A Comprehensive Review of Digital Image Watermarking Using Transform Function for the Feature Extraction and Optimization Algorithm for Dynamic Embedding

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Abstract: The digital multimedia data faced a problem of privacy and copyright. The digital watermarking techniques play vital role in this era. In current decade various watermarking algorithms are proposed in different domain such as spatial domain and frequency domain. In frequency domain the process of watermarking is very robust and secure against the intentional attack. The third-party intentional attacks deformed the watermark and change the copyright of digital data. For the improvements of security strength, the feature based watermarking techniques help the reduces the correlation points of embedding of image and reduces the security risk of digital data. The transform-based function gives the texture features such as DWT, SIFT, FFT and many more transform functions. The selection of features points used optimization techniques such as genetic algorithm, particle swarm optimization and ant colony optimization. In this paper present the comprehensive review of digital watermarking algorithms based on the transform function, optimization techniques and dynamic embedding against the different types of attacks.

Index Terms **- Watermarking, Transform Function, Feature Extraction, Optimization Algorithm, Dynamic Embedding.**

I. INTRODUCTION

The impact of internet technology are increases day to day our society. The society uses the internet generates and share the multimedia data over the social networking sites. The sharing of digital multimedia data faced a problem of image tampering and copy paste and degraded the impression of person. For the prevention of digital multimedia used copyright protection[1-2]. The copyright protection uses digital watermarking scheme. The digital watermarking scheme proceed in two different scenario such as spatial domain and frequency domain. In spatial domain the digital watermarking work in fashion of pixel-based operation. In frequency domain the watermarking process used the transform-based function for the process of watermarking. The transform-based function such as DWT, FFT and IWT used the concept of feature extraction and feature selection for the process of watermarking[3]. The feature based watermarking process is very strong in other techniques such as bit level operation and other process of transform function. The process of digital watermarking also provides the facility of digital image data integrity over the internet.

The integrity of digital data ensures the process of authentication and authorization of digital data[4, 5]. The process of authentication and authorization tampered by the man in middle attack and destroy the digital watermark and free from copyrights. The tampering of digital image data also targets the intellectual property of privacy preservation. The tampering of digital data is internationally crime. Robustness and security are two major area of work in digital watermarking. For the security and robustness used transform based function for the process of digital watermarking. The transform-based function discrete cosine transforms (DCT) is block based operation in watermarking process[6]. The block based watermarking process faced a problem of searching of coefficient for the process of embedding to original image and watermark image. The searching and large number of blocks create more time for embedding in digital watermarking algorithms. Instead of that the discrete wavelet transform function is easy to embed digital watermarking. The discrete wavelet transforms (DWT) function is combination of lower frequency and higher frequency. The process of decomposition of wavelet transform function induces the impulsive noise and degraded the quality of digital watermark[7-9]. The degraded quality of watermark easy for attacker for the predication. Instead of that used integer wavelet transform function (IWT).

The intergern wavelet transform function generates the series of packets for the embedding of watermarking. And remove the process of noise and increase the quality of image. These all transform function directly apply to the watermarking process. Now a day's various authors proposed a method of feature based watermarking techniques. The features based watermarking techniques used the lower content of features of image such as color, texture and shape and size. The extraction of features used dominated features extraction process such as for the extraction of color features used DCD features extraction process. The Dominated color descriptor (DCD) extract the color features of given image. Instead of this for the extraction of texture features used the transform-based function such as DWT, IWT and sherbet transform function. Texture is transparent feature of image. For the extraction of shape and size used geometrical invariant function for the extraction of this features[10-14]. In all three types of features the texture features is most dominated features for the process of watermarking. The feature selection is also important area in digital watermarking. For the selection of features used optimization algorithms. The process of features selection is also the process of features reduction. The process of reduction gives the optimal features for the process of embedding of digital watermark[15]. For the dynamic pattern generation for the embedding of watermark used classification algorithms such as support vector machine and neural network. The support vector machine gives the process of better generation of patterns in watermarking process and increase the security strength of watermark process[16, 17].

The rest of paper is organized into different sections: Section II presents the basic process of watermarking and attacks of watermarking. A literature review on watermark is presented in Section III. Optimization and dynamic embedding in Section IV. Conclusions and future work given finally in Section V.

II. WATERMARKING AND ATTACKS

Digital watermarking is process of embedding one image in another image. The process of embedding used image is called host image and watermark image. The process of embedding used the value of key for the process of security. The value of key enhanced the process of security strength of watermark. The classification of watermark defines on different levels such as

application, human perception, domain and transmission of mode. In the perception of human watermark categorized in two categories visible and invisible. Further classified the invisible watermarking algorithm in robust and fragile. The process of robust watermarking classified in blind and non-blind. Figure 1 shows that the process of digital watermarking techniques and figure 2 shows the process of classification techniques of watermarking.

