

# SURVEY ON ROTATION, SCALING, AND TRANSLATION INVARIANT WATERMARKING ALGORITHM

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**Abstract:** Watermarking is closely related to steganography but in watermarking the hidden data is usually related to cover image. In this paper discussed about algorithms for rotation, scaling and translation (RST) invariant image watermarking. There are mainly two categories of RST invariant image watermarking algorithms. Then, we discuss about various algorithm used for RST invariant image watermarking.

**Keywords:** RST invariant, watermarking, Fourier transform algorithm.

## I. INTRODUCTION

Watermarking is closely related to steganography, but in watermarking the hidden information is usually related to cover object. Hence its mainly used for copyright protection and owner authentication. Watermarking is used for following reasons proof of ownership, broadcast monitoring, authentication, and data hiding. Digital watermarking is the signal embedding, secret information into the digital media such as image, audio, and video later the embedded information is detected and extracted out to identity of the digital media. Digital watermarking technology has many applications in protection, certification, distribution, anti-counterfeit of the digital media. Image watermarking is used to hide the special information into the image and to later detect and extract that special information for the author ownership. Video watermarking is used to add watermark in the video stream to control video applications. It is extension of image watermarking. Audio watermarking is one of most popular due to internet music. Text watermarking adds watermark to the PDF, document and other text file to prevent the changes made text. The watermark is inserted in the font shape and the space between characters and line spaces. Graphic watermarking is embed the watermark to 2D computer generated graphics to indicate the copyright. The watermarking is embedded by two types visible watermark and invisible watermarking. In visible watermarking, the watermark that visible in the digital

data likes stamping a watermark on paper. In invisible watermarking can insert information into an image which cannot be seen, but can be interrogated with right software.

## II. SURVEY

In this section different algorithm for rotation, scaling and translation (RST) are discussed

### A. RST invariant image watermarking

Rotation, scaling, and translation (RST). Two categories of RST invariant algorithm. First one is before conducting watermark detection RST is transformed. Watermark is embed and detect in an RST invariant.

#### (i) RST invariant domain based algorithm

This technique is used to embed watermark in domain these are invariant to geometric attacks. Fourier-Mellin transform have the property of invariance rotation and scaling. Because of implementation difficulties modified algorithm FMT is introduced[6].

#### (ii) Fourier-Mellin Transform:

O'Ruanaidh and pun found outed the theory of integral transform invariants. This is used for watermarks are resistant to RST[2]. Embedded watermark into Fourier – mellin domain. Steps for embedding watermark: Original



image are given to DFT. Then DFT magnitude for original image is applied to FMT. And In the resulting RST invariant domain watermark is embedded. Then by using original phase compute inverse FMT. By using original phase inverse the DFT to obtain the watermarked image. Watermark detection is contain following steps: DFT is applied to watermarked image. Then FMT is applied to DFT magnitude of the watermarked image. Then from the RST invariant domain detect the watermark. Fourier – mellin domain is best place for embed watermark, because that is invariant to RST.

*(iii) Phase correlation and log –polar mapping algorithm:*

New way for Fourier-mellin transform in digital image watermarking was proposed. To simplify RST transformations to shifts they embed watermark into LPM domain. Middle frequency regions in LPM magnitude are selected for embedding water mark data sequence. The embedding process in LPM domain is follows: DFT is applied to original image. Then generate the watermark sequence pseudo-random noise (PN) generator is used. Then To embed watermark data sequence middle frequency region in LPM magnitude is selected. Then compute an approximate ILPM. Then watermark is embed into DFT domain. Finally to get watermark image inverse to DFT is applied. This algorithm is good in displacement calculation and invariant to any angles of RST when the scale in reasonable range and very robust to JPEG compression and attacks.

*B. Radon-transform algorithm*

There are two generalized randon transform they are CIT and RIT used to extract characteristic values based on geometric transformation parameters used to calculate resynchronize the transformed watermarked image. This watermark embedded into spatial domain. By using the properties of the RIT and CIT, geometric transform can be calculated. Corner points are used for randon transform computation. Watermark embedding steps are follows: To find the corner points the Harris corner detection algorithm is applied. Then to calculate the characteristic values RIT and CIT are applied in the image. Then by using PN generator random two dimensional sequence is created. Then to perform invisible watermark embedding image pixel is defined based on local variance value. Then the watermark is embedded in spatial domain. The watermark embedding shows that coefficients with larger variance can be embedded with larger embedding strength.

