

# Determining the Watermark Image by Employing Division Model in Real Time Video

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**ABSTRACT:** In recent time internet provides groovy appliance in transferring a big quantity of information in different portions of the globe. Touse such types of information from internet application we have to need the information security, safety. Keeping the public interest in mind, the watermarking concept was created. For an information security, safety, purpose the watermarking technique comes into existence. In this paper, we are presenting a new schema for the robust video watermarking resistant against the division distortion. Spatial and transform techniques are used for implanting the watermark information and to develop the best quality watermarked video. To avoid the distortion camera parameter must be accurate. If this parameter is not accurate, distortion will occurs and may be destroy the quality of the video as well as watermark information. So, one of the main causes of distortion is an inaccurate parameter of the camera. The next reason of distortion is wide angle lenses which are basically used in camera ex. HMD devices and free view television etc. Transmission channel is also the cause of distortion. To avoid such types of distortion there is the need for accurate and efficient detection methods. By using these methods of detection, the stable results of watermarking information will be produced. We will use the correlation and SSIM (Structural similarity index measure) parameters for detection of watermark information. In this paper, we are working on the division distortion model. We are showing the graphical representation of correlation and SSIM with BER (bit error rate), MSE (mean square error) and detect the watermark image information from the distorted watermarked video.

**KEYWORDS:** Video watermarking, DWT, Division distortion, BER, MSE

## I. INTRODUCTION

Nowadays, in the discipline of information technology watermarking become an interesting and hot research subject. Watermarking simply means to embed the secret information in the form of image, text in the carrier signal (image/audio/video). The security of the digital information and copyright protection is so necessary [1-3]. We take the information from multiple sources like internet, Tv etc. and transfer this digital information or data from one place to the another place, it may be affected by the attacks (geometric/non-geometric) or affected by the multiple types of distortions like barrel distortion, rational type distortion and division distortion so on. These attacks and distortion has the power to spoil watermark information from the carrier signal. Distortion and attacks are a big concern for authorized users because this has an ability to destroy the watermark information and degrade the quality of the video. This concern can be increased by unauthorized users. So we have to need a copy security and copyright protection so on.

The most powerful feel too attached to the natural world is the vision. Today in many important implanted applications the use of camera is must. In camera, multi types of lenses are applied. These lenses are also creating the distortions. Sometime we are adding the distortion in the video for removing the present distortion like to remove the pin cushion distortion we have to add some distortion [4 5]. If we have added the distortion in the video then there is a chance to

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take out the watermark data and which is not right for us. A watermark is the hallmark of our rights so if it is damaged for any reason we can lose our rights and ownership. Watermark information's protection is so important nowadays. We are implanting the watermark information into the video then that video puts into the global world. So anyone uses the watermarked video. The biggest problem arises to secure the watermark information.

We are also showing the embedding and extraction process.