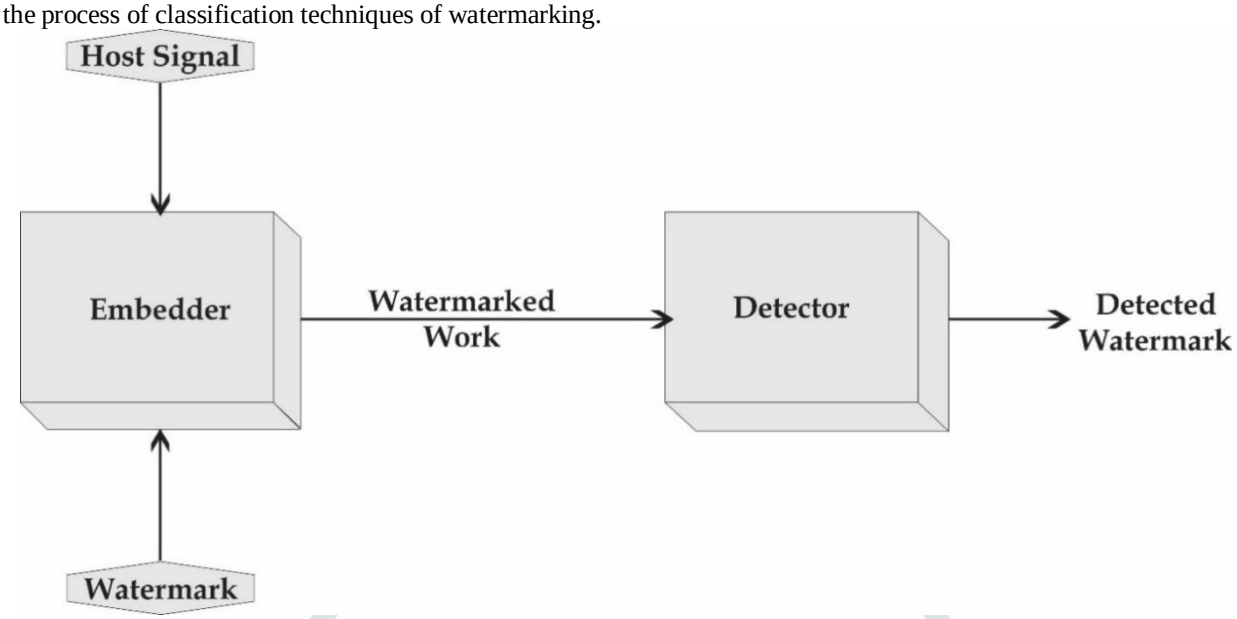

Figure1: the process of digital watermarking techniques in general process.

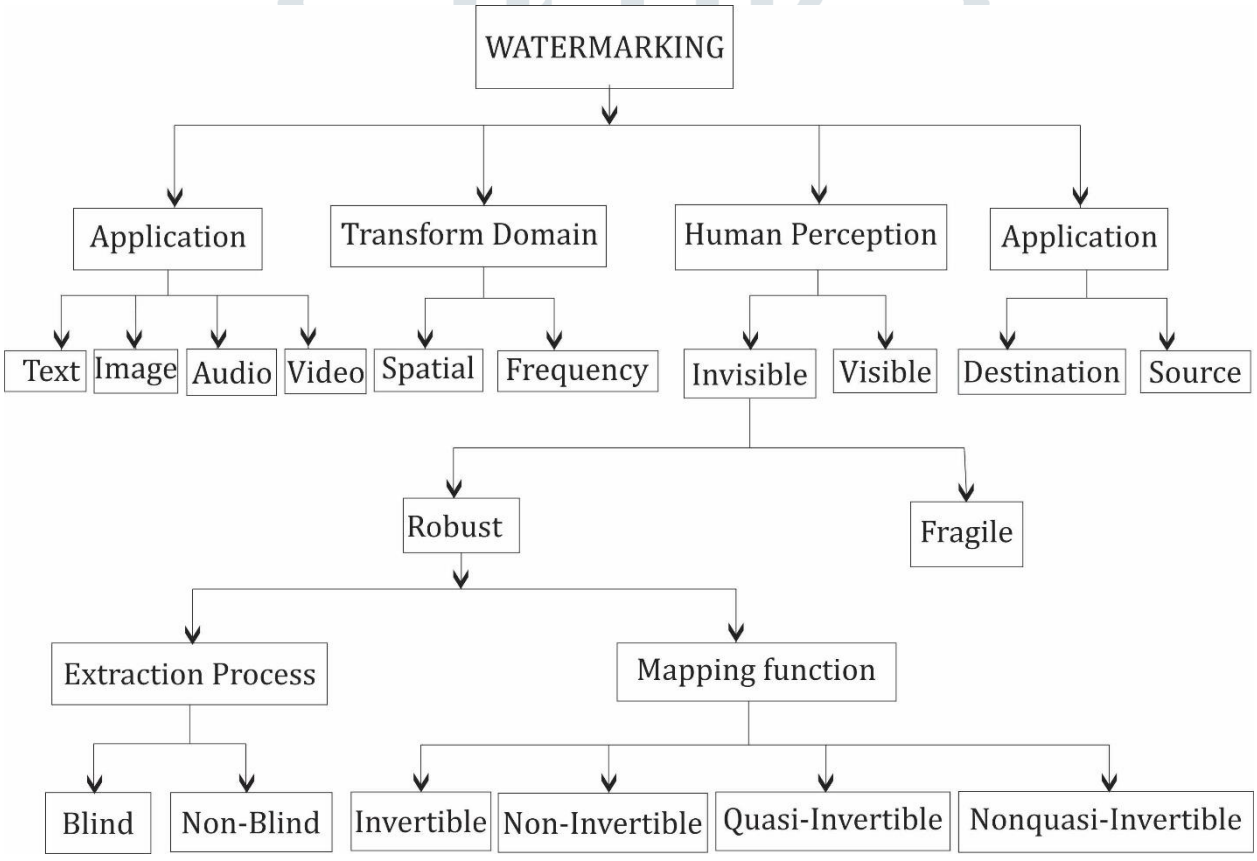

Figure2: the classification of digital watermarking techniques on different aspects and domain.

