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Security Enhancement by Integrating Image Classification with Digital Watermarking

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Abstract- Developing automatic methods for managing large volumes of digital information is increasingly important as online resources continue to be a vital resource in everyday life. Among these methods, automatically organizing, indexing and security of multimedia data remain an important challenge. This paper introduces a new concept which integrates image classification with watermarking to secure the digital images. In this, firstly image classification can be done which is on the basis of artificial intelligent scheme named as IWD (Intelligent Water drop System). Image used for classification is high resolution image. After feature extraction the process of feature selection is on the basis of IWD and then classification can be done on the basis of that selected features. After classification watermarking concept is added. The watermarking used in this work is invisible watermarking. This whole work enhances the security by integrating image classification with watermarking.

Keywords- Image Classification, Watermarking, IWD, Haar Wavelet;

I. INTRODUCTION

The development in the information technology field has provided the extended and easy access to digital information which needs to be secured. So, the problem of illegal copying and redistribution of the original digital media has reached to the highest point. This becomes a threat which decreases the integrity and confidentiality of the digital information. Here the Confidentiality stands for that only the entitled people have access to the images. The Reliability has two aspects, first is integrity: it means the image has not been modified by a non-authorized person and authentication proofs that the image belongs to the correct person and is issued from the authorized source.

The concept of an emerging technology named as watermarking came in order to solve the problems related to the intellectual property of media. Watermarking process can either be visible or invisible type. In this work, we utilize the invisible technique. Invisible watermarking is widely used in public information settings such as digital images, art galleries and also in defense communication where data security is of prime importance. Two types of methods are there for Watermark embedding: one is in the spatial domain and the other in the transform domain. The watermark is directly embedded into the image pixels in case of spatial domain but the image is decomposed into blocks and then mapped into the transform domain in case of frequency domain.

Digital watermarking is process of embedding the signal permanently into digital data which include images, audio, video, text and can be extracted or detected for different computing operations. The watermark is hidden in the confidential data in a way that without degrading the data it performs operations as required. So it is clear that by using watermarking the work is accessible but it is permanently marked.

II. IMAGE CLASSIFICATION

Image classification [1] is the task of traditional images into groups based on the available training data. This grouping of images into classes can be useful in semantic organizations of digital libraries and in obtaining automatic annotations of images. The classification of natural imagery is difficult generally, since images from the similar semantic class may have huge variations and real images from distinct semantic classes may be shares a common background (clouds, aviation, waves, dolphins and whales). These problems limit the implementation of knowledge-based and object-based approaches. A common approach to image classification includes addressing the following three problems:

(i) image features — how to represent the image,
(ii) organization of feature set — how to organize the data,
(iii) classifier — how to classify an image.

Acquiring optimum image features and precisely modeling the feature data are important steps in this approach. The aim of image classification is to check whether an image belongs to a certain group or not. Distinct types of categories have been taken in the literature like cars or defined in terms of scene types, such as city and mountains. To solve these kind of issues a binary classifier is used which can be learned from a set of images that are manually labeled which belongs to the category or not. By increasing the quantity and diversity of hand-labeled images the performance of the learned

classifier is improved, however, labeling images is a time consuming task. Although it is possible to label large amounts of images for many categories for research purposes e.g. in personal photo organizing applications.

Image classification has many applications in the area of Web search and multimedia information delivery. Earlier image classification has met two major difficulties. First, the labeled images for training are often in short supply and labeling new images incur much human labor. Second, images are usually ambiguous means an image can have multiple explanations. How to effectively overcome these difficulties and build a good classifier therefore it becomes a challenging research area.

III. PROPOSED WORK

Image classification and scene classification remains to be a major challenge to the computer vision community. One of the most significant developments in the last decade is the application of local features to image classification. In previous work, an approach that integrates association rules analysis and decision tree is presented and applied to object-oriented high resolution image classification. The analysis of association rules is adopted for mining strong rules from an image.The decision tree is used for finding the optimal rules for classification. In our proposed work, we will implement optimization algorithm (IWD) based on artificial intelligent scheme for image classification. After that, we will use water marking scheme for security reasons. We use MATLAB tool to implement our work.

A. Basic Design of Work:

The efficiency of this system depends on two processes which include classification & watermarking. The basic design of our proposed work is as shown in figure 1.

