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Robust watermarking technique for textured images

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Abstract

The growth of the Internet along with the increasing availability of multimedia applications has given rise to the number of issues in medical science and defense applications. The ease of communication has given rise to several privacy problems which can be addressed by watermarking. This paper presents a robust watermarking technique based on texture matching of the watermark with the host image. The watermark is texturized using Arnold transform and matching is found using histogram of gradient and Log Gabor filter. The watermark is inserted at several places in the image to ensure the security of the image in smaller parts. The efficacy of the algorithm is tested in terms of PSNR (peak signal to noise ratio) and NCC (normalized correlation coefficient).

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Keywords—DCT; Arnold Transform; Log Gabor filters;Histogram of Gradient;SVD.

1. Introduction

The increased popularity of digital multimedia has opened new challenges in security issues. Authentication and integrity verification in the images solve some of these issues[1]. A robust watermark is a mark that is promptly adjusted when the host image is altered through a linear or nonlinear transformation. Medium in which watermarking can be done are text, image, audio and video. Digital image has been widely used in cover media due to its high abundance on internet. The main purpose of the paper is to propose a method for image watermarking which improves the (i) capacity, and (ii) imperceptibilityof the watermarked image[2]. Watermarking involves two

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processes; (i) embedding and (ii)extraction.‘Embedding’[3] is performed to hide the logo at the transmitting side and ‘extraction’ is performed at the receiving side to judge the ownership shown in Figure1.Low-complexity algorithms will ensure efficiency in terms of computation time for embedding and extraction[4]. Robust watermark [5,6]is a digital watermark that resists a selected class of transformations. Robust watermarks are used in copy protection[7] applications, authentication and secure information. The efficiency of robust watermarking can be judged by measuring the PSNR that makes the image visualization better and NCC that measures the correlation between the embedded and extracted logo.

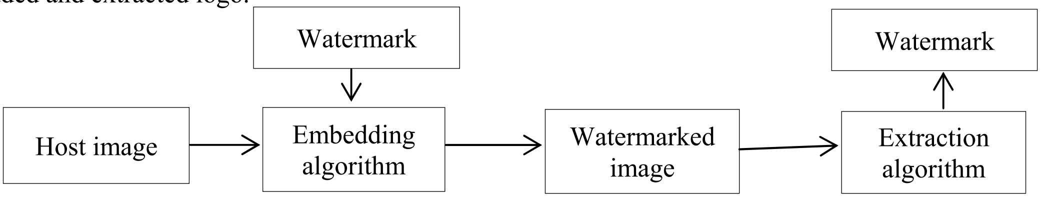

Figure1 Block diagram of Watermarking

Section 2 discusses the system model explaining the details of the proposed algorithm Section 3 presents the results and analysis of the proposed and other existing algorithms used in the present study. Section 4 gives final remarks by concluding the proposed algorithm.

2. System Model

The cover image is divided into blocks of size 64×64.Then the followingembedding algorithm is performed which consists of six main stages:

1) Firstly basic texture segmentation is done to distinguish between textured regions and non-textured regions in the cover image.
2) In textured region,adaptive logo scrambling is done by Arnold Transform and lossless rotations and in non-textured region only lossless rotation is performed [8].
3) The dissimilarity between the host blocks and logo images are found by histogram of gradient (Hog) and Log Gabor filters (Log).
4) The perfect match of texturized logo image corresponding to each host block is obtained.
5) Embedding is done by using Discrete Cosine Transform (DCT)for host image and weighted Singular Value Decomposition (SVD) for logo image[9].
6) Watermark Extraction is done by the inverse process.

2.1 Basic texture segmentation

In this stage we divide the image into two parts that is sufficiently textured and poorly textured[10].So firstly simple standard deviation map (SD) of each 3x3 block (I) centered at (x, y) is taken.

$$SD(x,y)=\frac{\sqrt{\sum_{m=x-1}^{x+1}\sum_{n=y-1}^{y+1}(I(m,n)-\bar{I}_{xy})^2}}{8} \tag{1}$$

where$\bar{I}_{xy}$ = average of intensity values inside 3x3 block and I(m,n)=pixel value at (m,n)

Then a threshold of 0.85 is applied to create binary standard deviationŠ.

$$\check{S}(x,y)=\begin{cases}1 & \text{if } SD(x,y)>=\alpha\max(SD)\\ 0 & \text{otherwise}\end{cases} \tag{2}$$

whereα=0.1. Then Binary morphological operation ‘closing’ is performed to fill in holes and disconnected area by considering the structuring element of radius 9 pixel.Finally Š is used to classify between textured and non- textured regions.