Security of Finger Prints with Video Watermarking Techniques Based On DWT and SVD

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Abstract. Content producers and service providers face highly important challenges in securing digital video content. As watermarking is an important copyright protection technology, this literature includes several methods of combining data into a multimedia component. Due to its increasing application, in recent watermark schemes, the Discrete Wavelet Transformation (DWT) is used. In this text we suggest a DWT and the SVD-based hybrid system. After the image is separated into four strips, we add SVD to each strip and adjust the specific values into the same detail. Modification at all frequencies allows a framework to be established that is consistent with a broad range of threats.

Keywords: Video Watermarking, Finger print, DWT, SVD, Image security, MATLAB.

1  INTRODUCTION

Watermarking is a method of inserting data into audio, or video format (data hiding). The embedded data is either extracted or located in the multimedia for security purposes. The watermark layout, an integrating algorithm, a removal and naming algorithm is a watermark algorithm. The sturdiness is an optimised watermark protection in order to deliberately having accomplished the tone, filtering (blurring, sharpening etc.) of normal A/V processes and attacks. Ability seems to be the volume of details in an embedded watermark that can be used. The most important bit coding, simple m series, transformation techniques and image correction are the methods employed for still image watermarking. That type of information required either by detector is important for the classification of watermarking systems.

2  LITERATURE SURVEY

Typical use of watermarks includes security of copyright (identification sources of content, unauthorized copying) as well as deactivation of unauthorised access to content. In these two applications, non-blind schemes can be used only where there is a disagreement about ownership of material, so watermarks must be eliminated or identified in a special laboratory setting. For access control, a semi-blind or blind scheme could verify the watermark on each approved user computer used for material reception [1].

The costs of a watermarking device may vary significantly and depend on the expected usage. JPEG as well as JPEG 2000 are two commonly used photo encoding formats. With these widespread transitions, several watermarking systems have been built in the last few years [2].

There is a conflict between robustness and clarity in any frequency domain watermarking system. The second option involves an illustration of the company mark or other copyright content. The detector recreates the watermark and uses a fitting calculation to compute its efficiency level [3].
The integration of both low and high frequencies of a visual watermark ensures a secure device that prevents different types of attacks [4]. A DWT based watermarking architecture says that architecture of low-frequency devices increases strength in attacks with low-pass features such as filtration, looser compression, and geometric distortion and allows the unit more resilient to improvements in photographic histograms, such as contrast shift and luminosity, gamma correction and histogram equalisation [5].

Combined watermarks are less resistant to low-pass philtres, loss of compression and minor geometric image deformations but are usually extremely stable when compared with the addition of noise and non-linear deformations in grayscales. Both underwater signs are binary images, one CO and the other White [6]. The photo on the top is a picture of a little child. Two layers of the cover photograph. In the second LL stage and in the second EP watermark level, the CO watermark has been integrated. In the whole cover frame, the built-in watermark was highly visible. In low-frequency locations, such as the wall behind the kid, the degradation is noticeable and makes the picture more commercial [7].

3 METHODOLOGY

3.1 Video Watermarking
This research is related to video frame picture steganography. Video structures & image frames However, we separate the frames from the camera before we inject the image into the video frames. By way of a simple algorithm, we have the video frames. It is important to split the RGB image into the components and then start the process in order to get the same message image from the RGB. The message image shows red, green and blue.

3.2 Singular Value Decomposition (SVD)
In three consistent points of view, single value decomposition (SVD) can be presented. We can see it as a means of converting the associated variables in A set of variables that are non-correlated to help illustrate the multiple relations between the initial data objects. SVD may therefore be considered a tool for reducing data.

Find the 2-dimensional points in Figure 1 as an example of these theories. The regression line from which the original data is better approached 1-dimensional (line) object. In the sense that the distance from each beginning point to the line is shortened. This is the better method.

Figure 1. Split video into frames

Figure 2. RGB component of input image
Figure 3. Best-fit regression line reduces data from two dimensions into one.

Figure 4. Regression line along second dimension captures less variation in original data.

