# Fibonacci Series based Watermark Embedding in a Video

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## ABSTRACT
It is proven by various researchers in the past literatures that watermarking is the fabulous technique for copyright protection. Especially in video, it takes much time for watermark embedding & so for the extraction due to redundancy of watermark embedding. Solution to this problem is just embed the watermark in any one frame decided randomly but due to frame dropping attack it is difficult to detect the watermark. One more solution to this problem is to identify the key-frames and embed the watermark in the key-frames only. This solution proves best for so many attacks like frame dropping, frame collusion and frame averaging. But limitation is to identify the exact key-frames, so to avoid this, in this paper author proposes to select the frames for watermarking as per their Fibonacci series. This scheme will save the time to identify the different scenes or key-frames & will gives better performance with the same effect. An experimental results show that the scheme is really proves better than the existing schemes.

## General Terms
Information Security, Copyright Protection, Video Processing.

## Keywords
Video, DWT, Fibonacci, Watermark.

## 1. INTRODUCTION
With the increasing reliance on digital media and the rapid growth of Internet distribution possibilities, mechanisms of digital content distribution are continually becoming important and the intellectual property rights violation has become a serious concern for many institutions and organizations. In addition to difficulties in management of many illegal activities such as counterfeit, un-authentication, using/copying works without permission, etc. [1][2], another problem, which is related to a numerous of digital files including text, image, audio, and video, is daily publishing without information of source, origin, authorship, copyright and intellectual property policy. To solve these problems, scientists have launched a variety of methods, mechanisms, as well as management policies to protect copyright content, and enhance security and safe-transmission of important information together with avoid attacks and suspicion from the malicious third parties. Among all techniques suggested, digital watermarking is considered to be useful and meet most needs of data protection, authentication, and copyright products [3].

## 2. LITERATURE REVIEW
Digital Video Watermarking is mainly classified in Spatial & Frequency Domain. In many literatures it has been proved that Frequency domain techniques gives more advantage to the robustness of the watermark. In so many literatures like [4-10] authors discusses about embedding watermark in every frame of the video. Working fine for various image processing attacks but were greatly suffering with collusion, frame averaging attacks. Then afterwards many researchers in [11-20] have used video watermarking based on scene changes. Idea was embedding the different part of the watermark in different scene. Schemes so robust that it can sustain many attacks like frame dropping, frame averaging etc but limitation was time complexity was quite higher. Solution to this scheme were presented in the [21-30] were key frame based watermarking scheme is used. Here key-frame is identified first and watermark is only embedded in key-frames. The scheme is pioneer and works well for many video attacks like frame averaging, frame dropping, collusion etc. The scheme is solely depends on the identifying the key frames from the video. Limitation of the scheme was, there is need of separate algorithm which will detect the key-frames

and also if in frame dropping if all the key frames are dropped then it is difficult to recover the watermark.

## 2. FINDINGS

a. Video watermarking is different than image watermarking
b. It is essential to embed the watermark in more than one frame due to attacks like frame dropping.
c. Embedding watermark in all frames is always recommended but it discourages the performance of the scheme.
d. For embedding a watermark in selected frames, need of key-frame selection algorithm is essential, which add another complexity for research community.

## 3. PROPOSED SCHEME

In this paper, author proposes a Fibonacci series based embedding of a watermark in a frames of the video. Initially video is decomposed in to frames. Watermark is embedded in to only those frames whose frame number is matches with the numbers of the Fibonacci series. Figure 1 shows the block diagram of the proposed scheme. Initially, video is taken as an input then it is decomposed into video frames. Fibonacci series is generated which is used for the frame to embed the watermark.

Figure 2 shows the proposed algorithm for watermark embedding as per the Fibonacci series. Algorithm 1 represents the steps to embed the watermark in the video frames. Algorithm 2 represents the generation of Fibonacci series which needs in algorithm 1 for choosing frames to embed the watermark.

