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Data Hiding in Digital Video for Authentication and Data Security

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ABSTRACT: Nowadays, digital multimedia content (audio or video) can be copied and stored easily and without loss in fidelity. Therefore, it is important to use some kind of property rights protection system. The majority of content providers follow wishes of production companies and use copy protection system called Digital Rights Management (DRM). DRM protected content is encrypted during the transmission and the storage at recipient's side and thus protected from copying. But during playing it is fully decrypted. Besides recipients must have a player capable to play DRM encrypted content, the main disadvantage of DRM is that once the content is decrypted, it can be easily copied using widely available utilities. Disadvantages of DRM can be eliminated by using another protection system, watermarking. Watermarking can be considered to be a part of information hiding science called steganography. Steganography systems permanently embed hidden information into cover content so that it is not noticeable. Thus, when anybody copies such content, hidden information is copied as well. Three aspects of information hiding systems contend with each other: capacity, security and robustness**.**

KEYWORDS: watermark ; DRM;

I. INTRODUCTION

Electronic watermarking is a method whereby information can be imperceptibly embedded into electronic media [1]. This embedded information should ideally be robust against common signal manipulations such as the addition of random noise, digital-to-analog conversion, lossy compression or intentional attacks to remove the embedded watermark [2]. Electronic watermarking can be applied to various typed of media, which include text, image, audio and video content. As the focus of this research project is video watermarking, further discussions will focus mainly on topics related to the watermarking of video content. The video watermarking category can be divided into two sub-categories, namely

- Compressed-domain video watermarking; and
- Uncompressed-domain video watermarking.

Compressed-domain video watermarking techniques can embed watermarks into compressed video streams without the need to uncompressed and recompress the video stream, which can speed up the watermarking process. Uncompressed-domain techniques, on the other hand, first need to uncompressed the video in order to embed a watermark. After the watermark has been embedded, the content needs to be recompressed.

II. RELATED WORK

The Discrete Wavelet Transform (DWT) can be used to obtain a multi-resolution representation of digital images for analysis. It has also been shown that the human vision system decomposes a retinal image into various spatially oriented frequency channels in a way similar to the DWT. Because of these properties, the DWT can be used to identify areas in an image where a viewer is less likely no notice image distortions. The DWT also exhibits good

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spatio-frequency localisation properties where, if a DWT coefficient is modified, only the region of the image containing the specific frequency of the modified coefficient is affected. This allows control of the area in an image where a watermark will be embedded, compared to other techniques that may affect the complete video frame [4]. A single-level wavelet decomposition decomposes a video frame into three multiresolution representations, namely LH1, HL1, HH1 and a single multi-resolution approximation named LL1. These are also called subbands. The LL1 subband contains a low frequency approximation of the original image. The three remaining subbands, LH1,HL1 and HH1, contain edge detail in the horizontal, vertical and diagonal directions, respectively. This decomposition process can be repeated as many times as required, by each time further decomposing the LLn approximation. As with the DFT, the one-dimensional DWT can be extended for multiple dimensions by simply applying the one-dimensional process to each dimension in a separable fashion.

The image is decomposed into a set of frequency channels of constant bandwidth on a logarithmic scale. In other words, the image is decomposed into different scale levels, where required levels are then further decomposed with a resolution suited to the level. Unlike the Fourier transform, which has a fixed spatial and frequency resolution, the resolution of the wavelet transform varies with level of the DWT. Through this approach, we obtain a hierarchical multi-resolution representation of the image which is well-suited for interpreting the information contained in the image. A decomposition obtained through a three-level DWT is shown in fig. 3.1. As the level of the DWT increases, the spatial resolution of the subbands decreases.