Figure 2 indicates that there is a second line of regression, opposite to the first. The second dimension of the initial data set is as far as possible captured in this line. It does not approximate the original data more effectively since it corresponds to a dimension which initially indicates less variance. This regression lines may be used to construct a sequence of unrelated data points that do not actually appear in the subgroups of the original data at the first glance.

These all basic ideas of SVD: to take a strongly dimensioned and very variable range of data points, and to reduce the data to a smaller dimension space, which more specifically reveals and orders the substructure of the original data from the most variations. SVD is quickly overlooked for NLP applications, which makes SVD viable variations beyond one specific level to minimise the knowledge dramatically but be confident of preserving core connections of interest.

Example

The theorem of the SVD says: \[ A_{n \times p} = U_{n \times n} S_{n \times p} V_{p \times p}^T \]

Where, \( U^T U = I_{n \times n} \) and \( V^T V = I_{p \times p} \) (i.e. U as well as V are orthogonal)

Where U columns of vectors (gene vector coefficients) are left, S is special and diagonal (mode amplitudes), while VT is diagonal with rows of the right single vectors (vector levels expression). The SVD extends the original data to the diagonal coordination scheme for covariance matrix.
The SVD approximation is based on the $AA^T$ and $A^TA$ values. The $A^TA$'s proprietary vectors make up that columns of $V$, the $AA^T$'s proprietary vectors, $U$. The square roots of value of your $AA^T$ or $A^TA$ are also unique values in $S$. Diagonally ordered, the singular values in the $S$-matrix are directed downward. The real numbers are each single value. Where $A$ is valid, $U$ and $V$ are also real. Matrix $A$ is truthful.

Take the example of the matrix given Kuruvilla et al: to understand how to solve the SVD:

\[
A = \begin{bmatrix}
2 & 4 \\
1 & 3 \\
1 & 0 \\
0 & 0
\end{bmatrix}
\]

It is seen in this description that matrix 4x2 matrix. We realise that a non-zero vector $x$ is a vector of the $W$ matrix $n \times n$ if:

\[
Wx = \lambda x
\]

In order to identify the value of the $AA^T$ and $A^TA$, we test the matrices. The $AA^T$ The columns are made from $U$ by vectors, so we can do the next analysis to evaluate $U$.

As described above.

\[
AA^T = \begin{bmatrix}
2 & 4 \\
1 & 3 \\
1 & 0 \\
0 & 0
\end{bmatrix}
\begin{bmatrix}
2 & 4 & 0 & 0 \\
1 & 3 & 0 & 0 \\
0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0
\end{bmatrix}
= \begin{bmatrix}
20 & 14 & 0 & 0 \\
10 & 10 & 0 & 0 \\
0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0
\end{bmatrix}
\]

Now that the $n \times n$ matrix is available, we are able to evaluate the $W$ matrix's own values.Since $Wx = \lambda x$ then $(W - \lambda I) x = 0$

\[
\begin{bmatrix}
20 - \lambda & 14 & 0 & 0 \\
14 & 10 - \lambda & 0 & 0 \\
0 & 0 & -\lambda & 0 \\
0 & 0 & 0 & -\lambda
\end{bmatrix}
\begin{bmatrix}
x_1 \\
x_2 \\
x_3 \\
x_4
\end{bmatrix}
= 0
\]

\[
U = \begin{bmatrix}
0.82 & -0.58 & 0 & 0 \\
0.58 & 0.82 & 0 & 0 \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1
\end{bmatrix}
\]

$A^TA$ also prepares the $V$ columns so that the value of $V$ can be calculated in the same way.

\[
A^TA = \begin{bmatrix}
2 & 4 & 0 & 0 \\
1 & 3 & 0 & 0 \\
0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0
\end{bmatrix}
\begin{bmatrix}
2 & 4 \\
1 & 3 \\
0 & 0 \\
0 & 0
\end{bmatrix}
\]

And hence the expression we get:

\[
V = \begin{bmatrix}
0.40 & -0.91 \\
0.91 & 0.40
\end{bmatrix}
\]

$S$ is square root of $AA^T$ or $A^TA$'s own values, as described above. Can be reached directly by sending us:

\[
S = \begin{bmatrix}
5.47 & 0 \\
0 & 0.37 \\
0 & 0 \\
0 & 0
\end{bmatrix}
\]

Note that: $\sigma_1 > \sigma_2 > \sigma_3 > ...$ this is what the Kuruvilla paper revealed in Figure 4. The values were calculated and standardised in that text in such a way, the single highest value equivalented to 1.
Proposed DWT-SVD based video watermarking embedding process on video frame is as follows:

**Step 1:** Select as well as read video from the MATLAB current directory.

**Step 2:** Split the input watermarking video into number of frames and select a cover frame in which we want to embed the message.