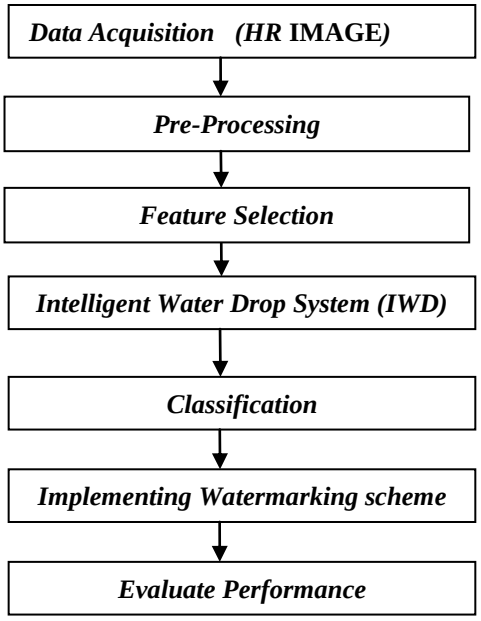


Fig 1: Basic Design of Work

Following are the steps:

1) Data Acquisition: This step involves the data acquisition process in which jpeg image has been taken of 275X282 size.

2) Pre-Processing: This step perform pre-processing. Pre-Processing has been done with the help of median filter.

3). Feature Selection on the basis of IWD: This step is used for the selection of optimized features which are relevant and help for simple classification. Here for feature selection we used Intelligent Water Drop System algorithm which is based on artificial intelligence.

The IWD algorithm is based on the dynamic nature of river systems. The actions and reactions that happen among the water drops in rivers. The IWD algorithm may be used for maximization or minimization problems. The solutions are constructed by the IWD algorithm. The IWD algorithm is an optimisation algorithm that uses a swarm of water drops to search for optimal solutions in the environment of the given problem. In fact, each IWD constructs a solution incrementally to the problem by moving on the graph representation of the problem. Among the obtained solutions the best quality solution is chosen and the total path is traced by removing the soil. During each algorithmic iteration it gains some velocity and removes soil from the path it flows through. After number of iterations it finds good paths that are decoded to good solutions of the problem.

4) Classification: After performing feature selection classification can be done on the basis of that selected features. Classification consists of predicting a certain outcome based on a given input.Classification has been done by using intelligent waterdrop algorithm(IWD). In order to predict the outcome, the algorithm processes a set containing a selected set of attributes and the respective outcome called goal or prediction attribute.

*5) Implement Watermarking***:** In this after performing classification we implement watermarking on each and every class of the classified image. We used 3-level DWT for digital watermarking. Discrete Wavelet transform (DWT) is a mathematical tool for hierarchically decomposing an image. It gained widespread acceptance in signal processing, image compression & watermarking. It decomposes a signal into a set of basic functions, called wavelets. Wavelets are created by translations and dilations of a fixed function called mother wavelet. Digital image Watermarking consist of two process embedding & extraction.

Watermark Embedding

For this process firstly we apply 3 level DWT on host image decomposes the image into sub-images. The approximation looks just like the original. The same manner 3 level DWT is also applied to the watermark image. For this Haar wavelet is used. Then technique alpha blending [8, 12, 13] is used to insert the watermark in the host image. In this technique the decomposed components of the host image and the watermark are multiplied by a scaling factor and are added. Since the watermark embedded in low frequency approximation Component of the host image. So it is perceptible in nature or visible. The formula of the alpha blending for watermarked image is:

WMI=k*(LL3) +q*(WM3)
WM3 = low frequency approximation of Watermark,
LL3 = low frequency approximation of the original image, WMI=Watermarked image, k, q-Scaling factors

By embedding the watermark Image on cover image Inverse DWT is applied to the watermarked image coefficient to generate the final secure watermarked image.

Watermark Extraction

First we have applied 3 level DWT to watermarked image and cover image which decomposed the image in sub-bands. After that we apply alpha blending on low frequency components.
Alpha blending: formula for alpha blending extraction for recover watermark is given by
RW= (WMI – k* LL3)/q
RW= low frequency approximation of recovered watermark, LL3 = low frequency approximation of the original image, and WMI = low frequency approximation of watermarked image.
After extraction process, inverse discrete wavelet transform is applied to the watermark image coefficient to generate the watermark extraction process.

B. Algorithm Design of Work:

The step wise algorithm design of this proposed work is given below:

Step 1: Image Acquisition.

Step 2: Pre-process the whole image through filters.