Watermarking Attacks

The security threats are major issue in current scenario of digital multimedia. The digital multimedia data loss the credential and integrity due to attacks. The process of digital watermarking also compromised with the security attacks and loss the copyright and intellectual property rights of digital data. The types of attacks depend on the domain of watermarking techniques. The transform based watermarking techniques faced a problem of geometrical and intentional attacks. The geometrical attacks such as cropping. Sharing, translation and rotation. These attacks remove the watermark symbol with transmitted image. Figure 3 represent the classification process of watermarking attacks.

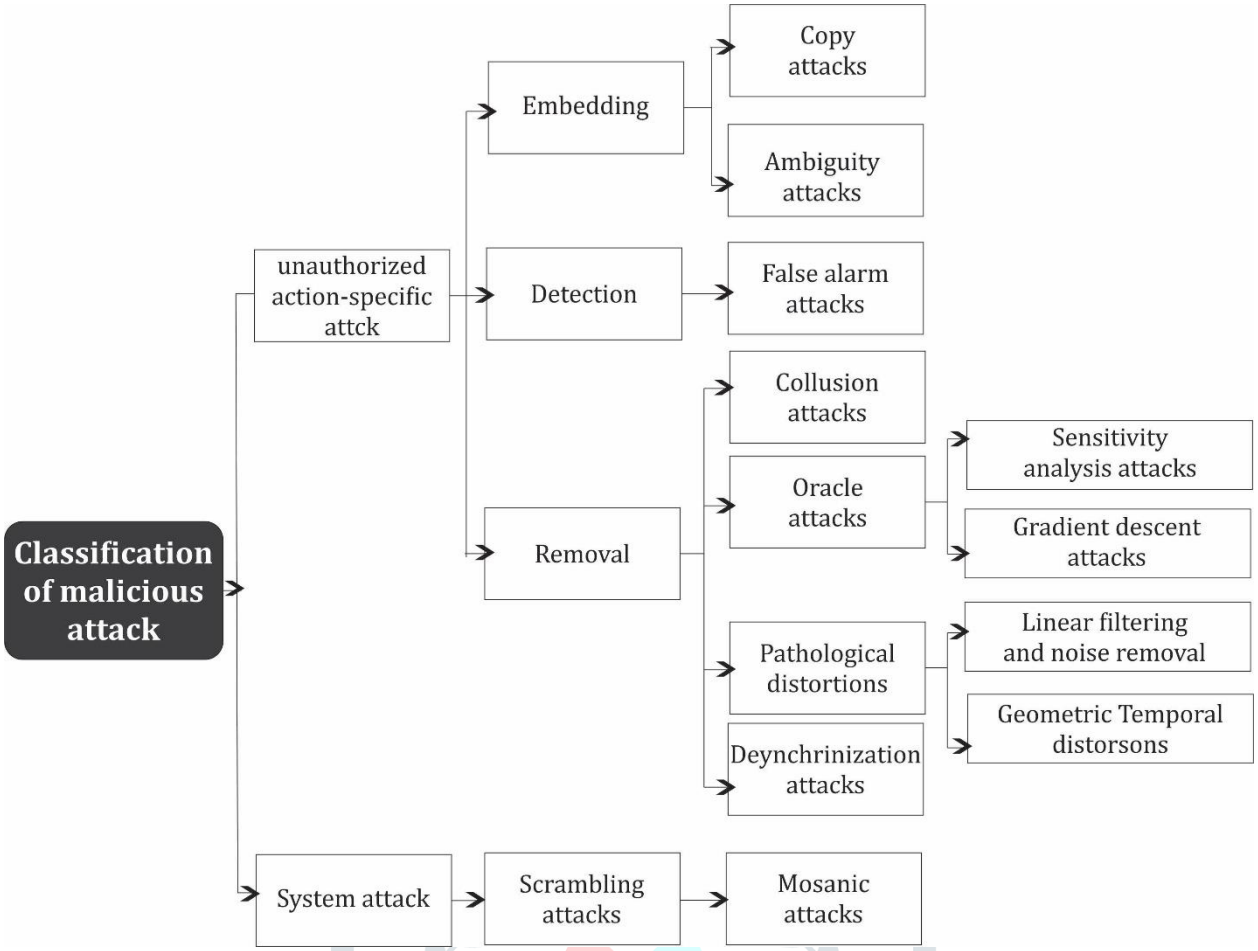

Figure 3: process block diagram of the classification of different types of attacks in digital watermarking.

III. RELATED WORK

The diversity and applicability of watermarking techniques increase day to day in different area of application such as document copyright, medical image, personal data integrity and most important issue in fake currency in any county. In prevention of fake currency and document watermarking process established a milestone. For the continues improvements of watermarking process various authors and researcher work in different domain. Here we present the review based on their approach and issue work done in area of watermarking.

