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SECURE AND ADAPTIVE IMAGE ROBUST WATERMARKING WITH ADVANCE SCRAMBLING HIGH PSNR

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Abstract: Watermarking is a strategy to conceal the picture effectively into any covering object (picture for our situation) so any gatecrasher can't translate it by any methods. Proposed work is another plan of picture watermarking which incorporate pre-handling of cover picture with Discrete Wave Transform (DWT) and Singular Value Decomposition (SVD) Proposed work utilizing an alphanumeric key which at first alters the watermark utilizing basic 'XOR' operation, and at the recipient end this key must be there so collector can extricate the watermark. Proposed work is likewise utilizing torus Automorphism which at first change the watermark into a scramble arrange which can't be acknowledgment as unique watermark. The work is been plan and tried on MATLAB 2013 test system.

Keywords: DWT: Discrete Wave Transform**,** SVD: Singular Value Decomposition, TA: Torus Automorphism, AS: Arnold scrambling**,** LL: approximate band, LH: Vertical Band, HL: Horizontal band, HH: diagonal detail band

I-INTRODUCTION

There are a few picture watermarking plans with a test to give both perceptual quality and in addition power against assaults, as these two measures struggle with each other. As indicated by the area of inserting, there are two sorts of watermarking plans - spatial space and change space based watermarking plans. Spatial space watermarking plans install watermark by changing pixels of host picture, while change area plans insert watermark in change area coefficients.

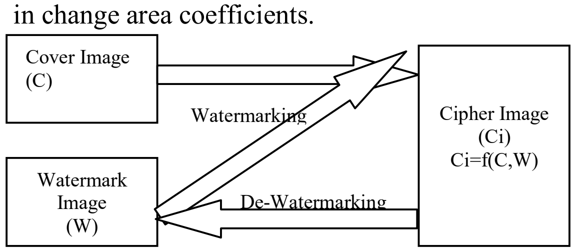

Figure 1 watermarking hiding scenario

In change space, DWT and DCT are fundamentally utilized for its multi-determination and vitality compaction properties individually. In light of extraction process, there are again two sorts of watermarking plans dazzle and non-daze watermarking plans. Non-dazzle watermarking plan requires the host picture for extraction of watermark while daze plans require not

The real issues of secure information correspondence are as take after:-

Watermarking is an overhead for correspondence framework it is requires just to secure information however redundant for information correspondence. In watermarking the extent of cover picture must be high than watermark picture. We can't utilize same calculation for all sort of cover picture and watermark. In watermarking the ideal opportunity for concealing watermark ought to be sufficiently low so it doesn't irritate correspondence. To start with issue is to keep up adjust between indistinctness, vigor and limit as expanding one factor unfavorably influence on other and a decent advanced watermarking framework have above component. To accomplish great impalpability, watermark ought to be inserted in high recurrence segment while heartiness happens in low recurrence segment

II-METHODOLOGY

Proposed work is another outline of picture watermarking which incorporate first pre-preparing of cover picture with DWT and SVD. DWT based watermarking can be versatile and as cover picture changes, its frequencies likewise get changes so the watermark picture additionally get stows away at various areas and spread at various areas. SVD is been connected for concealing bits of watermark and SVD is been taken of 8x8 square which shroud a solitary piece of watermark at 64 distinctive particular estimations of each square, on account of SVD affect all sort of correspondence assaults like balance, commotion, pressure and channel can be abstained from, Changing SVs somewhat does not influence the nature of the flag and if nature of flag changes because of some other reason SVs still get marginally change as contrast with different examples of flag. So if in correspondence some of SVs changes our singles bit which is covered up at 8x8=64 SVs areas still can be recouped. Proposed work utilizing an alphanumeric key which at first adjusts the watermark utilizing straightforward

'XOR' operation, and at the recipient end this key must be there so collector can extricate the watermark. Proposed work is likewise utilizing torus Automorphism which at first change the watermark into a scramble arrange which can't be acknowledgment as unique watermark, this gives additional security of the watermark and if some interloper recoup watermark from cover picture, he will get a scramble watermark which will additionally expected to get in its unique shape.

