: Canny, Edge Detection, Log, Prewitt, Robert, Sobel

I. INTRODUCTION

Data security is the process of preserving the whole data with secrecy. There are number of methods for securing the data. These are watermarking, steganography and cryptography. From Greek derived steganography word. Stegano means hide and graphy means writing. In military and intellectual property department used steganography for secrecy. Embedding payload is the capacity of file means how much data we can hide. Performance of steganography is measured in terms of its hiding capacity with its distortion rate [1]. Video is gathering of images and sound. Steganography methods of images and sound are used for video steganography .Video steganography is more beneficial because it can hide more data with less distortion rate[2].I have used random frame selection and edge detection techniques to hide the data into the frame of video. In random frame selection technique take random frames of video to hide the data, if we take frames sequentially then attacker can doubt. In edge detection techniques, we hide data at edge pixels of image .LSB method is very common for hiding the data .In edge detection techniques we can hide more data than other method like LSB.

II. VIDEO STEGANOGRAPHY

We can hide different types of files into different video format. Video is used as a carrier in video steganography to hide the information. Video formats are mp4 and mpeg [3, 4].A video made up of collection of frames, which are played at specific frame rate depending upon video format.

Dipika Deshmukh, Student, SRTM University, Nanded. Maharashtra, India

Dr. Kurundkar Gajanan*, Assistant Professor, Department of Computer Science, Shri Guru Buddhiswami Mahavidyalaya, Dist. Parbhani, Maharashtra, India.

The size of frame is considered as m*n. In this m is the rows and n is the columns of the image. RGB image contain three separate images. RGB image required 24 bits to specify a single pixel [5].

III. EDGE DETECTION

There are different patterns for hiding the data but among those pattern edge detection is a safe way for hiding the information [6].An edge are the points of an image where abruptly changes its brightness. Edge detection preserves the structural properties of an image [7].Edge detection field is developed its own in image processing. Basically, edge detection used for feature detection and extraction. Practical applications in medical imaging, face recognition, study of astronomical structures and fingerprint recognition [8]. Edges are the boundaries between higher intensity and lower intensity of the image.in image processing edges act like filter. The sharp edges of image can recognized with the help of this edge filter. Throughout the whole image edge values are placed in random fashion. Thus it becomes highly secured. Edge detection of image is helpful in data compression and image segmentation. An edge pixel is characterized by its strength and direction.

1. Sobel Edge Detector
2. Prewitt Edge Detector
3. Robert Edge Detector
4. Laplacian of Gausian(Log) Edge Detector
5. Canny Edge Detector

IV. EDGE DETECTION STEPS

Edge detection has mainly three steps. These are as follows [9]

Filtration: Generally salt and pepper noise does corruption of image. Also impulse and Gaussian type noise don of image. For the reducing these noise, filtering is carried out.

Enhancement: It focuses on pixels where important change in local intensity values. It means the improving image quality. Its main purpose is to produce better and more suitable than original. Apply the filers on image for enhancement.

Edge detection: Different methods are used to decide which points are edge points and which edge pixels are removed as noise

V. PROPOSED METHOD

i. Read and display video

We can take any type of video for our research work.

I have taken xylophone.mp4 video from matlab. In research work, first step is read input video file. VideoReader () function is used for reading the video. Then display the video.

ii. Fragmentation of video

In our research work after displaying the video, fragmentation of video is carried out.Xylophone.mp4 video contains 141 frames. From this 141 frames, we are taking single frames for hiding the data. If we take all frames for hiding the data then quality of video will be disturb.

iii. Select random frame

We have selected single frame of number 141 for hiding the data. This selected frame converted into tif image and save it individually. Preprocessing is required to this image.

iv. Separation of RGB channels

After selecting single frame extraction of RGB channel takes place. We have separated all these three channels by using rgbImage () function. But takes only blue channel for further processing.

v. Filtration It is a technique for enhancing the Image. Apply average filter of size (5, 5) on blue channel image using imfilter () function. We have filter an image to highlight certain features like smoothing, sharpening and edge enhancement.

vi. Enhancement

It focuses on pixels where important change in local intensity values. It means the improving image quality. Its main purpose is to produce better and more suitable than original. Apply the filers on image for enhancement

vii. Edge detection

    a) **Edge detection steps for Gradient based operator(Sobel, Prewitt, Robert)**
        1. Generate all the filters
        2. Apply mean filter on gmap
        3. Calculate Magnitude
        4. Apply thresholds on gmap

Edge detection steps for LoG operator

    1. Apply LOG filter
    2. Check for zero crossings
    3. Threshold based on gradient magnitude

Edge detection Steps for Canny operator

    1. Smoothing
    2. Compute Gradient
    3. Non-maximum Suppression
    4. Hysteresis Thresholding

viii. Find edge pixels

Find the edge pixels from each channel and combine using logical operations.

ix. Generate secret key

Taking random frame numbers as a secret key for hiding the data.