Et al.	Paper	Author	Technique Used	Advantages	Issues
[1]	Image Integrity Authentication Scheme BasedonFixedPointTheory	Xu Li, Xingming Sun and Quansheng Liu	Image integrity authentication scheme based on fixed point theory	Fixed points are used for image integrity authentication: • Fragility • Easy calculation • Transparence	• The overflow problem concerns only the pixel values 0 and 255.
[2]	Digital Hologram Authentication Using a Hadamard-Based Reversible Fragile Watermarking Algorithm	Hao-Tang Chan, Wen-Jyi Hwang and Chau-Jern Cheng	Improved Hadamard-Based Reversible Fragile Watermarking Algorithm	• Able to hide a watermark • Extend the hiding capacity • High transparency • Supporting the self- contained-ness	• A major issue for hologram storage and delivery is self-contained-ness.
[3]	Digital Image Watermarking Based on DWT-DCT: Evaluate for a New Embedding Algorithm	AfrojaAkter, Nur-E-Tajnina and Muhammad Ahsan Ullah	New embedding algorithm (NEA)	• This algorithm evaluated for 2 level, 3 level and 4 level of DWT • Without attack condition	• Copying, modifying, and distributing the intellectual properties in an illegal way.
[4]	Lossless Digital Watermarking Scheme for Image Maps	Sun Jianguo, Zheng Chonghui and Gao Di	Lossless digital watermarking	• This algorithm cannot be universality. On	• Classical algorithms-based space or

			scheme	comprehensive experiments, the performance of our scheme is superior to that of the proposed solutions on space and frequency algorithms.	frequency domain with higher complexity.
[5]	Robust Watermarking Algorithm for Digital Image Based on SIFT Feature Points	Xinguo Zou, Na Li and Nawei Ji	Robust Watermarking Algorithm Based on SIFT Feature Points	• Effectively resist common attacks • Gives a better fit to the human visual system and it has good invisibility	• Common attacks, such as gaussian noise-adding, salt and pepper noise-adding, cropping, wiener filtering
[6]	A Robust Digital Watermarking algorithm using DES and ECC in DCT Domain for Color Images	Bidyut Jyoti Saha, Kunal Kumar Kabi, Arun and Chittaranjan Pradhan	Robust Digital Watermarking algorithm using DES-ECC	Simulation has proved the imperceptibility, robustness and effectiveness of the proposed algorithm	• Impossible to attack without knowing exact parameters and also robust against common attacks.
[7]	Self-Recognized Image Protection Technique that Resists Large-Scale Cropping	Jung-San Lee and Bo Li	self-recognized and crop-resistant watermarking method	Our method can yet handle attacks of maximum 75 percent cropping, and its embedding efficiency must be improved to achieve better visualization of different types of host images.	• A watermarking mechanism must be robust enough to resist malicious attacks—that is, an authorized user must be allowed to retrieve a recognizable logo, even if the watermarked image has been attacked.
[8]	Design and Implementation of an MSI number-based Image Watermarking Architecture in Transform Domain	Koushik Mahanta, Dibya Jyoti Das, H.M.Khalid Raihan Bhuyan, Ankita Dutta and MrigankaGogoi	MSI number-based Image Watermarking	• Watermarking with very high precision. • It can can take only on gray scale cover image and binary watermark image. • This algorithm can be upgraded to support multi transform functions.	• Problems started arising regarding the safety and security of the digital information
[9]	Imperceptible and Robust Blind Video Watermarking using Chrominance Embedding: A Set of Approaches in the DT CWT Domain	Md. Asikuzzaman, Md. Jahangir Alam, Andrew J. Lambert and Mark R. Pickering	Chrominance Embedding	• Incorporate an angular registration strategy that improves the robustness to rotation. • Method is robust to cam-recording from a large screen.	• Two major Problems of the dwt in its critically decimated form which are: lack of shift invariance and poor directional selectivity
[10]	A Wavelet based Image Watermarking Technique	B. Sridhar and Dr. C. Arun	Wavelet based method	Algorithm can achieve excellent	• The embedded

	using Image Sharing Method			robustness against attacks such as noise addition.	watermark signal can also be easily removed or destroyed.
[11]	Image Compression Using Multidirectional Anisotropic Transform: Shearlet Transform	S.Thayammal and D.Selvathi	A novel transform coding technique based on shearlet transform is proposed.	The shear let gives additional directional information which yield improvement in compression performance	• Band restriction problems
[12]	A Novel Image Watermarking Scheme Using Extreme Learning Machine	Anurag Mishra, Amita Goel, Rampal Singh, Girija Chetty and Lavneet Singh	ELM based method	• This machine for image watermarking in regression mode • Lena and baboon are embedded with the output of the trained elm within the selected low frequency coefficients obtained	• Taking more time (training time, embedding time, extraction time)
[13]	A color image encryption algorithm using the fractional-order hyperchaotic systems	Xiangjun Wu	fractional-order hyperchaotic systems-based method	• The algorithm effectively reduces the correlations between three components of the color images. • The presented algorithm is secure enough to resist the following attacks. • Feasibility and efficiency for color image	• It is not secure enough to resist the following attacks: the brute-force • Attack, ciphertext-only attack, known/chosen-plaintext attack • And statistical attack.
[14]	Robust Temporal Video Watermarking Using YCbCr Color Space in Wavelet Domain	A. K. Verma, Mayank Singhal and C. Patvardhan	YCbCr color space and Wavelet based method	• Less embedding strength helps in better imperceptibility • Gives better robustness against other types of attacks • Provides minimum possible noticeable changes in watermarked video	• Hidden information is not noticeable
[15]	Blind Digital Watermarking algorithm based on DCT Domain and Fractal Images	Arun, Kunal Kumar Kabi, Bidyut Jyoti Saha and Chittaranjan Pradhan	DCT Domain based blind digital watermarking	• Color image separately to increase the secrecy and robustness of the algorithm. • Show effectiveness of the algorithm to hide fractal	• Problems of several threats and protects the digital data from being compromised or altered.

