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Universal Steganalysis Towards Higher Detection Accuracy

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Abstract: Steganalysis technique is to hide the message or data through the cover media. The main issue in Universal Steganalysis detects the hidden information without any knowledge of embedded data in the digital object. DWT is embedding small number of data in frequency domain; because of host image quality will be pervertedextremely.DWT requires a large computational resource. In images DWT produces a blurrer and noise at edges, less compression ratio and Lower quality than JPEG at low compression rates. DWT is not plenty of shift invariance and directional selectivity. With DWT denosing or threshoulding, the, coefficients may not able be represent the image with sufficient accuracy in the time domain and frequency domain. The proposed method is to use K-nearest neighbors algorithm (K-NN), which is a non-parametric method used for classification and regression. In both cases, the input consists of the k closest training examples in the feature space. The output depends on classification or regression.

Keywords: Steganalysis, DWT, ANN, KNN, Stego Image, Clean image.

I.INTRODUCTION

Steganography technique is hiding any secret message in another message without knowing to anyone about presence of secret message except the receiver. Steganalysis technique is to hide the message or data through the cover media, which means infirm the steganography. Universal Steganalysis is a steg-analysis technique which is not developed for a specific steganography system. It requires even no priori information or less information of the targeted steganographic techniques for detection of hidden message. It takes a learning based strategy that involves training based on cover images and stego images regardless of the embedding domains and algorithms.

II.EXISTING METHOD

Steganography technique using DWT (Discrete Wavelet Transform) is used for the hiding a large amount of data with high security, a good invisibility and no loss of secret message. Hiding the information using DWT is to change the magnitude of DWT coefficients of three sub-bands, HH, HL, and LH of cover image. Entropy of image gives the statistical information of the randomness, which can be used to extract the Texture information within any image. Texture information means that Texture gives us information about the spatial arrangement of the colors or intensities in an image It has higher compression ratios to avoid block in artifacts. It allows good content in time domain and spatial frequency domain. The whole image introduces an inherent scaling in the transform. Better identification of the data is relevant to human perception higher compression ratio. Higher flexibility: Wavelet function can be freely chosen.DWT is embedding small amounts of data in frequency domain, because of this quality of the host image will be perverted significantly. It requires a large computational resource; it produces blurring and ringing noise at near edge regions in images. It has low compression ratio. Anupama K.Ingale,Nagaraj V.Dharwadkar, Pratik, Kodulkar [1] proposed that DWT and Entropy are used to find the feature extraction. In DWT, features are calculating by using the energy, correlation, homogeneity and contrast. By using the histogram, the entropy features are calculated. Training and testing phase of the images are using the ANN classifier. Number of features depends on the size of the image in entropy. ANN classifier is used to combine the DWT outputs and Entropy outputs to combine DWT and entropy outputs after classifying the both outputs to the final ANN classifier.

Algorithm for ENTROPY:

Step1: Read an image using imread () function.
Step2: Divide the image into blocks of 8X8 matrix.
Step3: Apply histogram on each array element using imhist() function.
Step4: Calculate entropy by using equation.Entropy=sum (Hist.*log2 (Hist));

Algorithm for DWT:
Step1: Read an image I using imread () function.
Step2: Apply DWT for image using dwt2 () function
Step3: Separate the RGB components form after applying DWT.
Step4: Create co-occurrence matrix of RGB components using graycomatrix () function.
Step5: Extract four features (contrast, correlation, energy, homogeneity) of the co-occurrence matrix using graycoprops () function.
Step6: Repeat the steps 2 to 5 for extracting different levels of DWT to get final feature vector.

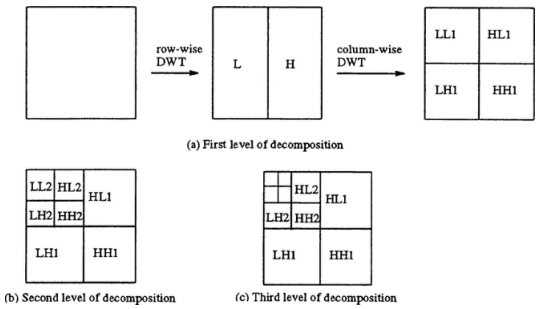

Fig 1: Multi-scale decomposing of an image using DWT.