Calculation ADOPTED FOR WATERMARKING: Let C is the cover picture of MxN size and W is the watermark picture of PxQ estimate, DWT connected on 'C', proposed work utilize 'sym4' sort wavelet for disintegration of Cover picture

Sym 4	h_0 = -0.0757657148, h_1 = -0.0296355276 h_2 = 0.4976186676, h_3 = 0.8037387518 h_4 = 0.2978577956, h_5 = -0.0992195436 h_6 = -0.0126039673, h_7 = 0.0322231006	g_0 = -0.0322231006, g_1 = -0.0126039673 g_2 = 0.0992195436, g_3 = 0.2978577956 g_4 = -0.8037387518, g_5 = 0.4976186676 g_6 = 0.0296355276, g_7 = -0.0757657148

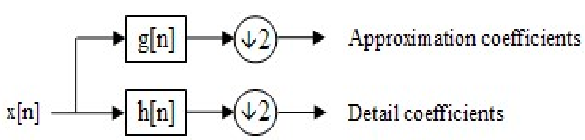

Figure 2 DWT HP and LP coefficient generation

$$x(n)_L = \sum_{k=-\infty}^{\infty} x(k)g(2n-k) \quad (1)$$

$$x(n)_H = \sum_{k=-\infty}^{\infty} x(k)h(2n-k) \quad (2)$$

Where g and h coefficients taken from the table 3.1. DWT2 is use for Images for two dimension DWT, hence $x(n)_L$ and $x(n)_H$ further need to filtered as below

$$x(n)_{LL} = \sum_{k=-\infty}^{\infty} x(n)_L g(2n-k) \quad (3)$$

$$x(n)_{LH} = \sum_{k=-\infty}^{\infty} x(n)_L h(2n-k) \quad (4)$$

$$x(n)_{HL} = \sum_{k=-\infty}^{\infty} x(n)_H g(2n-k) \quad (5)$$

$$x(n)_{HH} = \sum_{k=-\infty}^{\infty} x(n)_H h(2n-k) \quad (6)$$

Equation (3), (4), (5) and (6) are the level one DWT decomposition

$$x(n)_{HHH} = \sum_{k=-\infty}^{\infty} x(n)_{HH} g(2n-k) \quad (7)$$

$$x(n)_{HHL} = \sum_{k=-\infty}^{\infty} x(n)_{HH} h(2n-k) \quad (8)$$

$$x(n)_{LL1} = \sum_{k=-\infty}^{\infty} x(n)_{HHL} g(2n-k) \quad (9)$$

$$x(n)_{LH1} = \sum_{k=-\infty}^{\infty} x(n)_{HHL} h(2n-k) \quad (10)$$

$$x(n)_{HL1} = \sum_{k=-\infty}^{\infty} x(n)_{HHH} g(2n-k) \quad (11)$$

$$x(n)_{HH1} = \sum_{k=-\infty}^{\infty} x(n)_{HHH} h(2n-k) \quad (12)$$

Equation (9), (10), (11) and (12) are the level one DWT decomposition

$$x(n)_{HH1H} = \sum_{k=-\infty}^{\infty} x(n)_{HH1} g(2n-k) \quad (13)$$

$$x(n)_{HH1L} = \sum_{k=-\infty}^{\infty} x(n)_{HH1} h(2n-k) \quad (14)$$

Equation (9), (10), (11) and (12) are the level one DWT decomposition

$$x(n)_{LL2} = \sum_{k=-\infty}^{\infty} x(n)_{HH1L} g(2n-k) \quad (15)$$

$$x(n)_{LH2} = \sum_{k=-\infty}^{\infty} x(n)_{HH1L} h(2n-k) \quad (16)$$

$$x(n)_{HL2} = \sum_{k=-\infty}^{\infty} x(n)_{HH1H} g(2n-k) \quad (17)$$

$$x(n)_{HH2} = \sum_{k=-\infty}^{\infty} x(n)_{HH1H} h(2n-k) \quad (18)$$

Equation (15), (16), (17) and (18) are the level one DWT decomposition

Size of $x(n)_{HH}$ is (MxN)/4 size and $x(n)_{HH1}$ is (MxN)/16 and $x(n)_{HH2}$ is (MxN)/64, Let size of $x(n)_{HH2}$ is RxS where R=M/8 and S=N/8. SVD taken of 8x8 block of $x(n)_{LL2}$, $x(n)_{LH2}$, $x(n)_{HL22}$ *and* $x(n)_{HH2}$ means at each DWT decomposed level $x(n)_{LL2}$, $x(n)_{LH2}$, $x(n)_{HL22}$ *and* $x(n)_{HH2}$ will have total RxS/64 SVD. We total 4 $x(n)_{LL2}$, $x(n)_{LH2}$, $x(n)_{HL22}$ *and* $x(n)_{HH2}$ components after three level DWT decomposition. Means (RxS/64)x4 watermark bit can be hide. And as known R=M/8 and S=N/8

$$total\ numbet\ of\ watermark\ bit\ that\ can\ be\ hide\ in\ cover = \frac{RxSx4}{64} = \frac{MxNx4}{8x8x64} = \frac{MxN}{1024}$$

Here we are explaining the Calculation of SVD for $\boldsymbol{x(n)_{HH2}}$ only although it is been computed for all 8x8 block of
$\boldsymbol{x(n)_{LL2}}$, $\boldsymbol{x(n)_{LH2}}$, $\boldsymbol{x(n)_{HL22}}$ ***and*** $\boldsymbol{x(n)_{HH2}}$