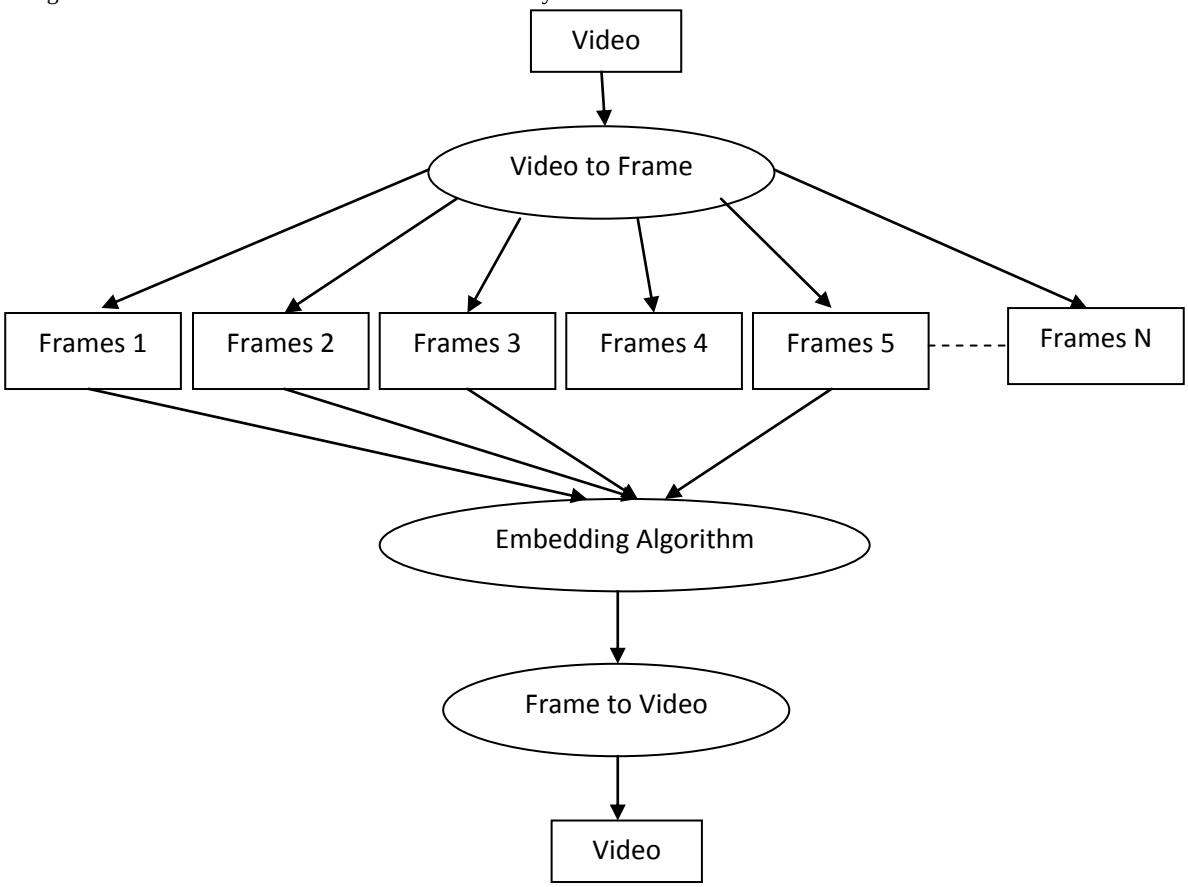


**Fig 1: Block Diagram of Proposed Scheme**

**Algorithm 1 : Watermark Embedding:**

[1] *Read video from user.*
[2] *Convert Video to Frame*
[3] *Then Select the frame whose frame number in the series of Fibonacci series.*
[4] *Embed the Watermark into the selected frame*
[5] *Collect all frames i.e watermarked and un-watermarked*
[6] *Convert all frames into video.*

**Algorithm 2: Fibonacci Series Generation is :**

**In algorithm:**

[1] *Initialize Sum=0, F1=0, F2=1, i=1*
[2] *Get the no. of frames upto which u want to generate the Fibonacci no, i.e., n.*
[3] *Add F1 and F2 to get the next Fibonacci number*
[4] *Assign the value of F2 to F1 i.e. F1=F2*
[5] *Assign the value of Sum to F2 i.e. F2=Sum*
[6] *Write the value of Sum to get next Fibonacci number in the series.*
[7] *Increment i with 1 i.e. i=i+1 and repeat step 3,4,5,6 with*

*the last value of i=n*
[8] *Stop*

In algorithm 1, avi video is taken as an input. In step2 it is decomposed into frames. In step 3 as per the frame number & its match with Fibonacci number of the series, frame is chosen to embed the watermark. In step 4, watermark is embedded in selected frames. In step 5 all the frames are collected & video is formed from it in step 6.

## 4. EXPERIMENTAL RESULTS

Here, some of the videos are taken for experimentation. Table 1 shows the video files used for watermark embedding. Table 2 shows the image as a watermark.

Table 1: Videos considered for Experiment

| SN | Video | No. of frames | Duration | Fame Size |
|---|---|---|---|---|
| 1 | Test.avi | 30 | 1 Sec | 220x180 |
| 2 | sceneclip.avi | 91 | 6 Sec | 160x120 |
| 3 | Foxrain.avi | 60 | 4 Sec | 128x96 |

Table 2: Images used as a Watermark

| SN | Image | Type | Fame Size | Image Snap |
|---|---|---|---|---|
| 1 | SNJB Logo | Gray | 64x64 |  |
| 2 | CS | Mono | 12x9 |  |
| 3 | Copyright | Mono | 50x20 |  |

Visimark 1_0 is a tool for evaluation of video watermarking algorithms. Visimark 1_0 is adopted for testing of watermark scheme.
Usually for when we use the DWT, it proves to be the most robust technique as compare to other transforms like DCT or DFT. Table 3 show the experimental results; author used Stirmark and Visimark to check the robustness of the scheme. NC (Normalized Correlation) is used to compare the original watermark and recovered watermark from watermarked video.

Table 3: Results of Fibonacci based watermarking scheme

| Attack Class | NC Values of Proposed Scheme |
|---|---|
| Lossy Compression | 0.72 |
| PSNR | 0.80 |
| Add Noise | 0.69 |
| Median Filter | 0.52 |
| Cropping | 0.70 |
| Rescale | 0.61 |
| Rotation | 0.67 |
| Affine | 0.65 |
| Frame Dropping | 0.92 |
| Colluding | 0.85 |
| Frame Swapping | 1.0 |
| Scene Swapping | 1.0 |
| Frame Averaging | 0.7 |

As per table number 3, one can conclude that the proposed scheme gives better results than the existing method of key-frame based watermarking.

## 5. CONCLUSION

Fibonacci series based watermarking method proves most suitable alternative for key-frame based watermarking scheme. Both the scheme proves good result but the proposed scheme is more efficient than the any other key-framed based watermarking method. Also the drawback of the key-frame based watermarking is easily covered here.

In future it is expected that with Fibonacci series, scrambling of watermark can also be used gain the advantage over many attacks of the videos.

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