				codes into color cover image.	
[16]	Non-Blind Watermarking Scheme for Image and Video using DWT-SVD	T.Naga Jyothi and K.HariBabu	DWT-SVD based Non-blind watermarking	• It mainly deals with adding hidden messages or copyright notices in digital video. • Potential approach for protection of ownership rights on digital video.	• The same watermark is embedded into four sub-bands which is very difficult to remove or destroy.
[17]	A New Robust Semi-Blind Digital Image Watermarking Approach Based on LWT-SVD and Fractal images	Kayvan. Ghaderi, Fardin. Akhlaghian and Parham. Moradi	LWT-SVD based method	• Used fractal coding that much less size than original watermark. • Significant improvement in imperceptibility and the robustness under attacks	• Copyrighted digital data becomes one of the most important issues in the digital industry
[18]	A Digital Watermarking Approach Based on DCT Domain Combining QR Code and Chaotic Theory	Qingbo Kang, Ke Li and Jichun Yang	DCT Domain and QR Code based method	• Method has a strong robustness and security, • Copyright protection and content authentication for digital media.	• Need improve the watermark's ability against the attacks while influencing as less as possible the original image.
[19]	A Hybrid Image Compression Scheme using DCT and Fractal Image Compression	Chandan Singh Rawat and SukadevMeher	DCT and Fractal Image Compression based hybrid method	• This eliminates the continual compression of analogous blocks • Proposed system was efficient in compressing the images	• The problem with this block results as these blocks become visible when the image is reduced to higher compression ratios.
[20]	Imperceptible and Robust Blind Video Watermarking Using Chrominance Embedding: A Set of Approaches in the DT	Md. Asikuzzaman, Md Jahangir Alam and Mark R. Pickering	Chrominance Embedding based method	• Extract the watermark from specific level(s) • Angular registration strategy that improves the robustness to rotation • The proposed method is robust to cam-recording from a large screen	• Camcorder theft is one of the biggest problems that the film industries are facing and is the single largest source of video piracy.
[21]	RRW—A Robust and Reversible Watermarking Technique for Relational Data	Saman Iftikhar, M. Kamran and Zahid Anwar	RRW method	• It allows recovery of a large portion of the data even after being subjected to malicious attacks. • Evaluated	• Watermark information calculation is formulated as a co problem to meet the data quality constraint of the data owner.

				through attack analysis	
[22]	Motion JPEG Video Authentication Based on Quantization Matrix Watermarking: Application in Robotics	LamriLaouamer, Abdelhamid Benhocine, Laurent Nana and Anca Pascu	Quantization Matrix Watermarking based method	• Watermarking the quantization matrix represents a major advantage in terms of time. • Significant result, the local station can recognize the wifibot sending the stream.	• The problem of recovering rights and authentication of images included in Motion JPEG video streams sent by different wireless robots (wifibots).
[23]	Robust Reversible Watermarking via Clustering and Enhanced Pixel-Wise Masking	Lingling An, Xinbo Gao, Xuelong Li, Dacheng Tao, Cheng Deng and Jie Li	RRW-Masking based method	• Obtains comprehensive performance in terms of reversibility, robustness, invisibility, capacity and run-time complexity; • It is widely applicable to different kinds of images • It is readily applicable in practice	• Recover watermarks by creatively modeling the extraction process as a classification problem
[24]	A New Robust Blind Watermarking Scheme Based on Steerable pyramid and DCT using Pearson product moment correlation	Azz El Arab El Hossaini, Mohamed El Aroussi, Khadija Jamali, Samir Mbarki and Mohammed Wahbi	DWT based method	Our scheme achieves a good imperceptibility where human eyes cannot perceive changes of the resulting image after the embedding process.	• Problem of illegal distribution of multimedia
[25]	A Novel Lossless Robust Reversible Watermarking Method for Copyright Protection of Images	Sidham Abhilash and S M Shamseerdaula	Modified Lossless Robust Reversible Watermarking	• New watermark embedding and extraction processes for good robustness and low run-time complexity. • Obtains comprehensive performance in terms of reversibility, robustness, invisibility, capacity and run-time complexity	•
[26]	Robust Chaos Based Image Watermarking Scheme for Fractal-Wavelet	P. Shanthi	Robust Chaos Based method	• Used to eliminate the execution time • Increase the security level and also provide higher psnr value • Provides high security to the watermarked image • Security level is	• Problem of geometric and non-geometric attacks.

				increased with the help of chaotic map	
[27]	Watermarking Technique using UID for Relational Data Saving in Database	G. Agila and N.R. Ananthanarayanan	Watermarking method	• Able to recover discover the knowledge from watermarked data and • Ensuring the data quality to some extent • Data hiding techniques are efficient • Allows recovery of a large portion of the data saving in database even after being subjected to malicious attacks.	• An attacker is able to easily to remove watermark or steel the original data by simple manipulation of data by shifting msb
[28]	Video watermarking scheme based on visual cryptography and scene change detection	Th. Rupachandra Singh, Kh. Manglem Singh and Sudipta Roy	visual cryptography based method	• Scheme can identify the ownership without the original host video and it does not alter the host video to hide the invisible watermark • It is not possible to recover the invisible identification share without the secret key • Serve as a secondary backup in case of failure of the primary watermark to identify the owner	• Problem is to integrate the security information directly into the content of the digital data in inseparable form during its useful lifespan and digital watermarking is such an effective way to protect copyright of the digital multimedia data even after its transmission.
[29]	SVD based Robust Digital Image Watermarking using Discrete Wavelet Transform	Satendrakumar, Ashwini Kumar Saini and Papendra Kumar	SVD-DWT based method	Significant improvement in perceptibility and the robustness under possible attacks. Further work of integrating the performance measured against jpeg compression, histogram equalization (he), rotation, scaling, contrast adjustment (ca), cropping, and gamma correction (gc) against various attacks our approach is in progress	• Problem of easy editing and duplication of images
[30]	ROI Based Embedded Watermarking of Medical	Baisa L. Gunjal and Suresh N.	ROI Based Embedded	• Improvement in information and	• The process is too lengthy and