Step 3: IWD Parameter initialization (Coefficients of image)
Static Parameter initialization:
The number of water drops N_{IWD} is set to a positive integer value, which is usually set to the number of values Nc of the graph.
For velocity updating, the parameters are av = 1 , bv = .01 and cv = 1 .
Parameter initialization: Soil & velocity of IWDs
Every IWD has a visited node list Vc(IWD), which is initially empty: Vc (IWD) = { } . Each IWD's velocity is set to InitVel. The IWDs are set to have zero amount of soil.

Step 4: Distribution of IWDs on the image.

Step 5: On the basis of water drop, obtain the max. soil content by adding water drops one by one.

Step 6: For each IWD moving from pixel i to pixel j, update its velocity velIWD (t) by

$$vel^{IWD}(t+1) = vel^{IWD}(t) + \frac{a_v}{b_v + c_v . soil^2(i,j)}$$

where velIWD (t +1) is the updated velocity of the IWD.
Step 7: The solution is constructed by IWDs along with water drop velocity updations.
The content with higher soil values will be neglected.
Continue with lower soil values.
Step 8: Generate a new matrix & implement digital watermarking by applying 3 level DWT in each class of the classified image.

Step 9: Perform Watermark embedding using alpha blending by using formula:

WMI=k*(LL3) +q*(WM3)
WM3 = low frequency approximation of watermark.
LL3 = low frequency approximation of original image
WMI =watermarked image.
k and q are scaling factors.

Step 10: Generate secure watermarked image.

IV. RESULTS & DISCUSSION

The Classification can be done by using Intelligent Water drop based algorithm. Fig 2 shows the original image. This original image is a high resolution alwar city image and is shown below.

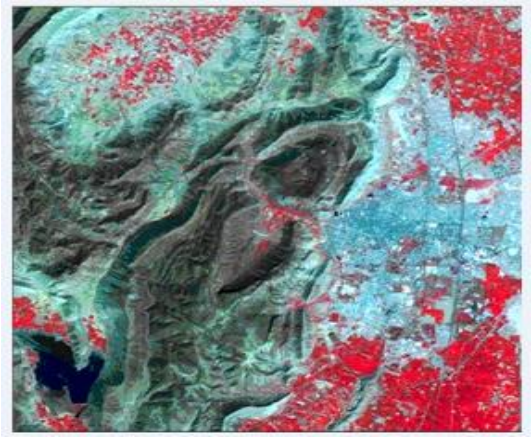


Fig. 2: Original Image

IWD based algorithm classify the image according to their intelligence. The resultant classified image is as shown in Fig 2.

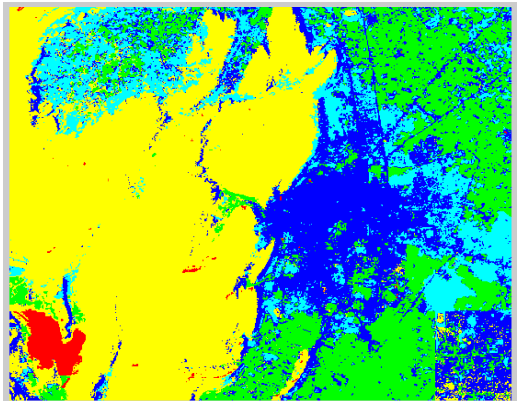
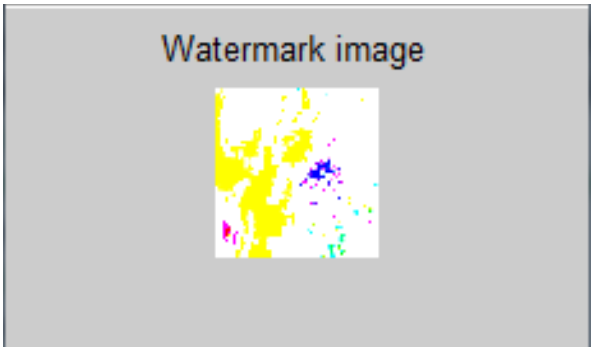


Fig 3: Classified Image 1.Urban 2.Water 3.Veg 4.Barren 5.Rocky.

Here the classification process is integrated with watermarking to secure the classified image.Then watermark of this classified image is prepared with the help of discrete wavelet transform as shown in Fig 4.



*F*ig 4: Watermark Image

To test this integrated system, perform digital watermarking by using 3-level digital watermarking where 'haar' wavelet is used and alpha blending embedding to embed the watermark to a cover image. Here the selected cover image is shown in Fig 5.