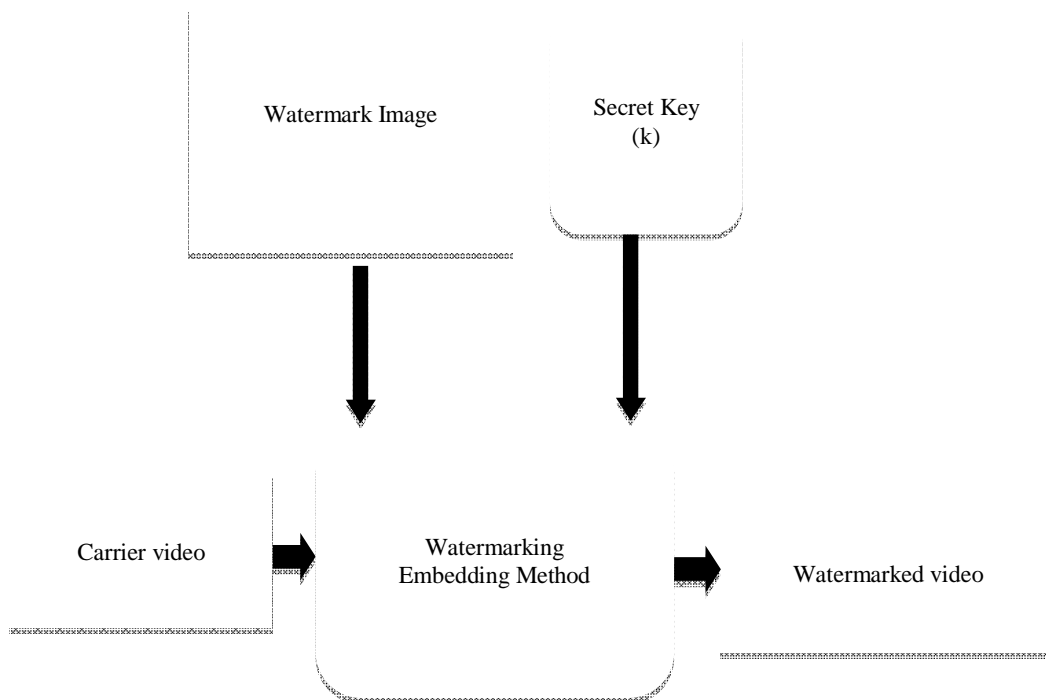


Fig. 1 Digital watermarking embedding process [6]

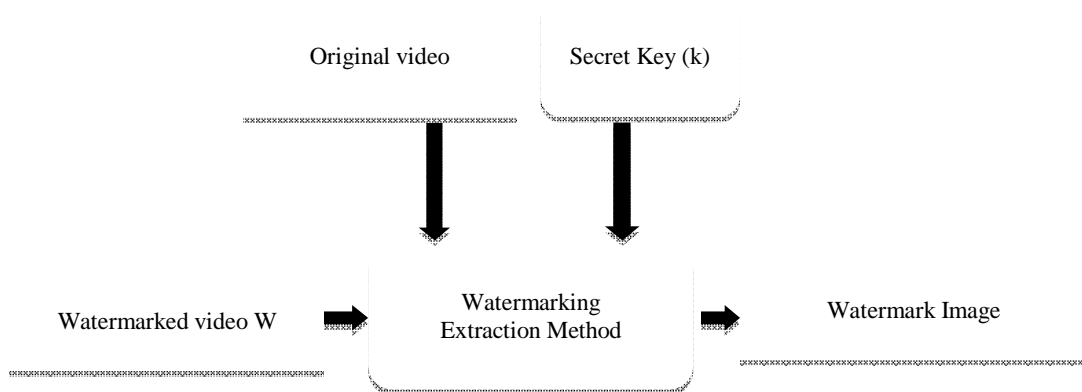


Fig. 2 Digital watermarking extraction process [6]

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There are multiple techniques are adding up to detect the watermark information. We are working on the division distortion model. If this type of distortion is present in the watermarked video then we can detect the watermark information and owners can avoid the worry of missing a watermark. In the embedding process, we add the watermark signal into the carrier signal or original signal. We should be used secret key at the time of embedding. This same secret is used at the time of the extraction process. The secret key provides the safety and protection from the unauthorized users [6]. In this paper, we firstly choose video where the watermark is added. After addition of watermark we also add the division distortion to the watermarked video. In this video watermark information may be removed after the addition of distortion. My work is to detect the watermark information at higher BER (bit error rate) and MSE (mean square error). We are finding the watermark information with the help of some parameters and showing the relation between correlation and SSIM with BER (bit error rate), MSE (mean square error).

## 1. DIVISION DISTORTION MODEL

The division model is totally different from the normal model. For making any type of distortion model we should demonstrate its performance as well as previous approximation. Lens distortion model is not so simple. If you want to work on the division model we have to complete knowledge about the Taylor series [7]. In division model we take the first order nonlinear terms.

$$x = (1 + \lambda \|p\|^2)p \quad \dots (1)$$

Several models have been produced, but there not all of them were rather efficient, but there was a model which can be considered in evaluating the result of the distortion of the video's frame. The equation 2 represents the mathematical formula representing the division model:

$$p = \frac{1}{(1 + \lambda \|x\|^2)} x \quad \dots (2)$$

The standard formula for the lens distortion

$$\begin{pmatrix} \hat{x} - x_c \\ \hat{y} - y_c \end{pmatrix} = f(r) \begin{pmatrix} x - x_c \\ y - y_c \end{pmatrix} \quad \dots (3)$$

$f(r)$  is the distortion function which indicates the shape of the distortion model.

$(x, y)$  is the pixel to coordinate which shows the distorted point,  $(\hat{x}, \hat{y})$  is also the pixel coordinate which shows the undistorted point,  $(x_c, y_c)$  is the center point of the distortion model. The both equations basically represent the camera's distortion function. We can also show the original and distorted frame.