x. Data embedding
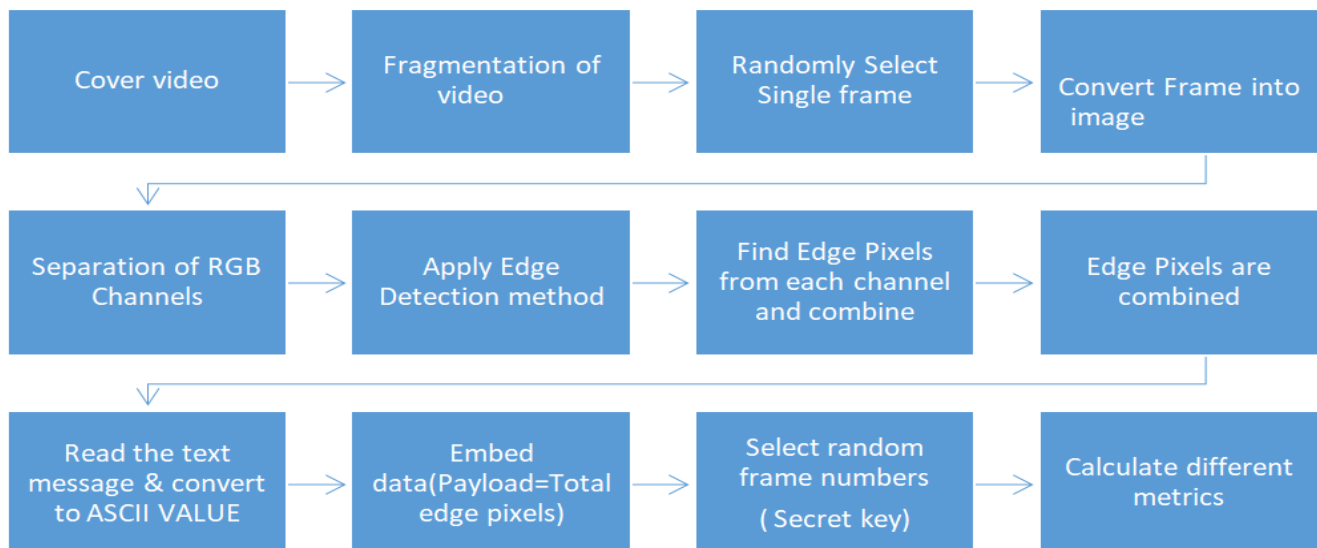
Store ASCII values of characters at edge pixel position.

xi. Calculate MSE, PSNR, Standard Deviation, Entropy

### xii. Decode message and display results

VI. PROCEDURE FOR ENCODING

Following figure shows flowchart for hiding the data into frame of video. We have hide secret data into single frame. We can hide secret data in number of frames of video. For hiding the data used edge detection method. There are different edge operators namely Sobel, Prewitt, Robert, Canny Laplacian. After finding the edge pixels of frame, hide the character's ASCII value into pixel position. Total payload capacity of image is equal to the number of pixels of image. At the time of hiding the data used secret key, which is the random frame number of video


Fig.1.Flowchart for Encoding+

VII. PROCEDURE FOR DECODING
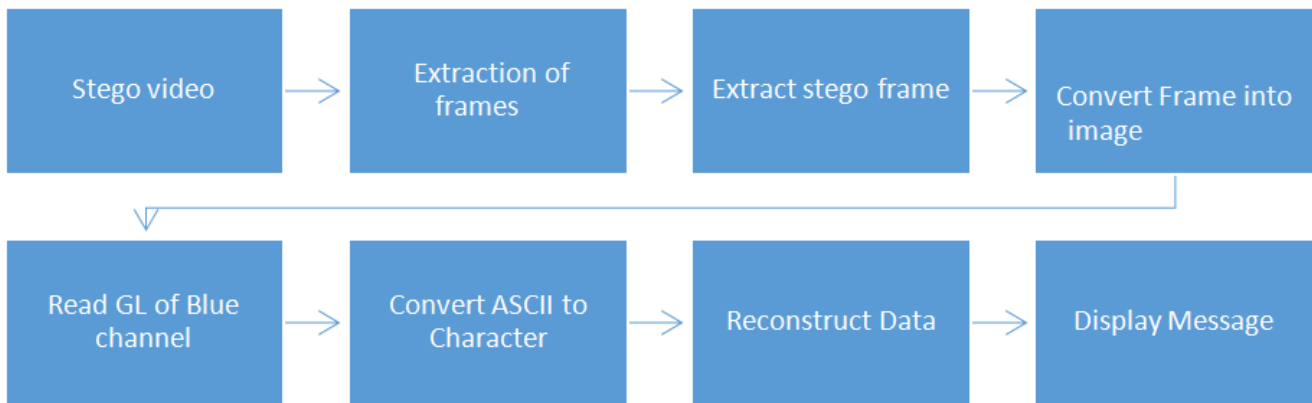
Fig.2. Flowchart for Decoding

## VIII. EXPERIMENTAL RESULT AND DISCUSSION

The proposed method is implemented with MATLAB. I have taken xylophone.mp4 video for video steganography. Payload capacity and imperceptibility are two major factors which affect the steganography. In proposed method used xylophone.mp4 video for the evaluation. We get result of imperceptibility after comparing the original frame of video with stego frame. Following figure shows original video then fragmentation of video.