Let B1 is the initial 8x8 piece of $\boldsymbol{x(n)_{HH2}}$. the solitary esteem deterioration of a 8x8 genuine framework B1 is a factorization of the shape $\boldsymbol{USV^T}$, where U is a 8x8 genuine grid, S is a 8x8 rectangular askew network with non-negative genuine numbers on the corner to corner, and V is a 8x8 genuine or complex unitary lattice. The corner to corner sections $\boldsymbol{\sigma_i}$ of S are known as the solitary estimations of B1. The segments of U and the sections of V are known as the left-solitary vectors and right-particular vectors of B1, separately.

$$W1 = B1xB1^T \qquad (W1 - \sigma_i I) = 0 \qquad (19)$$

For a unique set of eigenvalues to determinant of the matrix (W1-$\boldsymbol{\sigma_i}$) must be equal to zero. Thus from the solution of the characteristic equation, |W1-$\boldsymbol{\sigma_i}$|=0 we obtain eight singular values of $\boldsymbol{\sigma_i}$ ***where*** $\boldsymbol{i = 1, 2, \ldots.. 8}$

$$S = \begin{bmatrix} \sigma1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \sigma2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \sigma3 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \sigma4 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \sigma5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \sigma6 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \sigma7 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \sigma8 \end{bmatrix}$$

And if values of $\boldsymbol{\sigma_i}$ again put into equation (20) we obtain x1, x2, x3, x4, x5, x6 x7 and x8 value

$$(W1 - \sigma_i I)x = 0 \qquad (20)$$

$$U = \begin{bmatrix} x1 & -x2 & -x3 & -x4 & -x5 & -x6 & -x7 & -x8 \\ x8 & x1 & -x2 & -x3 & -x4 & -x5 & -x6 & -x7 \\ x7 & x8 & x1 & -x2 & -x3 & -x4 & -x5 & -x6 \\ x6 & x7 & x8 & x1 & -x2 & -x3 & -x4 & -x5 \\ x5 & x6 & x7 & x8 & x1 & -x2 & -x3 & -x4 \\ x4 & x5 & x6 & x7 & x8 & x1 & -x2 & -x3 \\ x3 & x4 & x5 & x6 & x7 & x8 & x1 & -x2 \\ x2 & x3 & x4 & x5 & x6 & x7 & x8 & x1 \end{bmatrix}$$

And if

$$W2 = B1^T xB1$$
$$(W2 - \sigma_i I)x = 0 \qquad (\mathbf{21})$$

And if values of $\boldsymbol{\sigma_i}$ again put into equation (21) we obtain x1, x2, x3, x4, x5, x6 x7 and x8 value

$$\boldsymbol{V} = \begin{bmatrix} x1 & x2 & x3 & x4 & x5 & x6 & x7 & x8 \\ -x8 & x1 & x2 & x3 & x4 & x5 & x6 & x7 \\ -x7 & -x8 & x1 & x2 & x3 & x4 & x5 & x6 \\ -x6 & -x7 & -x8 & x1 & x2 & x3 & x4 & x5 \\ -x5 & -x6 & -x7 & -x8 & x1 & x2 & x3 & x4 \\ -x4 & -x5 & -x6 & -x7 & -x8 & x1 & x2 & x3 \\ -x3 & -x4 & -x5 & -x6 & -x7 & -x8 & x1 & x2 \\ -x2 & -x3 & -x4 & -x5 & -x6 & -x7 & -x8 & x1 \end{bmatrix}$$

U, S and V computed for each 8x8 block of all level three DWT decomposed $\boldsymbol{x(n)_{LL2}}$, $\boldsymbol{x(n)_{LH2}}$, $\boldsymbol{x(n)_{L22}}$ ***and*** $\boldsymbol{x(n)_{HH2}}$, As explain above.

$$U_{x(n)_{LL2}}, S_{x(n)_{LL2}}, V_{x(n)_{LL2}} = SVD(x(n)_{LL2}) \qquad (22)$$
$$U_{x(n)_{LH2}}, S_{x(n)_{LH2}}, V_{x(n)_{LH}} = SVD(x(n)_{LH2}) \qquad (23)$$
$$U_{x(n)_{HL2}}, S_{x(n)_{HL2}}, V_{x(n)_{HL}} = SVD(x(n)_{HL}\ ) \qquad (24)$$
$$U_{x(n)_{HH2}}, S_{x(n)_{HH2}}, V_{x(n)_{HH2}} = SVD(x(n)_{HH2}) \qquad (25)$$

On the other hand W is the watermark image of PxQ size will logical XOR with the 8 bit key 'K'
W1= (W xor K) (26)
The Torus Automorphism disarranges the watermark bits similarly and arbitrarily before inserting and reproducing it after extraction. Torus Automorphism is one of the sorts of a dynamic framework. A dynamic framework, changes the details s when time t changes. Where p is a client input, it essentially swap the pixel positions.

$$(x_{i+t,j+t}) \leftrightarrow x_{i,j} where\ t = \sqrt{p^2 - i^2} \qquad (27)$$

W2=torus(W1) with p=2
W3=torus(W2) with p=4
W4=torus(W3) with p=8
W5=torus(W4) with p=16
W6=torus(W5) with p=32

This is the means by which scrambling done on watermark picture W1 and W6 is produced after five time Torus Automorphism. Every example of W6 changed over into paired and a double succession produced.