	Images for Secured Communication in Telemedicine	Mali	Watermarking	communication technologies made it possible to handle such applications through mobile phones. • Increased security levels • Producing exact recovery of original watermark	time consuming
[31]	3D Discrete Shearlet Transform and Video Processing	Pooran Singh Negi and Demetrio Labate	Discrete Shearlet Transform	It has higher redundancy, which accounts for the additional computation effort which requires	• Problems of video denoising and video enhancement.
[32]	Toward Safe and Secure Electronic Documents of E-Governments: Generating Authentic Documents using Image Processing Techniques	Abdullah AL-Shraideh, Suliman Bni Ahmad and AudehBni Ahmad	Image Processing and Watermarking method	• Produce authentic and secure official documents. • Watermarking to guarantee the authenticity and integrity of official documents.	• Problem of fraud digital work these days
[33]	Enhancement in Security of LSB based Audio Steganography using Multiple Files	Pooja Chandrakar, Minu Choudhary and Chandrakant Badgaiyan	LSB based Audio Steganography based method	• This user-friendly application maintains privacy, confidentiality and accuracy of the user's message upon hiding or recovering message. • Audio quality does not deteriorate much even in case of using multiple audio file thus minimizing the suspicion of any secret transmission.	• Problem of Audio quality deteriorates
[34]	A Hybrid Roi-Embedding Based Watermarking Technique Using Dwt and DCT Transforms	Osama Hosam and Nadhir Ben Halima	Hybrid ROI-Embedding Based Method	• Embedding is done into LL-DCT transforms of each block. • The quality of the watermarked image is high	• Problem of copyright protection
[35]	Hybrid Watermarking of Color Images Using DCT-Wavelet, DCT and SVD	H. B. Kekre, Tanuja Sarode and ShachiNatu	DCT, DWT, SVD based method	• Twice better in both aspects' imperceptibility and robustness • Higher value of k causes more distortion in cover image.	• Problem of evaluation against various image processing attacks like contrast stretching, image cropping,

					resizing, histogram equalization and gaussian noise
[36]	Watermarking in E-commerce	Peyman Rahmati, Thomas Tran and Andy Adler	Watermarking	Authentication system has an average accuracy of 99% in finding correctly the hidden information into the 100 ID cards after PS operation	• Problem of security
[37]	An Enhanced SVD Technique for Authentication and Protection of Text-Images using a Case Study on Digital Quran Content with Sensitivity Constraints	LamriLaouamer and Omar Tayan	Modified SVD method	Maintain the authenticity of the Quran text-image content and ensures content traceability back to its original and legitimate source/publisher through extraction of the watermark that identifies the genuine source/publisher	• Problem of text image protection and authentication for sensitive digital content using the digital Quran text-image content.
[38]	A Novel SVD-based Watermarking Scheme for Protecting Rightful Ownership of Digital Images	Chia-Chen Lin, Chin-Chen Chang and Yi-Hui Chen	SVD-based method	• Image quality still can be restored to a higher PSNR • Successfully reduces the difference between the restored image and its compressed host image	• How to restore a watermarked image to satisfactory condition after it is compressed by JPEG with a certain level of quality factor.
[39]	Hybrid Feature Classification Model with Probabilistic Classification of the Image Forgery Detection	Samiksha Singla and Harpreet Tiwana	improved Probabilistic Classification	Considering a very trivial problem by the standard of human vision and that is scene classification.	• F1-measure of 96.90 has been recorded against the maximum of 96.37 in the existing models, whereas the 94% overall accuracy has been recorded against the 93% obtained from the other descriptors.
[40]	Image interpolation using Shearlet based iterative refinement	H. Lakshman, W.-Q Lim, H. Schwarz, D. Marpe, G. Kutyniok and T. Wiegand	Shearlet based method	• Perform well for smooth image regions, with the main differences being observed at edges and in textured areas • With the final set of selected parameters, an average psnr gain of around 0.63 db was observed	• The problem of image interpolation is closely related to image modeling

				compared to a 8-tap filter over a test set of 200 images. The maximum gain was around 3.13 db, which is significant. • The proposed method showed improvements in subjective quality compared to other approaches and no evident artifacts were observed, even for complex regions.	
[41]	Robust Hashing for Image Authentication Using Zernike Moments and Local Features	Yan Zhao, Shuozhong Wang, Xinpeng Zhang and Heng Yao	Robust Hashing based method	• Collision probability between hashes of different images is very low. • It has a reasonably short hash length and good ROC performance. • By decomposing the hashes, the nature of image forgery and locations of forged areas can be determined.	• Problem of address a wider range of issues than simply deciding whether an image is a fake • Hash's sensitivity to small area tampering while maintaining short hash length and good robustness against normal image processing.
[42]	Synchronization of a novel fractional order stretch-twist-fold (STF) flow chaotic system and its application to a new authenticated encryption scheme (AES)	P. Muthukumar, P. Balasubramaniam and K. Ratnavelu	Modified AES method	• Using active control method has been achieved and the controller was designed such that the error system decay toward zero as the time tends to infinity. • Suitable for text and image recovery.	• Problem fully based on the discrete logarithm problem (DLP) and an inverse problem (IP).
[43]	A Novel DWT Based Blind Watermarking for Image Authentication	S. S. Sujatha and M. Mohamed Sathik	Blind watermarking-based method	• It is disordered with the help of Arnold Transform. • Watermark is robust against those attacks. • Highly robust against attacks such as JPEG compression, scaling and rotation.	• Problem of image authorization
[44]	Intelligent reversible watermarking in integer wavelet domain for	Muhammad Arsalan, Sana Ambreen Malik	Modified RevWM method	• It is quite effective and	• Ga is a direct random search