**Step 3:** Select as well as read that the watermark image.

**Step 4:** Divide the cover frame $F$ with DWT into four subbands called LL, HL, LH as well as HH.

**Step 5:** Separate R, G and B components and use SVD to obtain specific components $U, S$ and $V$ for separated RGB components.

**Step 6:** To receive four substrings called LL1, LH1, HL1 as well as HH1 add DWT to the watermark as well.

**Step 7:** Separate R, G and B components and SVD for single LL1 decomposed watermark image components.

**Step 8:** Now use the embedded watermark as follows:

\[
\begin{align*}
    S_{Wc} &= S_{L1c} + \alpha \cdot S_{LL1c} \\
    S_{Wg} &= S_{L1g} + \alpha \cdot S_{LL1g} \\
    S_{Wh} &= S_{L1h} + \alpha \cdot S_{LL1h}
\end{align*}
\]

Where $S_{L1c}, S_{LL1c}$ and $S_{LL1c}$ denotes the obtained SVD coefficients of LL from step 5 while $S_{LL1}$, $S_{LL1g}$ and $S_{LL1h}$ are the obtained SVD coefficients of LL1 from step 7.

\[
W_{L1,cab} = U_{L1, cab} \cdot S_{Wc, cab} \cdot V_{L1, cab}
\]

**Step 9:** Apply the inverse DWT to $W_{L1, cab}$ and LH, HL and HH to get watermarked frame.

**Step 10:** Now, overwrite the watermarked frame with the original frame to get the watermarked video.
The proposed DWT and SVD based 3D video watermarking extraction process on watermarked video frame is as follows:

**Step 1:** Read watermarked frame.
**Step 2:** Apply DWT to decompose it into 4 subbands named LL2, HL2, LH2, as well as HH2.
**Step 3:** Separate LL2 components of R, G and B and use SVD to acquire specific components \( U, S \) and \( V \) for separated RGB components.
**Step 4:** Now use extraction of watermarks as follows:

\[
S_{eR} = \left( S_{eR} - S_{L2R} \right)/\alpha \\
S_{eG} = \left( S_{eG} - S_{L2G} \right)/\alpha \\
S_{eB} = \left( S_{eB} - S_{L2B} \right)/\alpha \\
\]

Where \( S_{eR}, S_{eG} \) and \( S_{eB} \) denotes the obtained SVD coefficients of LL2 from step 3.
**Step 5:** Apply the inverse DWT to \( E_{L1r,g,b} \) and LH1, HL1 and HH1 to get extracted watermark.

### 4 RESULTS AND DISCUSSIONS

The DWT based digital image watermarking and proposed digital image watermarking embedding and extraction outputs are shown in Figure 6 and Figure 7. This paper explores various watermarking techniques and suggests simple watermarking techniques such as DWT-SVD. The algorithm applied works with RGB images only. The system proposed was checked and the efficiency of the attack was observed.
Figure 6. DWT based digital image watermarking (a) embedding (b) extraction

Figure 7. Proposed embedding and extraction
5 CONCLUSION AND FUTURE WORKS

This paper show that the image division into various bands, separate philtres used for watermarking, such as hair, sym4, db5, bios etc, are among the most important conclusions. The use of different wavelet philtres for the multiple situations. In optical watermarking, combining single value decomposition with DWT, how structural resemblance (SSIM) between two images can be calculated. It is an innovative approach for the evaluation of image quality and attracts much attention to good performance and easy measurement, the process by which genetic algorithms are implemented in association with DWT and the most optimum location to insert the watermark into the host image.

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