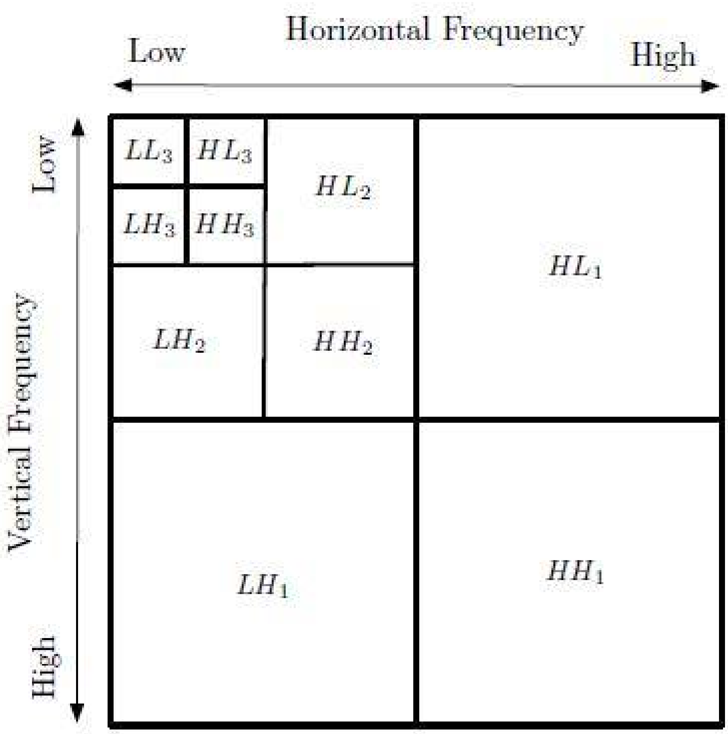

FIG. 3.1 DECOMPOSITION OF DWT

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III. PROPOSED ALGORITHM

Fig. 3.3 and 3.4 shows the watermark embedding and extraction method for video watermarking scheme used in our work.