BW6=dec2bin(W6,8) (28)

Now BW6 is the watermark which is need to be hide inside the DWT and SVD decamped cover images which are shown in equations (22), (23), (24) and (25)

$$MS_{x(n)_{LL}}, = lsb(S_{x(n)_{LL2}})xor\ BW_i \qquad (29)$$
$$MS_{x(n)_{LH2}}, = lsb(S_{x(n)_{LH2}})xor\ BW_{i+1} \qquad (30)$$
$$MS_{x(n)_{HL2}}, = lsb(S_{x(n)_{HL2}})xor\ BW_{i+2} \qquad (31)$$
$$MS_{x(n)_{HH2}}, = lsb(S_{x(n)_{HH2}})xor\ BW_{i+3} \qquad (32)$$

Equation (29), (30), (31) and (32) develop modified S components of SVD

$$(x(n)_{NLL2}) = U_{x(n)_{LL2}} * MS_{x(n)_{LL2}} * {V_{x(n)_{LL2}}}^T$$

$$(x(n)_{NLH2}) = U_{x(n)_{LH2}} * MS_{x(n)_{LH2}} * {V_{x(n)_{LH2}}}^T$$

$$(x(n)_{NHL2}) = U_{x(n)_{HL2}} * MS_{x(n)_{HL2}} * {V_{x(n)_{HL2}}}^T$$

$$(x(n)_{NHH2}) = U_{x(n)_{HH2}} * MS_{x(n)_{HH2}} * {V_{x(n)_{HH2}}}^T$$

IDWT 3rd level

$$x(n)_{NHH1L} = \sum_{n=-\infty}^{\infty} \{x\left(\frac{n}{2}\right)_{NLL2} \pm x\left(\frac{n}{2}\right)_{NLH2}\}$$

$$x(n)_{NHH1H} = \sum_{n=-\infty}^{\infty} \{x\left(\frac{n}{2}\right)_{NHL2} \pm x\left(\frac{n}{2}\right)_{NHH2}\}$$

$$x(n)_{NHH1} = \sum_{n=-\infty}^{\infty} \{x\left(\frac{n}{2}\right)_{NHH1N} \pm x\left(\frac{n}{2}\right)_{NHH1H}\}$$

$$x(n)_{NHHH} = \sum_{n=-\infty}^{\infty} \{x\left(\frac{n}{2}\right)_{NHH1} \pm x\left(\frac{n}{2}\right)_{HL1}\}$$

$$x(n)_{HHL} = \sum_{n=-\infty}^{\infty} \{x\left(\frac{n}{2}\right)_{LL1} \pm x\left(\frac{n}{2}\right)_{LH1}\}$$

$$x(n)_{NHH} = \sum_{n=-\infty}^{\infty} \{x\left(\frac{n}{2}\right)_{NHHH} \pm x\left(\frac{n}{2}\right)_{HHL}\}$$

$$x(n)_{NH} = \sum_{n=-\infty}^{\infty} \{x\left(\frac{n}{2}\right)_{NHH} \pm x\left(\frac{n}{2}\right)_{HL}\}$$

$$x(n)_{L} = \sum_{n=-\infty}^{\infty} \{x\left(\frac{n}{2}\right)_{LL} \pm x\left(\frac{n}{2}\right)_{LH}\}$$

$$x(n)_{N} = \sum_{n=-\infty}^{\infty} \{x\left(\frac{n}{2}\right)_{L} \pm x\left(\frac{n}{2}\right)_{NH}\}$$

$\boldsymbol{x(n)_N}$ is the final cipher image which will have watermark image hidden inside it.

Piece portrayal: Step 1: At first step the picture is been taken through MATLAB and after that in the MATLAB condition it gets changed over into pixels shape (whole number numbers)

Stage 2: For the information stowing away as it is a logical approach we required to change over it into recurrence cum time space which is conceivable with proposed symlet-4 based Wavelet change just there are numerous wavelets strategies are accessible so it was our choice to make that for the benefit of our prerequisite of time or recurrence determination. In the event that we pick 'type1' at that point great recurrence determination and on the off chance that we pick 'type8' at that point time determination improves so we have pick 'type4' wavelet which give sufficient time and recurrence determination. After 3 level of picture decay LH, HL and HH parts are taken on the grounds that H segment are less interpretable by human eye.

