

DCT Based Digital Video Watermarking Using MATLAB/Simulink

Sangeeta Yadav¹, Priyanka Anand²
M Tech Scholar¹, Assistant Professor²

Department of Electronics and Communication Engineering,
Bhagat Phool Singh Mahila Vishwavidhyalaya, Sonapat-131305, India.

Abstract: In the present era, due to the rapid advances in the field of Information Technology digital data can be easily created, copied, processed and distributed freely among unauthorized users. The copyright laws are not sufficient to deal with digital data. Watermarking could be used to protect the authenticity of the owner. In this paper, the Simulink based model for watermark embedding in frequency domain is implemented and simulation results are carried out. The transform used is Discrete Cosine Transform due to its robust nature.

Keywords: Discrete Cosine Transform (DCT), watermark embedding, Inverse Discrete Cosine Transform (IDCT), Simulink.

I. INTRODUCTION

In the world of the Internet, the digital data can be transferred, copied within seconds without the knowledge of the author[1]. The cases of piracy are hiking due to the advancement in technology. The author of the data does not know that the duplicate files of his work is available on the Internet that can be accessed by anybody[2]. In order to maintain the authenticity of the author, there is a need to develop a system that can deal effectively with such kind of problems. Watermarking is a technique of hiding some data that are called logo or watermark into the original image, video or audio. It effectively deals with the protection of digital data to protect the authenticity of the originator. In digital watermarking, a digital pattern is embedded into the digital data[3]. The digital data may be the image, video, etc. The image to be inserted is called the watermark and the final image created out from the model is called the watermarked image/video.

Watermarking could be classified into:

- Visible Watermarking
- Invisible Watermarking.

Visible Watermarking: The watermark is clearly visible under the normal viewing condition, but the watermark cannot be taken away.

Invisible Watermarking: The watermark is so small in size that it is not noticeable under the normal viewing

condition. The quality is severely degraded when someone tries to remove it.

The watermark can be embedded in the spatial domain and transform domain. In the spatial domain, an algorithm operates directly on the pixel values of the image while in the transform domain, the transfer of pixel values into another domain is carried out. The various transform used for this purpose are the Discrete Fourier Transform(DFT), Discrete Cosine Transform(DCT) and Discrete Wavelet Transform(DWT).

In this paper, visible watermarking in which an image is embedded is employed. The model is formulated in the MATLAB SIMULINK and the simulation result of the proposed model is carried out.

II. DCT FOR IMAGE COMPRESSION

The transform converts a signal to the other form to represent it. Discrete Cosine Transform converts the spatial domain which is pixel based to the frequency domain[4]. The robustness of Discrete Cosine Transform makes it an appropriate choice to use. For an image, the significant information is concentrated in a few coefficients of the DCT[5].

For an input image X and output image Y, the equation for 2-D DCT is given by:

$$Y_{pq} = \alpha(p)\alpha(q) \sum_{m=0}^{M-1} X(m) \sum_{n=0}^{N-1} X(n) \cos \frac{(2m+1)p\pi}{2M} \cos \frac{(2n+1)q\pi}{2N}$$

Where, $0 \leq p \leq M-1$
 $0 \leq q \leq N-1$

The equation for 2D-IDCT is given by:

$$X_{mn} = \alpha(p)\alpha(q) \sum_{p=0}^{M-1} Y(p) \sum_{q=0}^{N-1} Y(q) \cos \frac{(2m+1)p\pi}{2M} \cos \frac{(2n+1)q\pi}{2N}$$

Where, $0 \leq m \leq M-1$
 $0 \leq n \leq N-1$

M and N are the size of row and column for the input image X(mn).

A. Watermark Embedding Process

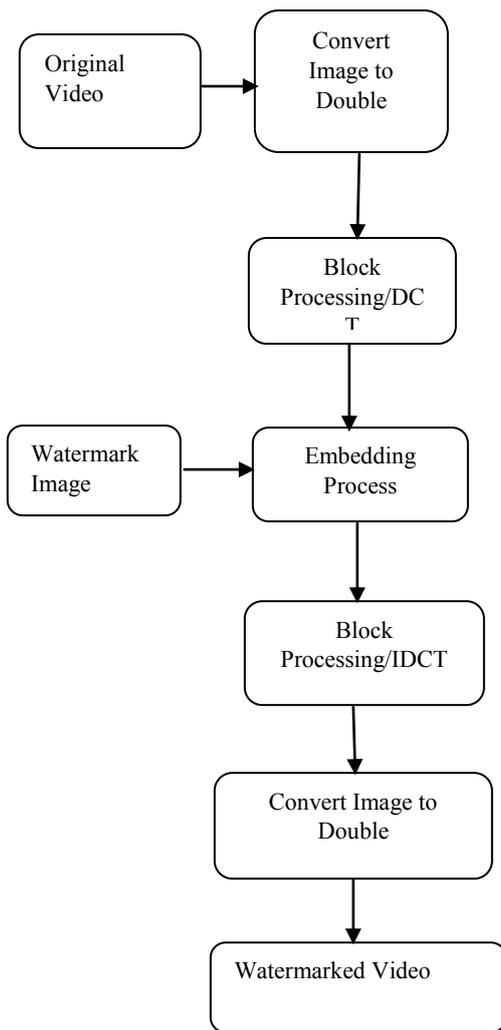


Fig.1: Flowchart showing watermark embedding process.