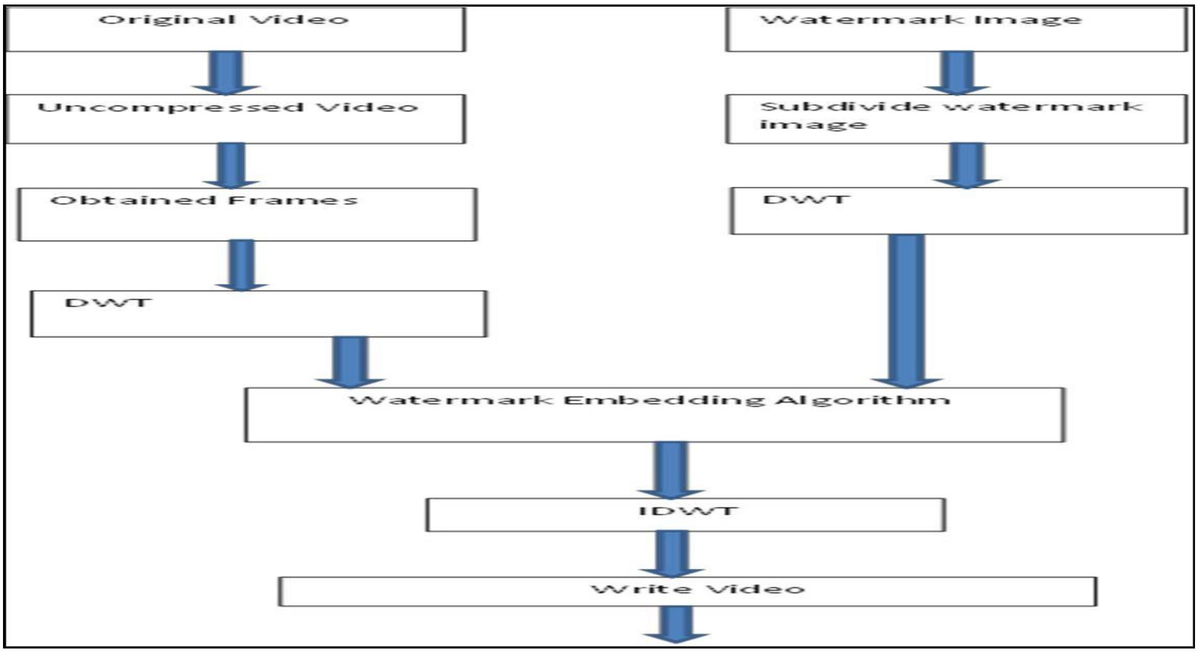

Fig. 3.3. Watermark Extracting Algorithm

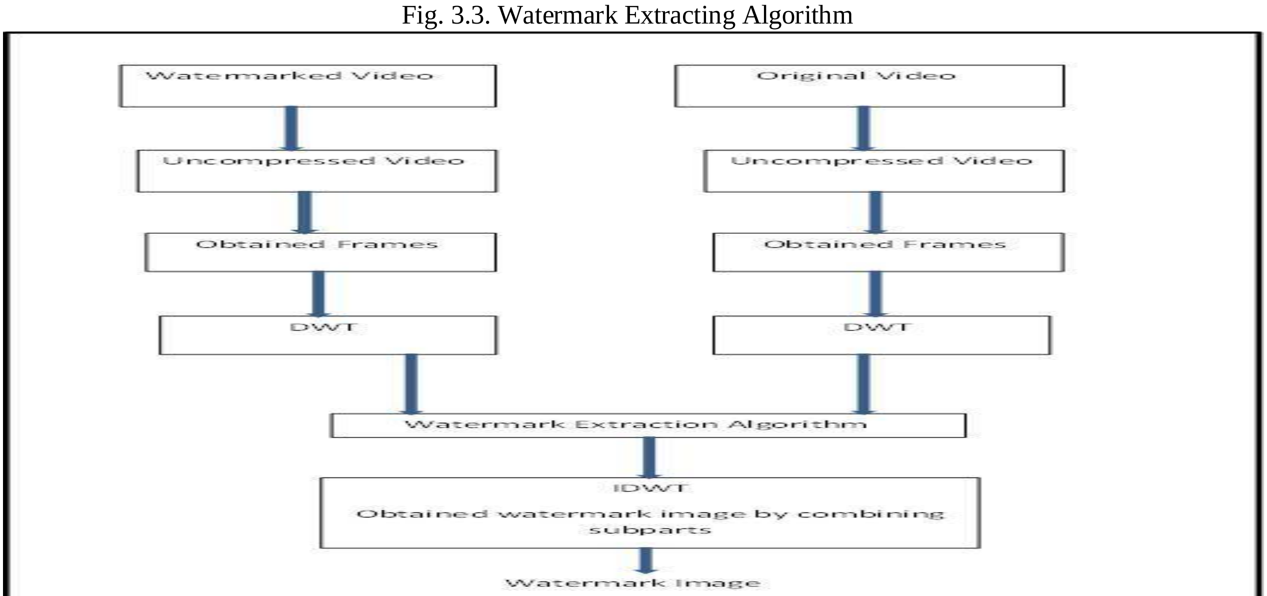

Fig. 3.4 Watermarking Extraction Algorithm

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IV. PSEUDO CODE

The watermark embedding algorithm used in our work is as follows
Step 1: Read video

Step 2: Uncompressed video

Step 3: Extract every frames from the video
Step 4: Read watermark image

Step 5: Divide watermark image into 16 subparts
Step 6: Read frame from the video

Step 7: Apply DWT to frame and extract 4 subbands

Step 8: Apply DWT to subpart of watermark image and extract subbands

Step 9: Embed DWT coefficients of watermark subpart into DWT coefficients of frame using Arnold scrambling.
Step 10: Apply IDWT to watermark embedded frame

Step 11: Goto step 6 and continue till all the subparts are covered
Step 12: Write video using all watermark frames

Step 13: Stop

The watermark extraction algorithm used in our work is as follows
Step 1: Read watermark video

Step 2: Uncompressed video

Step 3: Extract every frame from the video
Step 4: Read original video without watermark
Step 5: Uncompressed video

Step 6: Extract every frame from the video

Step 7: Extract watermark subpart using Arnold scrambling
Step 8: Goto step 7 and obtained all subparts of watermark
Step 9: Combine all subparts of watermark image