Stage 3: After change the most noteworthy recurrence components of LL2, LH2, HL2, and HH2 is break down into squares of 8x8 means 64 pixels as appeared in figure above.

Stage 4: Each 8x8 squares taken and SVD performed on every one of the 8x8 pieces, SVD break down the each square into three individual squares named U, S and V where S is the Eigen estimation of separate 8x8 squares.

Stage 5: The information Image (watermark) taken and the greater part of its pixels gets XOR with the 64 bit Key.

Stage 6: The adjusted 2D watermark (after XOR with Key) is given to torus Automorphism which additionally scramble the picture up-to five levels.

Stage 7: The altered 2D watermark (after XOR with Key and Scramble through torus Automorphism) changed over into double 1D string this is requires in light of the fact that we are concealing twofold estimations of information picture.

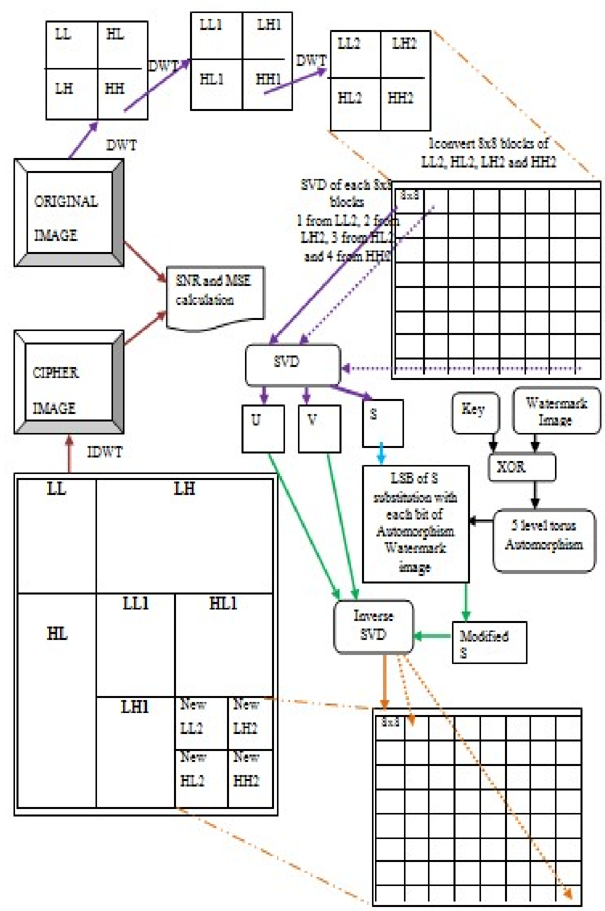

Figure 3 Proposed Method of watermarking

Stage 8: LSB of 'S' of each 8x8 piece supplant with a solitary double piece of watermark paired string and this procedure done until the point when all the twofold digits does not get supplant with LSB of 'S', to comprehend this procedure say initial 8x8 square after SVD we will shroud first parallel an incentive into its 'S' than for the following 8x8 piece we will again play out the SVD and now second paired will get covered up into new 'S' et cetera. One fascinating thing is that this single paired piece scattered inside 64 pixels of 'S'. This is the real reason that SVD based concealing techniques oppose and hearty against the channel assaults like commotion, pressure , tweak and channel.

Stage 9: perform ISVD with altered S and old U and V' and furthermore make another LL2, LH2, HL2 and HH2 recurrence segment connecting all ISVD's

Stage 10: Performing IDWT for with new LL2, LH2, HL2 and HH2 and grow new HH1

Stage 11: Performing IDWT for with new HH1 and old HL1, LL1 and LH1 and grow new HH

Stage 12: Performing IDWT for with new HH and old HL, LL and LH and create figure Image

Stage 13: Compute MSE and SNR between Original Image and Cipher Image.

The decoding is process for as can be watched it correct turn around arrange than the figuring procedure and our point is to extricate watermark not build the first picture so we did the procedure to have unique information as it were.

