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Wavelet based Camouflage Image detection Method

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ABSTRACT - ***This paper is entitled to find out the camouflage portion in the given image. Concealment of an object into an image frame is called camouflage and decamouflage is to reveal the object from the image frame. We want to detect such object by wavelet based texture feature analysis. This paper focuses on the application of detecting duplicate\pirated object which are being camouflaged by mixing duplicate object of same texture during logistics. In this approach input image is enhanced by median filter, then image is decompose in to sub-image blocks using 2-D DWT (discrete wavelet transform) and then calculate the texture features by WCF (wavelet co occurrence features) to get the segmentation of camouflage portion, and finally detailed dendrogram is plottetd and then watershed algorithm is used to get the camouflaged portion in the given image or object.***

Keywords ***Camouflage, wavelet transform, WCF and Decamouflaging.***

1. INTRODUCTION

Image texture feature plays very important role in image analysis it could be image discrimination, classification, segmentation, shape determination or finding defects in object through machine vision application.[1].In texture analysis there are two types of feature which we extract one is structural and second is statistical. Structural method identifies structural features and it is based on structural primitives, spatial sizes , topological and geometric properties of the object in an image [2] where as Statistical method identifies statistical features of an image based on intensity distribution. [2].Texture analysis is done by using several method in past decades still we can apply more innovative way to make image processing effective.

Camouflage is used to hide or mix up foreground image object in to background image [1].The origin of camouflage and decamouflage has been originated from ancient

kingdom of forest and battle field of military. In the battlefield, military uses camouflage as a technique to conceal the soldiers in the background texture so that enemies could not identify them and Decamouflaging or camouflage breaking is a technique to reveal the enemies those are camouflaged in the texture. Same approach is applied to hide the duplicate object in original one to get camouflaged and in this paper we will discuss how to detect such object.

The past texture analysis in image was proposed by Harlick et al which is based on co occurrence matrices which achieved accuracy of 84%[7] .Nagappa U Bhajntri et al have discussed about gray level co occurrence matrix and its invariant central moment to discriminate the texture but they could make it possible when texture feature is unknown[1]. Weszka et al introduced texture feature extraction based on second order statistics were better than 2D spectrum. Circular symmetry auto regressive model was used by Kashyap and Kotanzad to get the texture feature and the 91% of accuracy on 12 different natural textures. Some researcher also used Gaussian Markov Random field to classify texture. P. Sengottuvelan et al have discussed glcm based texture and object detection in unsupervised way which attain a success rate of 70%[8]. This paper describes the texture feature extraction and analysis to find the camouflaged part of the image and application area is detecting the duplicate object from many such original object, for this researcher have taken technique of 2D wavelet transform for features extraction and then texture classification. Here we are using wavelet statistical features to get textural details of the image and then based upon features will employ segmentation and detection of camouflaged part of image.

Recently, discrete wavelet transform (DWT) has emerged as a popular technique for image coding applications [1,3,7]. DWT has high decor relation and energy comp action efficiency.

Texture analysis has been studied for a long time using various approaches. Various methods perform texture analysis directly upon the gray levels in an image. These include gray level co-occurrence matrix (GLCM), autocorrelation function analysis, generalized co occurrence matrices (GCM), second order spatial averages, and two-dimensional filtering in the spatial and frequency domain. Other approaches operate at a symbolic level where a textured image is organized or represented in terms of primitives [2].

Image texture, defined as a function of the spatial variation in pixel intensities is useful in a variety of applications [8]. One immediate application of image texture is the recognition of image regions using texture properties. We can identify the five different textures and their identities as cotton canvas, straw matting, raffia, herringbone weave, and pressed calf leather. Texture is the most important visual cue in identifying these types of homogeneous regions. This is called texture classification. The goal of texture classification then is to produce a classification map of the input image where each uniform textured region is identified with the texture class it belongs. We could also find the texture boundaries even if we could not classify these textured surfaces. This is then the second type of problem that texture analysis research attempts to solve — texture segmentation. The goal of texture segmentation is to obtain the boundary map [3].

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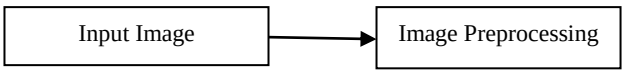
Second section of this paper describes the methodology and technique of camouflage identification, third section contains the design of algorithm, fourth section analysis of algorithm and fifth section contains conclusion of the study.

II METHODOLOGY

Our approach to find the camouflage in the given image shall be based on analysis of texture. Analysis of texture requires the identification of proper attributes or features that differentiate the textures in the image for segmentation, classification and recognition. Previously texture analysis was based on the first or second order statistics of texture then other models were proposed like Gaussian Markov random field and Gibbs random field to illustrate textures. The above approach is best suited when the analysis of small texture is very less [4].Now we have wavelet transform and Gabor filter which can avoid these problems.

Wavelet transform and Gabor filter methods based on multiresolution analysis proved to be good and satisfactory in texture analysis. Again in case Gabor filter output with this method for texture analysis are not mutually orthogonal which affects texture features and that reduce the applicability of this method in texture synthesis. Problem of Gabor filter can be evaded if wavelet transform is used, because it gives a precise framework for the analysis of texture at different scales. One more advantage of wavelet is that low and high pass filters remain same between consecutive scales where Gabor filter requires different parameters. In this way wavelet statistical features and wavelet co – occurrence features can be used effectively for the texture classification and characterization.