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(a)

(b)

Fig. 3 (a) Original watermarked frame (b) Original watermarked Frame with division distortion

We are showing the effect of division model of the original watermarked frame.

## II. PROBLEM FORMULATION

Nowadays, new advancement is making out in the area of multimedia devices. The new devices are coming to the market like free view television, HMD devices etc. This device creates the distortion into the video. This distortion will create the problem for the authorized users. When the distortion occurs in the video, then the pixel value can be fluctuated. The change of pixel value also destroys the watermark information which is present behind the carrier video signal. The researches have become a lot of techniques of distortion with the use of single parameter [9-16]. In my proposed work we have taken more than one parameter for finding the watermark information from the distorted watermarked video's frame.

## III. PROPOSED WORK

Lots of problems are present at traditional work. All problems are discussed in the problem formulation. In my proposed work, we are working on robust watermarking. We have developed accurate algorithms for embedding the watermark and detection the watermark information from the distorted watermarked video. We are also presenting the graphical representation of the correlation and the similarity index with BER, PSNR and also find out the correlation and similarity parameters for high entropy distorted watermarked frame.

### 1. TECHNIQUE USED

Multiple techniques are used for video watermarking. In the transform domain we are using the DWT (Discrete wavelet Transform) [17-18] and in spatial domain we are using the spread spectrum [19-21] and LSB technique. In the first step we are requiring the location where we can embed the watermark information. After the help of LSB technique we exchange the original video's frame pixel values with watermark image pixel value [22]. The last step of embedding the watermark information is DWT technique. With the help of DWT technique we are compressing the video frame and also using this technique we are embedding the watermark information.

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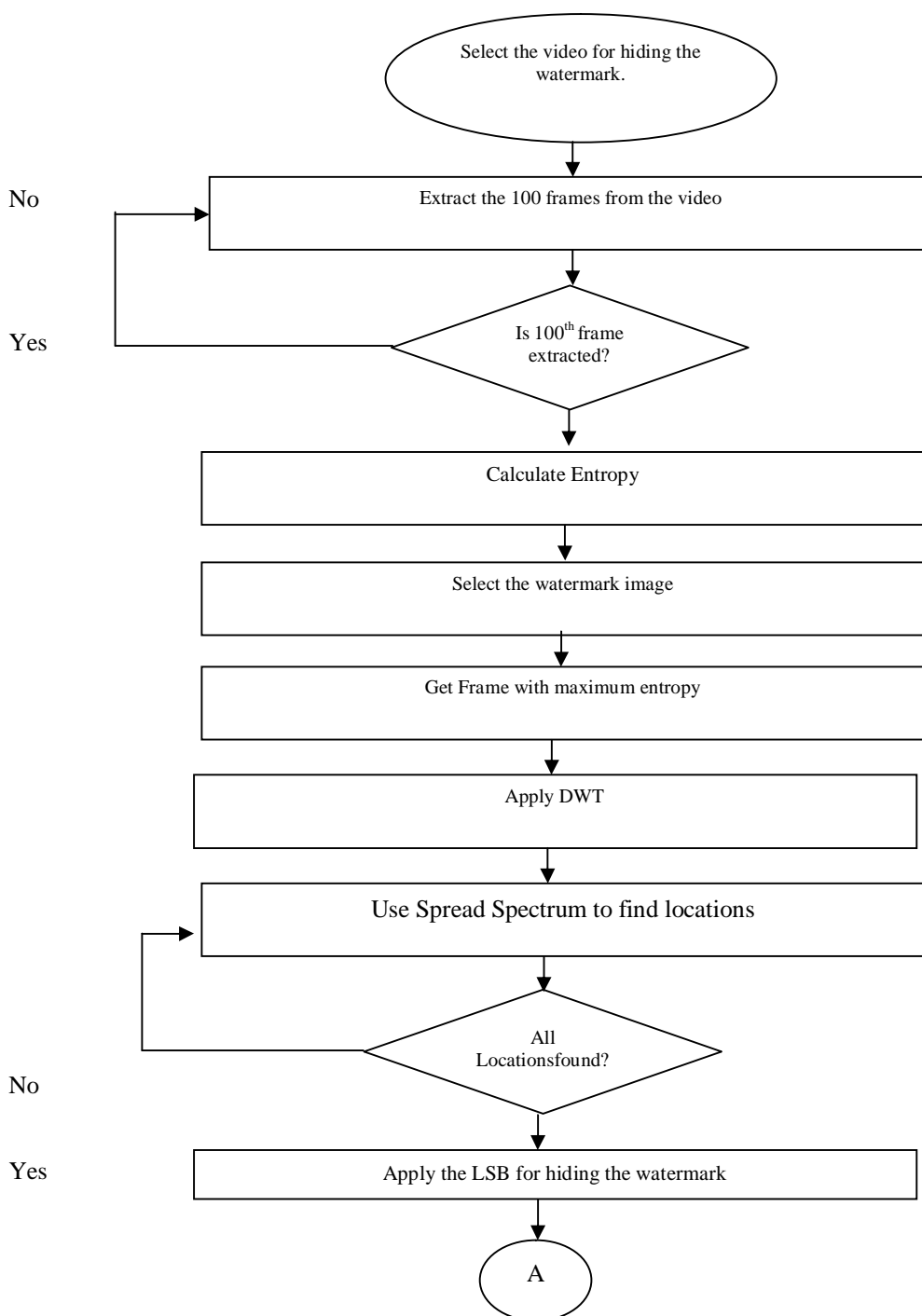
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## IV. METHODOLOGY