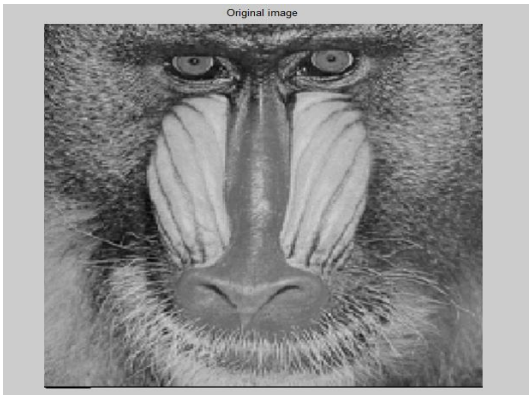


Fig. 5: Cover Image

In this work, invisible watermarking has been performed so no one can detect our confidential data. This make our classified image more secure. After embedding the watermarked image that is prepared is shown in Fig 6.

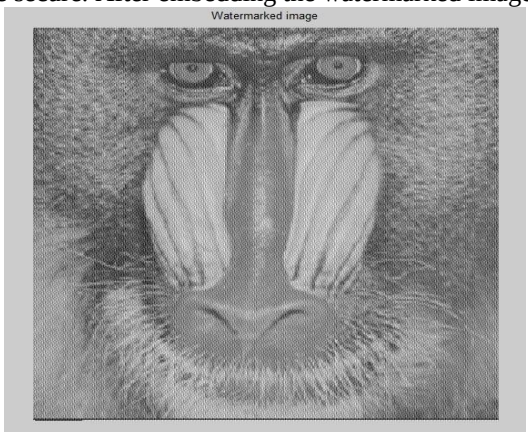


Fig 6: Watermarked Image

The watermarked image that has been recovered after watermark extraction is shown in fig 7.

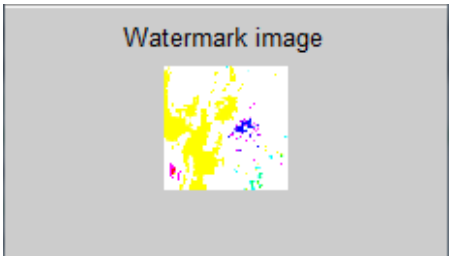


Fig 7. Recovered watermark

The accuracy of two classification results is listed in table I:

TABLE I. COMPARISON OF ACCURACY (%) OF TWO METHODS

Methods	Rocky	Urban	Barren	Veg	Water	Overall	Kappa
Proposed	75.43	95.54	91.75	88.32	91.27	88.46	0.8723
k-means	70.76	90.33	81.89	82.13	84.24	80.18	0.7783

V. CONCLUSION

Enhanced security scheme is developed by integrating classification process with watermarking. Here, a high resolution satellite image of alwar city is used to perform classification. Classification is based on artificial intelligence based algorithm IWD. Intelligent water drop (IWD) algorithm provides better result for classification having .8723 kappa value. To secure this classified image prepare a watermark .3-level DWT Digital watermarking, where alpha blending

embedding is uesd . This integrated security scheme enhances the security in the field of defense and other highly authenticated fields.