	medical images	and Asifullah Khan		easy to implement. • Given effective payload	technique, inspired by biological evolution, for solving optimization problems
[45]	A Novel Encryption Frame for Medical Image with Watermark Based on Hyperchaotic System	Shun Zhang, Tiegang Gao and Lin Gao	histogram-based reversible data-hiding method	• It is a fusion of encryption and watermark • It not only has large space of secret key • It testified the effective	• Problem of encryption and information hiding
[46]	Novel Fragile Watermarking Scheme using an Artificial Neural Network for Image Authentication	Yu-Cheng Fan and Yu-Yao Hsu	Fragile Watermarking based method	• Analyze the degree of changes in any tampered image and identify what kind of alteration has occurred. • It was tested on many images and found to provide visually better-watermarked images. • It shows a high recognition ratio in detecting the type of modifications	• Change traditional problem is embedding the fragile watermark at LSB of wavelet coefficients just detects slight change in image.
[47]	Zero-watermarking Algorithm for Medical Volume Data Based on Legendre Chaotic Neural Network and Perceptual Hashing	Baoru Han, Lisha Cai and Wenfeng Li	Zero-watermarking based method	Solves the contradiction between the watermark cannot be perceived and robust, can achieve blind watermark detection, and has strong robustness to various common attacks.	• Malicious attacks, tampering, illegal possession and other serious security problems attendant
[48]	Digital Image Watermarking using Fuzzy Logic approach based on DWT and SVD	T.Sridevi and S Sameena Fatima	DWT-SVD based method	• The PSNR values of retrieved watermark is very low but the visual quality is good • In SVD watermarking, singular values are embedded into singular values, instead of singular values any other vector that represents some information may be used.	• Problem to be considered in the watermarking are imperceptible, robustness, blindness and capacity.
[49]	An Intelligent Digital Colour Image Watermarking Approach	Hieu V. Dang and Witold Kinsner	Wavelets-NN based Method	• Choosing coefficients for embedding	• Problem as it has very low time

	Based on Wavelets and General Regression Neural Networks			watermark carefully obtains a very highly perceptual and robust watermarked image with high PSNR and WAR • Very helpful in classification and prediction • It has very fast time convergence and high prediction accuracy	convergence and low prediction accuracy
[50]	A Rough Geometric-Distortion Resilient Watermarking Algorithm Using Fuzzy C-Means Clustering of SURF Points	SaeidFazli and Masoumeh Moeini	Fuzzy C-Means based method	• Delaunay triangulation was used for this shaping. • Different tests demonstrate the repeatability and accuracy of this algorithm. • It is powerful for watermarking usage.	• Need powerful tool for watermarking

IV. OPTIMIZATION AND DYNAMIC EMBEDDING

The accurate and valid size of data enhanced the security and integrity of digital watermarking algorithms. The process of dynamic binding also decreases the possibility of malicious attacks of watermarking techniques. The generation of dynamic patterns of watermark image is big issue. For this task used the concept of feature based watermarking process. The feature based watermarking process used the swarm-based optimization algorithms. For the generation of patterns used the neural network models for dynamic pattern generation[47]. The process of optimization work on the principle of iteration and memory based. The process of iteration creates the issue of security threats in journey of watermark. The memory based watermarking techniques provides the robust against the threats. The process of dynamic embedding is great challenge for designing aalgorithm for the embedding the watermark process[51]. Here discuss the process of feature extraction of digital data and process of optimization for the better selection of symbol or watermark in the process of embedding. The all discussion describes in three section. In first section discuss the process of feature extraction, in second section discuss the process of feature optimization and finally discuss the process of dynamic embedding.

1. Feature Extraction

The proper features extraction process gives the better embedding process of digital watermarking. The feature extractor work on the lower content of digital image. The digital image consists of three basic features color, texture and shape size. The descriptor extractor the content of features on the given image. In current trends of feature based watermarking techniques used transform based function for the extraction of features such as DWT, IWT FFT and SIFT. These transform function gives the nature of texture features in given digital image[49]. The DWT (discrete wavelet transforms) is well known transform function in area of image processing. The major uses of DWT transform function is texture feature extraction. The DWT transform function based on combination of two different frequency HF and LF. The HF part of frequency called details of transform, and the LF part of frequency is called approximate of data. The level of transform function defines the process of direction of transform function. The processing of DWT transform function induces some noise data it is called impulsive noise. The embedding of impulsive noise degraded the quality of digital watermark image. Instead of DWT transform function various authors and researchers used the IWT transform function. IWT (integer wavelet transforms) function generates the series of packet for the process of embedding and remove the generation of impulsive noise[45-46]. Now further explode the process of feature extraction used the multiresolution transform function such as curvelet transform function. The curvelet transform function is extract the features in multiple cone of image. Now anthers feature extraction transform function is called the SIFT function. The SIFT transform function extract the features key point of given image and process of embedding is very strong.