ALGORITHM FOR EXTRACTION OF WATERMARK FROM CIPHER IMAGE: Let X is the cipher image of MxN size DWT applied on 'X'

Proposed work use 'sym4' type wavelet for decomposition of Cover image

$$x(n)_L = \sum_{k=-\infty}^{\infty} x(k)g(2n-k) \qquad x(n)_H = \sum_{k=-\infty}^{\infty} x(k)h(2n-k)$$

DWT2 is use for Images for two dimension DWT, hence $\boldsymbol{x(n)_L}$ and $\boldsymbol{x(n)_H}$ further need to filtered as below

$$x(n)_{LL} = \sum_{k=-\infty}^{\infty} x(n)_L g(2n-k) \qquad x(n)_{LH} = \sum_{k=-\infty}^{\infty} x(n)_L h(2n-k)$$

$$x(n)_{HL} = \sum_{k=-\infty}^{\infty} x(n)_H g(2n-k) \qquad x(n)_{HH} = \sum_{k=-\infty}^{\infty} x(n)_H h(2n-k)$$

$$x(n)_{HHH} = \sum_{k=-\infty}^{\infty} x(n)_{HH} g(2n-k) \qquad x(n)_{HHL} = \sum_{k=-\infty}^{\infty} x(n)_{HH} h(2n-k)$$

$$x(n)_{LL1} = \sum_{k=-\infty}^{\infty} x(n)_{HHL} g(2n-k) \qquad x(n)_{LH1} = \sum_{k=-\infty}^{\infty} x(n)_{HHL} h(2n-k)$$

$$x(n)_{HL1} = \sum_{k=-\infty}^{\infty} x(n)_{HHH} g(2n-k) \qquad x(n)_{HH1} = \sum_{k=-\infty}^{\infty} x(n)_{HHH} h(2n-k)$$

$$x(n)_{HH1H} = \sum_{k=-\infty}^{\infty} x(n)_{HH1} g(2n-k) \qquad x(n)_{HH1L} = \sum_{k=-\infty}^{\infty} x(n)_{HH1} h(2n-k)$$

$$x(n)_{LL} = \sum_{k=-\infty}^{\infty} x(n)_{HH1L} g(2n-k) \qquad x(n)_{LH2} = \sum_{k=-\infty}^{\infty} x(n)_{HH1L} h(2n-k)$$

$$x(n)_{HL2} = \sum_{k=-\infty}^{\infty} x(n)_{HH1H} g(2n-k) \qquad x(n)_{HH2} = \sum_{k=-\infty}^{\infty} x(n)_{HH1H} h(2n-k)$$

We total 4 $x(n)_{LL2}$, $x(n)_{LH2}$, $x(n)_{HL22}$ and $x(n)_{HH2}$ components after three level DWT decomposition.

Here we are explaining the Calculation of SVD for $x(n)_{HH2}$ only although it is been computed for all 8x8 block of $x(n)_{LL2}$, $x(n)_{LH2}$, $x(n)_{HL22}$ and $x(n)_{HH2}$

U, S and V computed for each 8x8 block of all level three DWT decomposed $x(n)_{LL2}$, $x(n)_{LH2}$, $x(n)_{L22}$ and $x(n)_{HH2}$, As explain above.

$$U_{x(n)_{LL2}}, S_{x(n)_{LL2}}, V_{x(n)_{LL2}} = SVD(x(n)_{LL2}) \qquad U_{x(n)_{LH2}}, S_{x(n)_{LH2}}, V_{x(n)_{LH2}} = SVD(x(n)_{LH}\ )$$

$$U_{x(n)_{HL2}}, S_{x(n)_{HL2}}, V_{x(n)_{HL2}} = SVD(x(n)_{HL2}) \qquad U_{x(n)_{HH2}}, S_{x(n)_{HH2}}, V_{x(n)_{HH2}} = SVD(x(n)_{HH2})$$

Y is the 1D binary sequence extracted from the 'S' obtain after SVD on LL2, HL2, HL2 and HH2

$$\mathrm{Y} = \{1\ \mathrm{LSB\ from\ all\ 64\ of}\ \mathrm{S}_{\mathrm{x(n)}_{\mathrm{LL2}}},\ 2\ \mathrm{LSB\ all\ 64\ of}\ \mathrm{S}_{\mathrm{x(n)}_{\mathrm{LH2}}},\ 3\ \mathrm{LSB\ all\ 64\ of}\ \mathrm{S}_{\mathrm{x(n)}_{\mathrm{HL2}}},\ 4\ \mathrm{LSB\ all\ 64\ of}\ \mathrm{S}_{\mathrm{x(n)}_{\mathrm{HH2}}}, \dots \dots \dots\}$$

nY=Reshape (Y, PxQ)

The Inverse Torus Automorphism nY to rearranges the watermark bits. P must be same as was at the time of watermark scrambling.

$$x_{i,j} \leftrightarrow (x_{i+t,j+t}) \text{where } t = \sqrt{p^2 - i^2}$$

nY1=torus(nY) with p=32
nY2=torus(nY1) with p=16
nY3=torus(nY2) with p=8
nY4=torus(nY3) with p=4
nY5=torus(nY4) with p=2

This is how inverse scrambling done on nY and new watermark nY5 is developed after five time inverse Torus Automorphism. At the last

Rx=(nY5) xor Key

Here Rx is the final Recovered Watermark.