In my recent work we have used multiple techniques in the process of embedding the watermark and detection of the watermark information.



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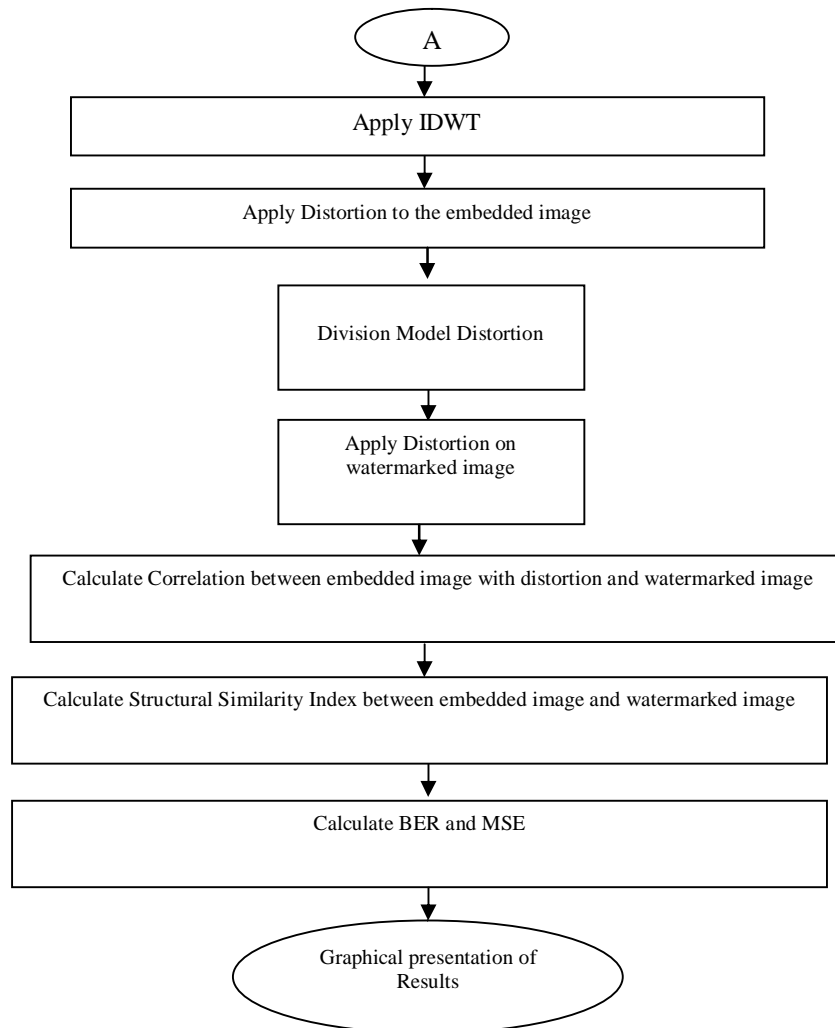