2. Features Optimization

Features optimization is new area of digital watermarking algorithms. The optimization of features used various heuristic and meta-heuristic function for the process of optimization. The heuristic function basically used for the limited content of features and gives the better results of optimization[46, 51]. But the image feature contents the large number of features and the process of optimization suffered from the process of optimization. in the umbrella of heuristic optimization algorithms such as genetic algorithm[57-60], bloats machine, hill climbing, A*, AO* DFS and BFS. Instead of meta heuristic function is verselet for large amount of features and data point. In umbrella of meta-heuristic function used swarm-based algorithm such as particle swarm optimization (PSO), ant colony optimization (ACO) and glowworm optimization algorithm (GSO). These swarm intelligence

algorithms give better features optimization process for the embedding of watermarking techniques. Here give the comparative table of both the optimization techniques.

Various study of features optimization in digital watermarking process. The size of feature is big issue of the process of optimization. Here describes the comparative optimization process of genetic algorithm, particle swarm optimization and ant colony optimization.

Genetic Algorithm (GA)	Particle Swarm Optimization (PSO)	Ant Colony Optimization (ACO)
It is generally used to solve complex optimization problem as it can handle both detached and incessant variable, and nonlinear objective and constraint function without requiring the minute information. Simple genetic algorithm is given by: 1. Generate the population randomly 2. By using the fitness function, select parents 3. Apply crossover on the parent chromosomes 4. Mutate the offspring chromosomes 5. Append the offspring to the pool 6. Perform Elitism (Select parents)	PSO, a heuristic search technique is inspired from the collaboration behavior of biological population or collective intelligence in biological population. PSO is similar to GA as they are evolutionary in nature and population-based methods. The basic set of steps of PSO is given by: 1. The swarm is initializing from the solution space 2. The fitness value of the individual particles is estimated 3. Modify gbest, pbest and velocity 4. Individual particles are moved to a new position 5. Go to Step 2, and repeat till the agreement or a stopping condition is satisfied	It is a population based general search technique which is used for difficult combinatorial problem, which is inspired by the pheromone trial laying behavior of real ant colonies. The ants, which are the search agents, search for a good solution to a given optimization problem. The basic steps in ACO are: 1. Represent the development of the solution by a construction graph 2. The parameters are initialized 3. From, each ant's random walk, a random solution is generated 4. Update pheromone intensities 5. Go to step 3, and repeat until stopping condition is satisfied

3. Dynamic Embedding

Embedding of host image and watermark symbol depends on the value of key and coefficient of both images. The embedding process mismatch the coefficient value the bond of coefficient is week and watermark symbol are easily distorted by the attacker. For the minimization of number of correlation coefficient in watermark process used dynamic embedding[54]. The process of dynamic embedding used the process of neural network model for the generation of pattern and embedding of pattern.

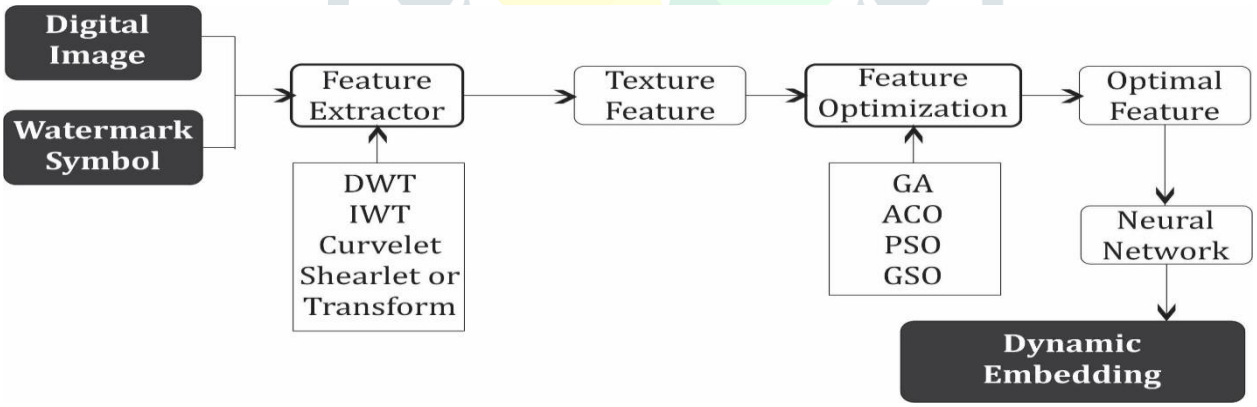

Figure 4: describe the process of feature extraction, feature optimization and dynamic embedding process.

V. CONCLUSION & FUTURE WORK

The digital watermarking process have great contribution in the field of copyright protection and intellectual property rights. The digital watermarking domain based on the principle of working domain. The digital watermarking process basically defines in two domains spatial domain and frequency domain. In this paper consider only frequency domain watermarking techniques. In frequency domain watermarking techniques, the process of watermarking furthers classified in two categories one is visible and invisible. The invisible watermarking process also categorized in two robust and fragile. The paper carried on robust watermarking process. The process of watermarking techniques used features based watermarking process. The feature based watermarking process enhance the performance of watermarking process. The process of feature based watermarking techniques need the process of features optimization. The process of feature optimization used swarm intelligence. The comparative performance of swarm intelligence algorithms suggest that the particle swarm optimization algorithms give better results and incorporates with watermarking algorithm. The process of watermarking algorithms used static block selection; the process of static blocks selection process compromised with security attacks of watermarks. For the process of dynamic embedding some authors used dynamic binding techniques using the neural network models, in terms of cascading and hybrid. In this paper also discuss the security threats in digital watermarking. The different scenario of security threats generates the possibility of exploding the work in digital watermarking. In future work on empirical evaluation of feature based watermarking techniques.

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