Block description:

Stage 1: At first step the figure picture is been taken through MATLAB and after that in the MATLAB condition it gets changed over into pixels shape (whole number numbers)

Stage 2: three level DWT and most elevated recurrence components of LL2, LH2, HL2, and HH2 is deteriorate into pieces of 8x8 means 64 pixels as appeared in figure above.

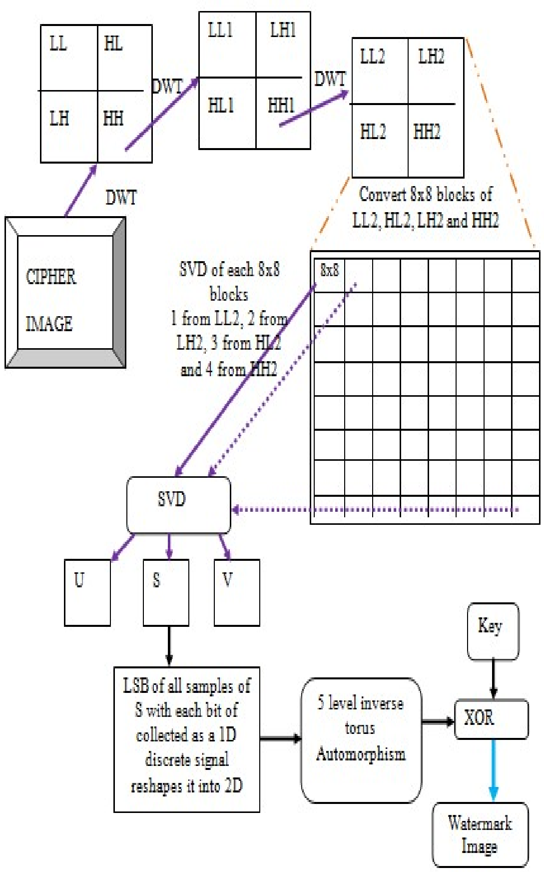

Figure 4 Proposed Method of watermark extraction

Stage 4: Each 8x8 pieces taken and SVD performed on every one of the 8x8 squares, SVD break down the each piece into three individual squares named U, S and V where S is the Eigen estimation of particular 8x8 squares.

Stage 5: LSB of every one of the 64 components of 'S' of each 8x8 pieces removed discovered most extreme comparable twofold shows up at the LSB of 64 components of 'S' and greatest consider as definite paired piece. From the all 'S' build up a 1D parallel arrangement.

Stage 6: reshape the paired bits at its unique 2D estimate PxQ from 1D twofold grouping.

Stage 7: The changed 2D picture is given to backwards torus Automorphism which facilitate re-organize the examples of the picture up-to five levels.

Stage 8: The re-organized picture is XOR with the 64 bit Key which create last watermark picture.

III-RESULTS

		
Cover image	Watermark image	Cipher image

Figure 5 Selected cover image (1) and watermark images(2) and cipher image developed (3)

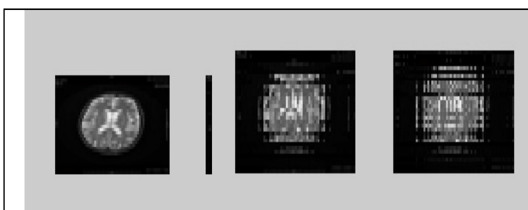

Figure 6 watermark image torus Automorphism level

If Where D is cipher image, C is cover image, len is length of cover image then

MSE= (D – C)^2/ Len, SNR= 10 log 10 (256^2/MSE), BER = sum of (Data xor Cipher) / (Len x 8)

Observe Results test cover image of Lena (512x512, 712 kb) and the cover images of 60x60 (4kb), 95x95 (8kb) and 128x128 (12 kb)

Cover Size	Watermark size	SNR	MSE	BER

512x512/ 712kb	60x60/4kb	80.57	0.27	0.2444
512x512/ 712kb	95x95/8kb	70.99	1.20	0.78
512x512/ 712kb	128x128/ 12kb	68.97	1.63	0.84

Table 1 observe results for cover Lena image with different size watermark image

COMPARATIVE RESULTS: The near outcomes are examination between proposed technique watermarking with accessible strategy for watermarking and it should be possible for the sake of SNR see by the distinctive strategies for the standard cover picture of 512x152 and watermark of 128x128 size.

AUTHOR	Output
Po-Yueh Chen et al	46.74dB
Tanmay Bhattacharya et al	27.3850 dB
Archana S. Vaidya et al	29.64 dB
Hyung -Shin Kim et al	36 dB
Mayank Awasthi et al	49.91 dB
Nallagarla.Ramamurthy et	51.8 dB
G. Rosline Nesa Kumari et	49.48 dB
Krishna Rao Kakkirala et	52.56 dB
Aniket Roy et al	51.9541 dB
Amra siddiqui et al	PSNR 41.92 dB
Zhi Zhang et al	PSNR 62.28 dB
Proposed work	PSNR 68.97 dB

Table 2 Comparative result

From the comparative results above we can clearly observe that the proposed work has best SNR among all available work.