(a)
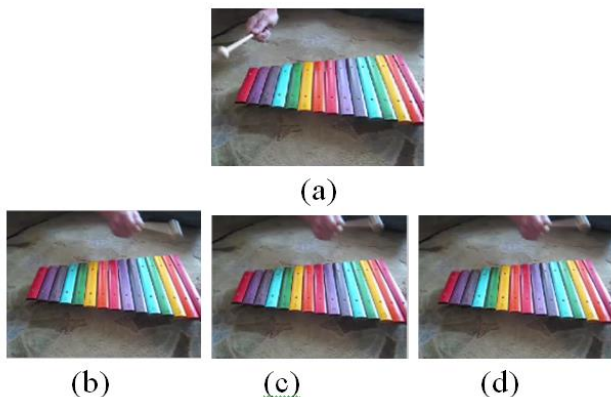
Fig.3. (a) Original video (Xylophone .mp4) (b) Frame no.100 (c) Frame no .101(d) Frame no.102

IX. EDGE DETECTION BY DIFFERENT EDGE OPERATORS

Following figure shows edge detection of 141 number frame using different edge operators like prewitt, Sobel, Robert, Canny, LoG. By careful observation of figure we can say that Sobel has more edges than other operators. Edges for Robert operator has very less. Edge map of Prewitt is medium. Surely we can say that Sobel has more edge pixels.
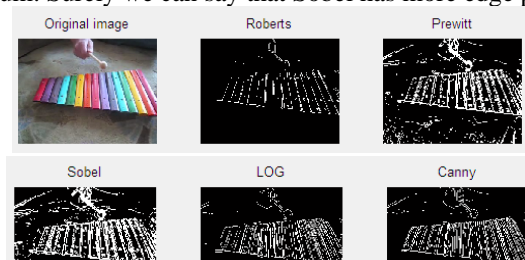
Fig.4.original image and edge maps by different operators

X. COMPARISON OF ORIGINAL AND STEGO FRAME

By careful observation, we can see that there is no difference between original image and stego image. Hence, surely we can say that imperceptible stego frame to human eye.

Fig.5.(a)Original image (b)Stego frame

XI. RESULT ANALYSIS

We are looking in previous result analysis table of Soumyajit Sarkar et al that they used LSB method for embedding the data in image pixels and evaluate results qualitatively. But in proposed method evaluate results qualitatively and quantitatively for image. They only mention the categories of payload capacity .They did not measure the actual information in bytes capacity. After observation of following table we have seen that the Robert edge detection technique has very low value of payload capacity. Then found that increases the capacity for LoG, Canny, and Prewitt and highest in Sobel edge detection method. We can say that more information is hidden within the edges getting for Sobel edge detector. PSNR gives ratio between stego image and original image. As more data hide in edge pixels of sobel then more changes occur in the pixel values. Hence PSNR is more for Sobel but greater MSE. Because of more data in stego image. Also standard deviation values are more for sobel. It is significant to note that payload capacity is approximate to the respective image edge for each technique.

Table-I Soumyajit Sarkar et al. [9]

Technique	Payload Capacity	PSNR	M.S.E
Robert	Very Low	62.6543	0.0353
Laplace	Low	60.893	0.0529
Prewitt	Medium High	60.7181	0.0551
Sobel	High	60.601	0.0566
Canny	Very High	58.487	0.0611

Table-II Comparison of different operators

Operator/ Parameter	MSE	PSNR	Entropy	Std	Payloads
Robert	0.0055	76.1954	7.5747	0.8775	2674
Prewitt	0.0055	76.1954	7.5747	0.8777	12000
Sobel	0.0033	78.4415	7.5747	0.8779	17406
LoG	0.0055	76.1954	7.5747	0.8768	6334
Canny	0.0055	76.1954	7.5747	0.8776	7319

XII. CONCLUSION

From the experimental work and result analysis, we can conclude that proposed method has good results for sobel operator. In previous table shown canny has best results. If you want to hide large, file then use video steganography. Video has more hiding capacity than image. We can conclude that the Sobel edge detection technique is best appropriate for large amount of data.

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AUTHORS PROFILE

Dipika Deshmukh She is research student of SRTM University,Nanded. Maharashtra, India

Dr. Kurundkar Gajanan Dattatray is working as Assistant Professor in Department of Computer Science, Shri Guru Buddhiswami Mahavidyalaya, Dist. Parbhani, Maharashtra, India.
His area of interest is Computer Networks & Computer System Security. He has published 4 Books in Computer Science. He has Published 20+ Research Paper in National/International Peer Reviewed Journals. He is Life Member of Indian Science Congress Association, Kolkata. Member of (IAENG) International Association of Engineers Member. He has more than 16 years experiences in teaching field