*C.Template based algorithm*

Another algorithm used for detecting watermark to identify the distortion and invert before compute the watermark detector[10]. A template can be embedded along with watermark image. The template are used to find transformation undergone the image but it doesn't contain any information itself. Watermark embedding steps are follows: If the original image is bigger then image are divided into block. If the image is small then fixed size in block. Then apply DFT to the block. Then along with two lines in DFT domain templates are choose approximately 14 points. Then using location of watermarks sequence points are generated .then by changing the value of locations watermark is embedded and embed template by adding Fourier domain in original image. during embedding use different embedding algorithm used to embed each bit of bipolar watermark sequence. Then to get watermark image compute inverse DFT.

*D.Salient- feature algorithm*

In template based watermarking algorithm trying to add recognizable template into host image, this template contain information about the geometrical structure of the host image. The following two watermarking algorithm use points as reference coordinates of the watermark embedding location. Geometrically invariant watermarking algorithm by using feature points. The watermarking embedded process are follows: With the shape of right angled generate random sequence isosceles triangle as watermark. Then by using Harris corner detector find out the robust feature points in the image. Then by using Delaunay tessellation image is divided into set of disjoint triangles. Then using affine transform and interpolation watermark sequence is transformed into same shape of each triangle. Finally to get watermark image transformed watermark sequence is embedded to each triangle. The watermark detection process is follows: With the shape of right angled generate random sequence isosceles triangle as watermark. By using Harris corner detector find out the robust feature points in the image. Then Using Delaunay tessellation image is divided into set of disjoint triangles. Then each triangle is changed into right angled isosceles triangle in same size and shape of watermark sequence. calculate the similarity of each triangle. Then each triangle made a local decision. .By comparing global similarity global decision is made. Finally according to the local and global decision final decision is made.

*D. Image decomposition algorithm*



Another method to an RST invariant watermarking algorithm is to decompose the image. Decompose components have RST invariance properties. Correlation between decomposed component of the image and the image will not be affected by rotation[5].

*(i) Match filtering algorithm*

Introduced a rotation tolerant watermarking method by using circular harmonic function correlation filter. They use this filter for watermark detection process instead of conventional match filter.

*E. stochastic analysis based algorithm*

For image analysis stochastic characteristics of image is important. To implement the RST invariant watermarking algorithm image moments is used.

*(i) Image normalization*

Geometric moments are used to geometrically normalize the image before watermark embedding and before watermark detection. To implement normalization to decoder the normalization algorithm doesn't need original image. The watermark embedding process is follows: Normalize the original image. Then in normalized original image watermark is embedded. Then to get watermark image transform image into original size. The watermark detection process are follows: Normalize the watermark image. Then similarity between normalized image and watermark data are calculated. To decide watermark is available compare with predefined threshold. image normalization is used to statistics parameters of the image to get the RST invariance property. In image normalization it cause image quality loss because it consists of rotation and scaling operation. Rotation and scaling are involved in interpolation. Because of this watermark doesn't embedded directly into normalized domain. Image normalization cannot resist cropping, it need complete information of the image to compute normalization vector to normalize the image.

*(ii) Higher order spectra algorithm*

The image first polar mapped to polar domain. Bispectrum integration is computed for instead adding elements to form dimensional projection vector. By modifying bispectrum phase vector RST invariant watermarking algorithm is implemented. To extract bispectrum phase vector polar mapping is needed and watermark is embedded. After embedding inverse the polar mapping to get watermark image. The watermark embedding steps are

follows: Compute DFT of the original image. Polar mapping is created for Fourier magnitude. By modifying elements of the vector embed the watermark. 4. to get watermarked image compute the inverse polar mapping and inverse DFT. Watermark detection process are follows: Compute DFT of the watermarked image. For Fourier magnitude create polar mapping. By using same strategy extract the feature. correlation between extracted feature vector and watermark data are calculated. To know present of watermark compare the correlation coefficient with predefined threshold.

**III.CONCLUSION**

In this paper we have discuss on various RST-invariant digital watermarking scheme. The algorithm are RST invariant domain, radon transform, template, salient features, image decomposition and stochastic characteristics. All these are widely used to implement the RST invariant watermarking schemes. RST invariant image watermarking algorithm must be truly robust against RST transformations, be truly blind in detecting watermarking.

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