Fig. 4 Flow chart of the proposed work

1. First step is to select the mobile video for embedding the watermark behind it.
2. After selecting the video, further extracts the total 100 frames from the video. If the 100<sup>th</sup> frame is reached, then move to the step 3 otherwise the extraction of the frames will be done again until the 100<sup>th</sup> frame reached.
3. Now evaluate the entropy value.
4. Now select the watermark image from the database.
5. Select the frame which has the maximum entropy value of hiding the data behind it.
6. Apply Discrete Wavelet Transformation to the frames.
7. Now apply spread spectrum mechanism to evaluate or to find the location for hiding the data.
8. Employ the Least Significant Bit approach to hide the data behind the selected frames at the location that was located in the previous step.
9. Apply Inverse of DWT to the image.
10. Add divisional distortion to the embedded image and watermarked image as well.
11. Evaluate the correlation between the distorted embedded image and distorted watermarked image.
12. Perform the calculation of the Structural Similarity Index between embedded and watermarked image.

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13. Evaluate various performance parameters such as BER and MSE.
14. Plot the graphs of the performance parameters for graphical representation.
- 15.

## V. RESULTS AND EXPERIMENTS

In this segment, we are finding the solutions after the implementation of the proposed study. We are essentially turning on video watermarking and the chief object to prevent the watermark in the video from getting ruined. The proposed work comprises of DWT technique in order to play upon the division distortion model.

In this paper, we are working on the video. The video's information is Number of Frames = 9391, Bits per Pixel = 24, Frame Rate = 29.9700, Height = 720, Width = 960, Video Format = RGB24.

We are holding 100 frames from the video. After frame extraction we have selected the 20 frames. we are selecting only 20 frames. The selection of frame is decided by the entropy value and then embeds the watermark information into the selected frame. The 288 frame number has highest entropy value and the 202 frame number has lowest entropy value. The later addition of division distortion into the watermarked video's frame and watermark image we are noticing the correlation and SSIM.

The value of correlation and SSIM is lying in between the 0.6 to 1. If it values so close to the 1 it means more similarities of the signal. We have to detect the watermark signal from the distorted watermarked video. The distortion is present in the watermarked video is division distortion. In the tabular form, we are representing the correlation and SSIM values of the frame. It represents the presence of the watermark signal.

Table 1 Evaluation of two parameters by the addition of division distortion model

DIVISION DISTORTION		
Frame Number	SSIM	Correlation
288	0.7087	0.9957
289	0.7057	0.9936
290	0.6989	0.9865
291	0.6984	0.9756
292	0.6958	0.9752
294	0.6915	0.9700
299	0.6900	0.9698
298	0.6898	0.9682
296	0.6896	0.9620
295	0.6872	0.9571
293	0.6855	0.9568
297	0.6849	0.9560
236	0.6802	0.9540
239	0.6795	0.9479
207	0.6792	0.9371
206	0.6766	0.9368
204	0.6722	0.9194
208	0.6690	0.9144
203	0.6667	0.9065
202	0.6637	0.9057

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Note. SSIM= Structural similarity index measure

We are proving the relationship between the BER, MSE with correlation and SSIM. In this relationship we are detecting the correlation and SSIM of the distorted watermarked frame with highest BER and MSE. The graphical form of the correlation and SSIM with BER and MSE is shown below:

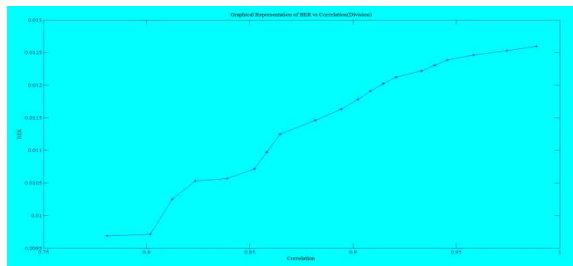


Fig. 5 Graphs for Correlation on the basis of BER in proposed work

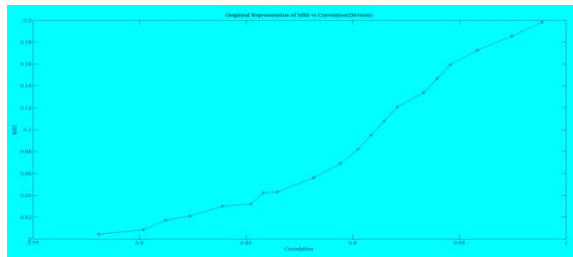


Fig. 6 Graphs for Correlation on the basis of MSE in proposed work

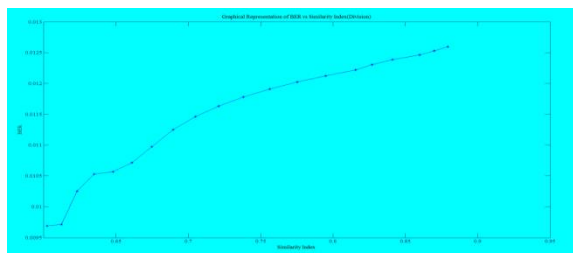


Fig. 7 Graphs for SSIM on the basis of BER in proposed work

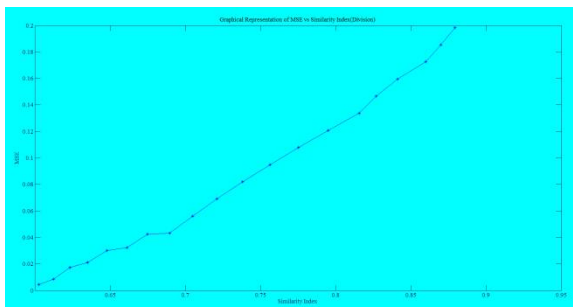


Fig. 8 Graphs for SSIM on the basis of MSE in proposed work



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The distorted watermark image and distorted watermarked video's frame are basically used for getting the watermark robustness. The original and watermarked image is used to finding the watermark imperceptibility [23 24]. The watermark robustness is correlation dependent. The watermark imperceptibility is PSNR dependent. PSNR factor is used to finding out the BER and MSE factors. We are using the  $\alpha$  factor which gives the strength of watermark signal. This factor shows the relationship between watermark imperceptibility and watermark robustness [25].

## VI. CONCLUSION

Watermarked video is acquired from the different sources like internet, television etc. The main cause of the distortion is use of sources. In this paper, we are working on division distortion and detect the watermark information from the distorted watermarked video by using the SSIM, BER, MSE and correlation parameters. Further enhancements can be performed by using various distortion models as well as various attacks. By working with all distortion models and attacks, we can increase the accuracy and efficiency of the system.