IV-CONCLUSION

Watermarking is a way to deal with shroud the information (picture for our situation) effectively into any covering object (picture for our situation) and it ought to do that any gatecrasher can't translate it by any methods, it can be finished up on the premise of writing work that accessible strategies are great in watermarking however there are still a few issues with those systems and that can be move forward. . It can be presumed that DWT is the most appropriate strategy for versatile watermarking and SVD is the technique which most appropriate for lossless and assault free correspondence.

The first target of the postulation work was to build up an upgraded procedure for concealing picture and information inside cover picture likewise to decrease the measure of information on channel while stenograph information transmission which is been accomplished. The issue with watermarking is that it requires bunches of information implies another greater picture for sending some little watermark picture, proposed work accomplished that same size of watermark can be transmitted with little size of cover picture as accomplished SNR is superior to accessible work 69.4.

REFERENCES

[1] Zhi Zhang, Chengyou Wang, Xiao Zhou, Image Watermarking Scheme Based on Arnold Transform and DWT-DCT-SVD, ICSP2016, 978-1-5090-1345-6/16/2016 IEEE

[2] Amra Siddiqui, Arashdeep Kaur, A protected and vigorous picture watermarking framework utilizing wavelet area, 2017 seventh International Conference on Cloud Computing, Data Science and Engineering - Confluence, IEEE, DOI: 10.1109/CONFLUENCE.2017.7943222

[3] Aniket Roy, Arpan Kumar Maiti, Kuntal Ghosh, An observation based shading picture versatile watermarking plan in YCbCr space, 2015 second International Conference on Signal Processing and Integrated Networks (SPIN), 978-1-4799-5991-4/15/2015 IEEE

[4] Krishna Rao Kakkirala, Srinivasa Rao Chalamala, Block Based Robust Blind Image Watermarking Using Discrete Wavelet Transform, 2014 IEEE tenth International Colloquium on Signal Processing and its Applications (CSPA2014), 7 - 9 Mac. 2014, Kuala Lumpur, Malaysia

[5] G.Rosline Nesa Kumari, Dr.S.Maruthuperumal, Dr.V.Vijayakumar, Hierarchical-Edge based Torus Automorphism for Digital Watermarking, International Journal of Science, Engineering and Technology Research (IJSETR) Volume 2, Issue 2, February 2013

[6] Nallagarla.Ramamurthy, Dr.S.Varadarajan, Effect of Various Attacks on Watermarked Images, (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 3 (2) , 2012,3582-3587

[7] Dan Kalman, A Singularly Valuable Decomposition: The SVD of a Matrix, THE COLLEGE MATHEMATICS JOURNAL, vol 27 no. 1, 1996

[8] Mayank Awasthi1 and Himanshi Lodhi, Robust Image Watermarking in light of Discrete Wavelet Transform, Discrete Cosine Transform and Singular Value Decomposition, Advance in

Electronic and Electric Engineering. ISSN 2231-1297, Volume 3, Number 8 (2013), pp. 971-976 \ Research India Publications
[9] Vinicius Licks and Ramiro Jordan, Geometric Attacks on Image Watermarking Systems, University of New Mexic, 1070-986X/05/2005 IEEE Published by the IEEE Computer Society
[10] Hyung - Shin Kim, Yunju Baek, Heung-Kyu Lee, Rotation, scale, and interpretation invariant picture watermark utilizing higher request spectra, Journal Korea Advanced Institute of Science and Technology, vol 5, no. 1, 373-1, pp 305-701, Korea
[11] Mrs.Archana S. Vaidya, Pooja N. More., Rita K. Fegade., Madhuri A.. Bhavsar., Pooja V. Raut. Picture Steganography utilizing DWT and Blowfish Algorithms, IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661, p-ISSN: 2278-8727Volume 8, Issue 6 (Jan. - Feb. 2013), PP 15-19
[12] Tanmay Bhattacharya, Nilanjan Dey, S. R. Bhadra Chaudhuri, A Novel Session Based Dual Steganographic Technique Using DWT and Spread Spectrum, International Journal of Modern Engineering Research (IJMER) , Vol.1, Issue1, pp-157-161 ISSN: 2249-6645 157
[13] Pao-Yen Lin, An Introduction to Wavelet Transform, Digital Image Processing 2/E. Upper Saddle River, NJ: Prentice-Hall, 2002, pp. 349-404
[14] Po-Yueh Chen, Hung-Ju Lin A DWT Based Approach for Image Steganography, International Journal of Applied Science and Engineering, 2014. 4, 3: 275-290