The basic steps to be followed are:

1. Insert the “Read Binary File” block from the computer vision system toolbox and select a video stored on the computer.
2. Connect this block to the “video viewer” block to see the original video.
3. Define the parameters in the “selector” block.
4. The digital image is segmented into blocks of 8*8 in order to convert it into time domain to frequency domain.
5. Repeat the above steps for the image to be watermarked and apply forward DCT to the block.
6. Add the output which is obtained from the “Block Processing” block to the “netsum” block. Adjust the sample time to -1.
7. The output of “net sum” block is connected to the “Block Processing” block. The Inverse DCT is applied to it.
8. The image obtained in the video viewer is the watermarked image.

B.GETTING FAMILIER WITH SIMULINK

MATLAB is a tool used to solve various problems of scientific domains. Simulink is a part of MATLAB in which the system is modelled with help of the block diagram model and the simulation is carried out[7]. The user can draw out the conclusions instantly. Simulink has its own library from where the user can dynamically choose the blocks and can immediately see the simulation results[8].

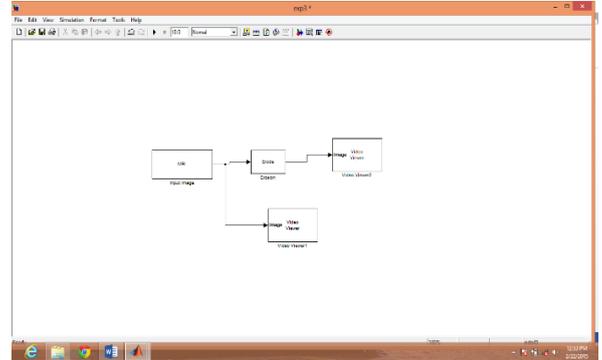


Fig.2: Block creation in MALAB/Simulink.

In this paper, the model for digital watermarking is created and simulation result is carried out. Working in Simulink environment also gives the opportunity to the user to integrate MATLAB algorithm into models and transmit the simulation result to MATLAB for further analysis[9].

The watermarked image obtained after the result could be used –

- To prevent redistribution of copyright image[10].
- To verify whether the work of an author is authentic or not.
- To detect the tampering of the image.
- For content labelling.

III. IMPLEMENTATION IN MATLAB SIMULINK

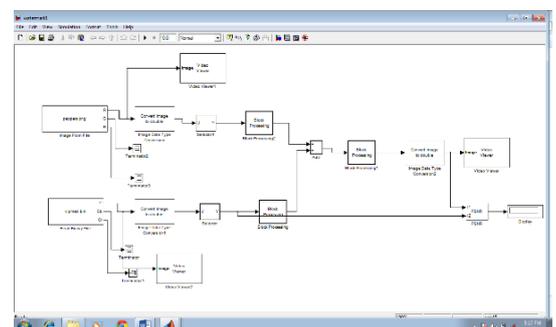


Fig. 3: Simulink model for digital watermarking.

The model for video watermarking is as shown in Fig. 3. The blocks used in the model are drag and dropped from the Simulink Library. Video viewer is applied to view the watermarked video. The parameters of various blocks are set as per the requirement.

IV. RESULTS AND CONCLUSION

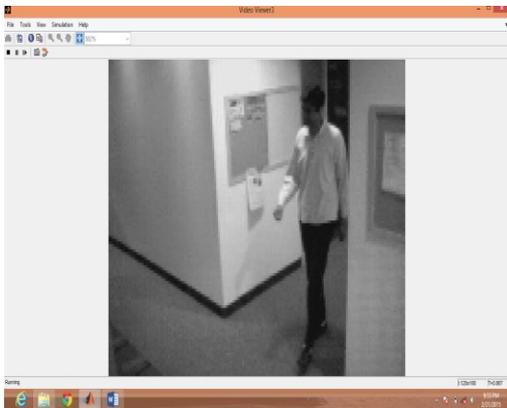


Fig. 4: original video.

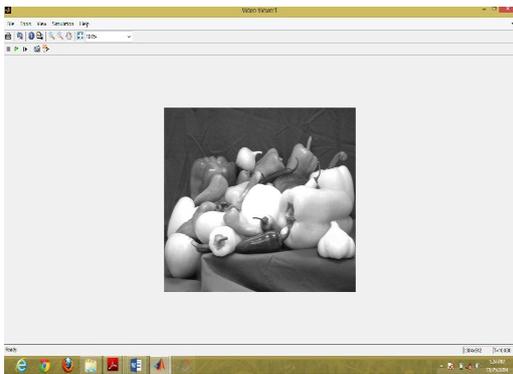
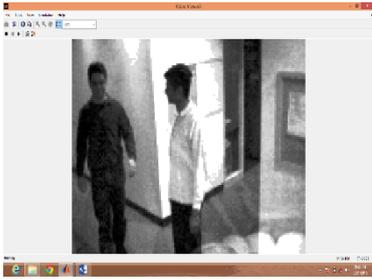
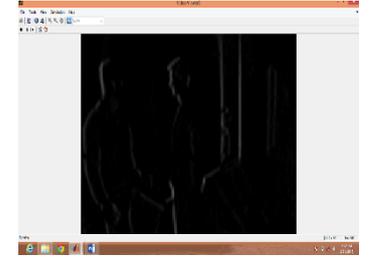


Fig. 5: Watermark Image.



Fig. 6: Watermarked Video with PSNR=11.23.

ATTACK	PSNR in dB
Gamma Correction 	5.87
Histogram Equalization 	4.75
Median Filtering 	11.24
Edge Detection 	12.17

The model for watermarking is carried out using Discrete Cosine Transform in the Simulink and the simulation results are shown above. The transform used is DCT due to its robust nature. PSNR value for the various attacks is calculated and it is concluded that watermarked image is robust and imperceptible to various attacks. Also the DWT transform could be used to give the best results. The realization is suitable for the real time applications.

The model could be implemented in the hardware in the future.

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