Step 10: Display watermark image
Step 11: Stop

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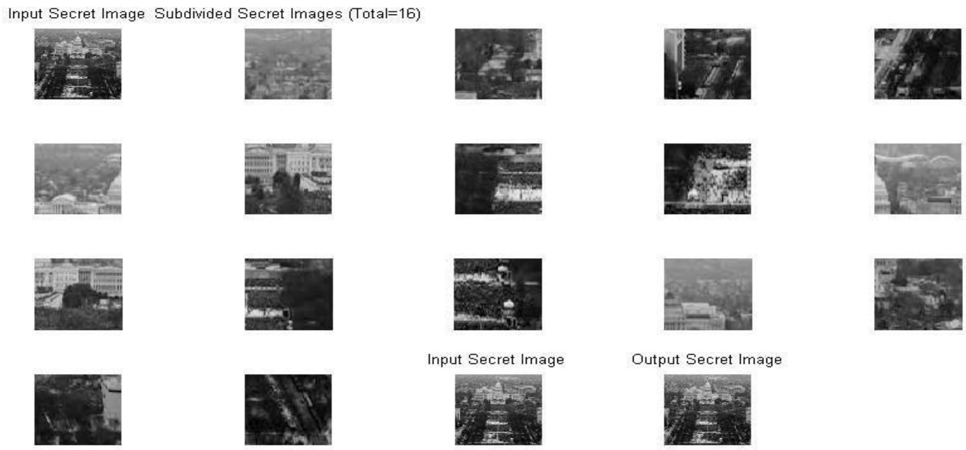
V. SIMULATION RESULTS

MATLAB: The Language of Technical Computing

Millions of engineers and scientists worldwide use MATLAB [11] to analyze and design the systems and products transforming our world. MATLAB is in automobile active safety systems, interplanetary spacecraft, health monitoring devices, smart power grids, and LTE cellular networks. It is used for machine learning, signal processing, image processing, computer vision, communications, computational finance, control design, robotics, and many more. The MATLAB platform is optimized for solving engineering and scientific problems. The matrix-based MATLAB language is the world's most natural way to express computational mathematics. Built-in graphics make it easy to visualize and gain insights from data. A vast library of prebuilt toolboxes lets you get started right away with algorithms essential to your domain. The desktop environment invites experimentation, exploration, and discovery. These MATLAB tools and capabilities are all rigorously tested and designed to work together. MATLAB helps you take your ideas beyond the desktop. You can run your analyses on larger data sets and scale up to clusters and clouds. MATLAB code can be integrated with other languages, enabling you to deploy algorithms and applications within web, enterprise, and production systems.

Key Features of MATLAB are

- High-level language for scientific and engineering computing
- Desktop environment tuned for iterative exploration, design, and problem-solving
- Graphics for visualizing data and tools for creating custom plots
- Apps for curve fitting, data classification, signal analysis, and many other domain-specific tasks
- Add-on toolboxes for a wide range of engineering and scientific applications
- Tools for building applications with custom user interfaces
- Interfaces to C/C++, Java®, .NET, Python®, SQL, Hadoop®, and Microsoft® Excel®
- Royalty-free deployment options for sharing MATLAB programs with end users



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VI. CONCLUSION AND FUTURE WORK

Watermarking is a copy protection system that allows tracking back illegally produced copies of the protected multimedia content. Compared with other copy protection systems like Digital Rights Management, the main advantage of watermarking is that the watermark is embedded permanently in visual data of the content but at the cost of slight loss in fidelity. By implementing and evaluating selected video watermarking techniques, using the same source content and visual quality constraints, the distinct characteristics of each watermarking approach can be identified. Appropriate conclusions can then be drawn and recommendations for future research can be made. A generic watermarking framework has been designed and implemented. In order to increase robustness against direct removal attack, the watermark should be embedded into textured areas only. Textured areas provide more non-zero coefficients in the residual than uniform areas do, thus the watermark may be hidden more safely.

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BIOGRAPHY

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