## REFERENCES

- [1] J. Yang, H. Hu, and H. Xi, "Online Buffer Fullness Estimation Aided Adaptive Media Payout for Video Streaming [J]", IEEE Transactions on Multimedia, vol. 13, no.5, pp. 1141-1153, 2011.
- [2] H. Hu, Y. Wen, and H. Luan, "Towards Multiscreen Social TV with Geolocation-Aware social Sense [J]", IEEE Multimedia, vol. 21, no.3, pp. 10-19, 2014.
- [3] Y. Jin, Y. Wen, and H. Hu, "Reducing Operational Costs in Cloud Social TV: An Opportunity for Cloud Cloning [J]", IEEE Transactions on Multimedia, vol. 16, no.6, pp. 1739-1751, 2014.
- [4] H. Hu, Y. Wen, and Y. Gao, "Towards an SDN enabled big data platform for social TV analytics [J]", IEEE Network, vol. 29, no.5, pp. 43-49, 2015.
- [5] H. Hu, Y. Wen, and T. Chua, "Joint Content Replication and Request Routing for Social Video Distribution over Cloud CDN: A Community Clustering Method [J]", IEEE Transactions on Circuits & Systems for Video Technology, vol. 26, no.7, pp. 1320-1333, 2016.
- [6] V.M. Potdar, S. Han, and E. Chang, "A Survey of Digital Image Watermarking Techniques", INDIN '05. 2005 3rd IEEE International Conference on Industrial Informatics, 2005, pp. 709- 716, 2005.
- [7] A.W. Fitzgibbon, "Simultaneous linear estimation of multiple view geometry and lens distortion," Computer Vision and Pattern Recognition, 2001. CVPR 2001. Proceedings of the 2001 IEEE Computer Society Conference on", pp. 125-132, 2001.
- [8] P. Singh, R.S. Chadha, "A Survey of Digital Watermarking Techniques, Applications and Attacks" International Journal of Engineering and Innovative Technology, vol. 2, no.9, pp. 165- 175, 2013.
- [9] G.S. Bhatia, K. Kaur, "Video Watermarking using YcbCr and RLE", International Journal of Engineering and Technology, vol. 03, no.08, pp. 1025- 1030, 2016.
- [10] J. Chang, L. G. Miao, "Correcting radial distortion of document images by morphology," Journal of Computer Applications", vol. 30, no.4, pp. 950-952, 2010.
- [11] M. Gadermayr, "Evaluation of different distortion correction methods and interpolation techniques for an automated classification of celiac disease", Computer Methods and Programs in Biomedicine, vol. 112, no.3, pp. 694-712, 2013.
- [12] C. Li, Y. Fucheng, "The study on digital watermarking based on word document. In Mechatronic Sciences", Proceedings 2013 international Conference on Mechatronic Sciences, Electric Engineering and Computer (MEC), pp. 2265-2268, 2013.
- [13] A. Agrawal, "Securing Video Data: A Critical Review", International Journal of Advanced Research in Computer and Communication Engineering, vol. 3, no.5, pp.6610-6613, 2014.
- [14] C.R. Viala, "Efficient Lens Distortion Correction for Decoupling in Calibration of Lens Wide Angle Lens Cameras", IEEE Sensors journal, vol. 13, no.2, pp. 854-863, 2013.
- [15] D. Pohl, G.S. Johnson, and T. Bolkart, "Improved Pre-Warping for Wide Angle, Head Mounted Displays", Proceedings of the 19th ACM Symposium on Virtual Reality Software and Technology, pp. 259-262, 2013.
- [16] D. Claus, A.W. Fitzgibbon, "A Rational Function Lens Distortion Model for General Cameras", A Rational Function Lens Distortion Model for General Cameras," Computer Vision and Pattern Recognition, 2005. CVPR 2005. IEEE Computer Society Conference on, vol. 1, pp. 213-219, 2005.
- [17] Y. Yang, "Novel Zero Watermarking Scheme Based on DWT-DCT," China Communications", vol. 13, no.7, pp. 122-126, 2016.
- [18] P. Sharma, S. Swami, "Digital Image Watermarking Using 3 level Discrete Wavelet Transform", Conference on Advances in communication and Control System, pp. 129-133, 2013.
- [19] N. Kokui, H. Kang, K. Iwamura, and I. Echizen, "Best embedding direction for spread spectrum-based video watermarking", Consumer Electronics, 2016 IEEE 5th Global Conference on, pp. 1-3, 2016.
- [20] H. S. Malvar, "A Improved spread spectrum: a new modulation technique for robust watermarking," IEEE Trans. Signal Processing", vol. 51, no. 4, pp. 898- 905, 2003.
- [21] I. J. Cox, J. Kilian, F.T. Leighton, and T. Shamon, "Secure spread spectrum watermarking for multimedia", IEEE Trans. Image Processing, vol. 6, no. 12, pp. 1673- 1687, 1997.

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(An ISO 3297: 2007 Certified Organization)

Website: [www.ijirset.com](http://www.ijirset.com)

Vol. 6, Issue 6, June 2017

- [22] R. Goyal, N. Kumar, "LSB Based Digital Watermarking Technique," International Journal of Application or Innovation in Engineering & Management", vol. 3, no. 9, pp. 15-18, 2014.
- [23] Y. Fang, K. Zeng and Z. Wang, "Objective Quality Assessment for Image Retargeting Based on Structural Similarity [J], IEEE Journal on Emerging & Selected Topics in Circuits & Systems", vol. 4, no. 1, pp. 95-105, 2014
- [24] Y. Fang, K. Ma and Z. Wang, "No- Reference Quality Assessment of Contrast-Distorted Images Based on Natural Scene Statistics [JJ]", IEEE Signal Processing Letters, vol.22, no. 7, pp. 838-842, 2015.
- [25] H. Tian, Y. Xiao, "Robust watermarking of Mobile video Resistant against Barrel distortion", IEEE Journals & Magazines, vol. 13, no.13, pp. 131-138, 2016.
- [26] Y.-H. Lin, "A digital blind watermarking for depth-image based rendering 3D images", IEEE Trans. Broadcasting, vol. 57, no.2, pp. 602-611, 2011.
- [27] C.S. Lin, "Automatic distortion measuring system with reticle positioning for enhanced accuracy", vol. 4, no.9, pp. 960- 969, 2008.
- [28] G. Vass, "Applying and removing lens distortion in post-production" Proceeding of the 2nd Hungarian Conference on Computer Graphics and Geometry: Citeseer, pp. 1-8, 2003.