In our methodology we want study of image segmentation which is based on study of texture segmentation and this we can achieve through thorough study of texture analysis by wavelet co occurrence features then use optimal threshold to classify the image. Now employ dendrogram plotting to get the defective blocks of image, now it is turn to combine these similar camouflage portion with the help of watershed segmentation techniques in this way we can identify the camouflage portion in given image\object.



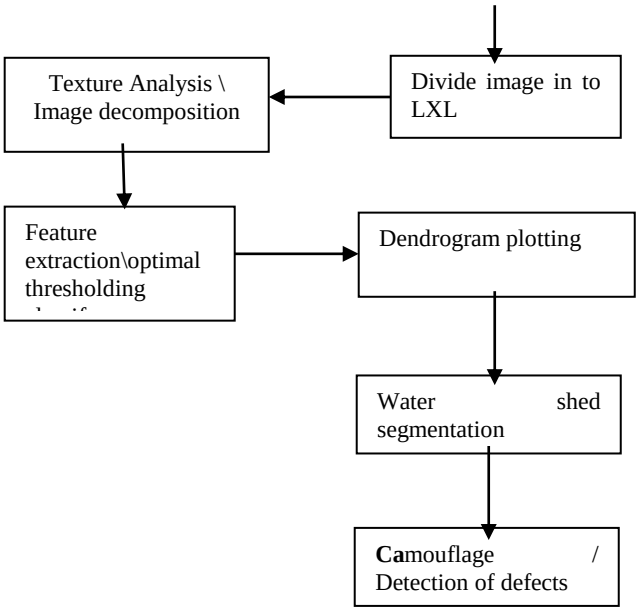


Fig. 1

III PROPOSED APPROACH

Our new proposed algorithm will be computationally efficient to find out more than one portion of camouflage, to discriminate defective portion from given image and also able to discriminate duplicate product. We have the following proposed approach:

1. Input image of size LxL
2. Apply median filter to remove noise if noisy image.
3. Starting from top left corner and Obtain LxL sub-image blocks, here LXL is size of image blocks.
4. Decompose image blocks using 2-D Discrete wavelet transform (DWT).
5. Calculate wavelet co occurrence statistical features like mean and entropy from decompose image block.
6. Based upon mean and entropy apply optimal thresholding techniques to classify the image block.
7. Plot the dendrogram by Bessel K
8. To get segmented object apply the watershed algorithm.
9. Identification of Camouflaged Object.

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In this proposed approach researcher identify camouflage part of image in supervised/unsupervised way and it will also detect defective part of image if more than one defects are appear in input image with the help of discrete wavelet transform feature extraction and watershed algorithm. So with the help of this proposed approach researcher tries to remove the drawback of target paper and extend the work on the data set used by the Nagappa.

IV EXPERIMENTATION

To apply the above proposed approach image sample is taken from Nagappa`s paper set of matchboxes which consist of four duplicate matchboxes fig. 2. The image size is 1024 X 1024, it will be divided into 128 X 128 size of image block then this block of image will be decomposed at one level to get the texture feature and that will be used to plot the dendrogram and now watershed algorithm shall be apply to discriminate the duplicate matchbox. Since the image in experiment is matchbox so easily at one level of decomposition is sufficient to segment otherwise four level decomposition is suggested for other synthetic and complex image. Table 1 is contained with the mean value calculated for each and every block of the divided image.

Fig. 2

Table 1(mean of the divided block of the image)

B	1	2	3	4	5	6	7	8
1	224.54	224.54	224.54	224.54	224.54	224.54	224.54	224.54
2	224.54	224.54	224.54	224.54	224.54	224.54	224.54	224.54
3	224.54	224.54	**209.51**	224.54	224.54	224.54	**209.51**	224.54
4	224.54	224.54	224.54	224.54	224.54	224.54	224.54	224.54
5	224.54	224.54	224.54	224.54	224.54	224.54	224.54	224.54
6	224.54	224.54	224.54	224.54	224.54	224.54	224.54	224.54
7	224.54	224.54	**209.51**	224.54	224.54	224.54	**209.51**	224.54
8	224.54	224.54	224.54	224.54	224.54	224.54	224.54	224.54

IV ANALYSIS

In order to get the more accurate identification of camouflage image researcher have proposed algorithm in previous section that present comparative analysis with target paper of Nagappa.So researchers have following points for the comparative analysis

1. In the proposed approach size of input image is considered to be LXL means easily we can decompose the given image in equal size.

2.Start with the removal of noise here researcher have used median filter because it is useful in preserving edges in an image while reducing random noise but in target paper noise was not removed.

3. After splitting the image into smaller blocks, texture features are extracted through sub-bands of DWT decomposed sub-image blocks. but in case of target paper it is done by Co-Occurrence matrix based texture features, in wavelet paper it has been proved to be the best in texture analysis of image.

4. Based on texture features and optimal threshold technique dendrogram is plotted to classify and then identify all camouflaged object is identified by watershed segmentation to get more than one segmented portion of camouflage image but in target paper watershed segmentation was used which results with one type of camouflage image this is the major limitation of target paper which we will overcome.

5. In proposed approach portion of camouflaged may less or more to the size of image whereas in target paper assumption of size of camouflage is always less than the size of image.

V. CONCLUSION

In this paper researcher started with the introduction of camouflage identification then we discussed about past work in this area basically our target paper of Nagappa et al. In this work we employ decomposition of divided image block to get the classification by dendrogram plot and then used watershed algorithm to get the camouflaged part in the given image.In this research work we have taken set of matchboxes that is mixing of original and duplicate and we easily able to find out duplicate matchbox. This approach would not be feasible for the object which is not of fixed size.

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