REFERENCES

1. A.K. JAIN,M.N. MURTY AND P.J. FLYNN, "Data Clustering", ACM Computing Surveys, Vol.31, No. 3, 1999.
2. Enrico Minack;Gianluca Demartini, and Wolfgang Nejdl, "Current Approaches to Search Result Diversitication",L3S Research Center, Leibniz Universität Ha nnnover, 30167 Hannover, Germany.
3. Basheer M. Al-Maqaleh and Hamid Shahbazkia, "A Genetic Algorithm for Discovering Classification Rules in Data Mining" International Journal of Computer Applications (0975 – 8887), Volume 41– No.18, 2012.
4. Vivekanandan ; P., Dr. R. Nedunchezhian, "A N+ew Incremental Genetic Algorithm Based Classification Model to Mine Data with Concept Drift" Journal of Theoretical and Applied Information Technology.
5. Andy Tsai; William M. Wells, Simon K. Warfield, and Alan S. Willsky, "An EM algorithm for shape classification based on level sets" Medical Image Analysis, Elsevier, pp. 491-502.
6. Kamal Nigam, Andrew Kachites Mccallum, Sebastian Thrun, and Tom Mitchell, "Text Classification from Labeled and Unlabeled Documents using EM" Machine Learning, pp. 1-34.
7. Bhanumathi, S., and Sakthivel., "A New Model for Privacy Preserving Multiparty Collaborative Data Mining", 2013 International Conference on Circuits, Power and Computing Technologies [ICCPCT-2013].
8. Ciubancan, Mihai., et al., "Data Mining preprocessing using GRID technologies", 2013 11th Roedunet International Conference (RoEduNet), pp. 1-3.
9. Velu, C.M., and Kashwan, K.R., "Visual Data Mining Techniques for Classification of Diabetic Patients", 3rd International Advance Computing Conference (IACC), pp. 1070-1075, 2013.
10. Ming-Hsien Hiesh; Lam, Y.-Y.A. ; Chia-Ping Shen ; and Wei Chen, "Classification of schizophrenia using Genetic Algorithm-Support Vector Machine (GA-SVM)" 2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pp. 6047 – 6050.
11. Feng-Seng Lin ; Chia-Ping Shen ; Hsiao-Ya Sung ; and Yan-Yu Lam, "A High performance cloud computing platform for mRNA analysis" 2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pp. 1510-1513.
12. Saraswathi, S. ; Mahanand, B.S. ; Kloczkowski, A. ; and Suresh, S., "Detection of onset of Alzheimer's disease from MRI images using a GA-ELM-PSO classifier" 2013 IEEE Fourth International Workshop on Computational Intelligence in Medical Imaging (CIMI), pp. 42-48.
13. Relan, D. ; MacGillivray, T. ; Ballerini, L. ; and Trucco, E., "Retinal vessel classification: Sorting arteries and veins" 2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pp. 7396-7399.
14. Samdin, S.B. ; Chee-Ming Ting ; Salleh, S.-H. ; and Ariff, A.K., "Linear dynamic models for classification of single-trial EEG" 2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pp. 4827-4830.
15. Vargas Cardona, H.D.; Orozco, A.A. ; and Alvarez, M.A., "Unsupervised learning applied in MER and ECG signals through Gaussians mixtures with the Expectation-Maximization algorithm and Variational Bayesian Inference" 2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pp. 4326-4329.
16. Keshavamurthy B. N, Asad Mohammed Khan & Durga Toshniwal, "Improved Genetic Algorithm Based Classification" International Journal of Computer Science and Informatics (IJCSI), Volume-1, Issue-3.
17. Andrew Skabar And Khaled Abdalgader "Clustering Sentence-Level Text Using A Novel Fuzzy Relational Clustering Algorithm" IEEE Transactions On Knowledge And Data Engineering, Vol. 25, Issue -1, January 2013.
18. Shanti.D, Sahoo.G, Saravanan.N, "Evolving connection weights of ANN using GA with application to the prediction of stroke disease",International Journal of Soft Computing, Medwell Publishing, Vol. 4,Issue 2, pp 95-102, 2009.
19. Reddy. C. K, Chiang. H. D, Rajaratnam.B, "TRUST-TECH-based expectation maximization for learning finite mixture models", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 30, pp.1146–1157, 2008.
20. Ziyong Zhou,Yang Zhang, "Integration of Association-rule and Decision Tree for High Resolution Image Classification", 21st International Conference on Geo informatics (GEOINFORMATICS), pp.1-4, 2013.
21. Guizhou Wang, Guojin He, Jianbo Liu "A New Classification Method for High Spatial Resolution Remote Sensing Image Based on Mapping Mechanism", Proceedings of the 4th GEOBIA conference, pp.186,2012.
22. Sandeep Kumar, Zeeshan Khan, Anurag jain, "A Review of Content Based Image Classification using Machine Learning Approach", International Journal of Advanced Computer Research, Vol.2, pp.3, Issue-5,2012.
23. Khlifia Jayech and Mohamed Ali Mahjoub, "New approach using Bayesian Network to improve content based image classification systems" IJCSI International Journal of Computer Science Issues, Vol. 7, Issue-6, 2010.
24. Devis Tuia, Gustavo Camps-Valls, "Semisupervised Remote Sensing Image Classification With Cluster Kernels" IEEE Geoscience and Remote Sensing Letters, Vol. 6, Issue-2, 2009.
25. Hamed Shah-Hosseini, "The intelligent water drops algorithm: a nature-inspired swarm-based optimization algorithm", Int. J. Bio-Inspired Computation, Vol. 1, Issue-1/2, 2009.
26. D. LU and Q. WENG, "A survey of image classification methods and techniques for improving classification performance" International Journal of Remote Sensing, Vol. 28, Issue- 5, pp.823–870, 2007.