For embedding secret information, we have used two tools one is SteganPEG which takes input jpeg image and converts the stego image into same format. SteganPEG uses partial decoding technique to embed secret data and the second tool is Quickstego which takes jpeg image as input and converts the stego image into .bmp format.

The remaining part of the paper is organized as follows. In section III we describe our proposed method, section IV Shows experiment results, section V comparison of results with existing algorithms and sectionVI conclusion.

III.PROPOSED METHOD

In our proposed algorithm we are using both spatial and frequency domain to extract feature set. In Training phase feature sets are extracted from various cover images which is then classified using proposed classifier. In testing phase images are clean images and are embedded with the secrete data using stego tools, known as stego images. Feature extraction techniques are applied on these stego image and then classifier is used to classify the image as stego or non stego image based on the knowledge base created during training phase. The KNN algorithm is used to extract the features in image and KNN classifier is used to classify the testing image. There are two types of images are used in this work, clean images and stego images. Stego image made by embedding the image to another image. K-nearest neighbor's algorithm (K-NN) is a non-parametric method; that means it does not make any assumptions on the underlying data distribution. The KNN algorithm is used for both classification and regression. The Input exists of nearest neighbors. The output depends on the classification or regression. In classification, a majority of its neighbors classifies a pixel, with the pixel is assigned to the most common among its k nearest neighbors. If K is two, then the pixel is selecting two nearest neighbor for features extraction. In regression, the output is belonging to value of the pixel. Classification and regression are useful technique to assign weight of the neighbors; it is also a lazy algorithm; it does not use the training data points to do any generalization. KNN training phase is very fast.KNN keeps all the training data for the testing phase.KNN assumes that the data is in a feature space. KNN, can work equally well with arbitrary number of classes. The K is n-dimensional which decides how many neighbors (where a neighbor is defined based on the distance metric) influence the classification. More exactly, the data points are in a metric space. The data can be scalars or possibly even multi-dimensional vectors. Since the points are in feature space, they have a notion of distance. This need not necessarily be Euclidean

distance although it is the one commonly used. Each of the training data consists of a set of vectors and class label associated with each vector. But KNN, can work equally well with arbitrary number of classes.

Algorithm for KNN neighbors and distances:
Step 1: read the input image.
Step 2: Divided image into 8X8 blocks.
Step 3: Get the output samples on Step 2
Step 4: Initialize the K value is the dimensions of neighbors and distances i.e. K=8.
Step 5: By using Euclidean distance to find nearest neighbor and distances**.**

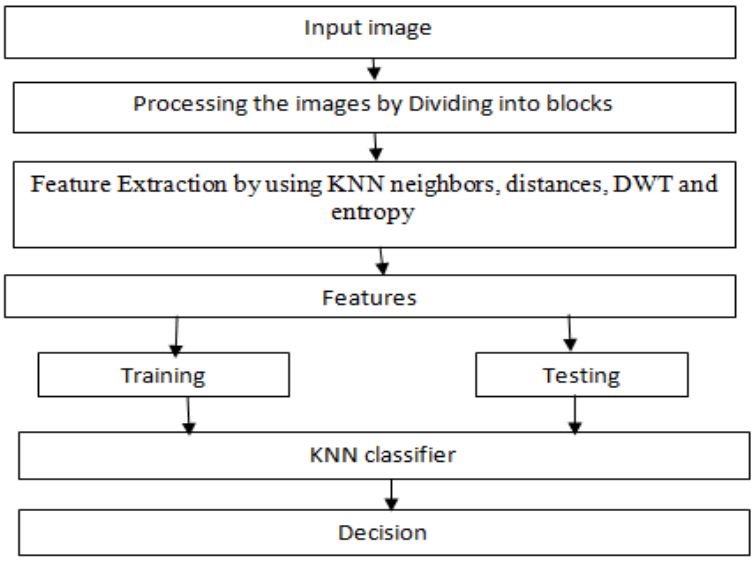

Fig 2: Block diagram for proposed work

IV.RESULTS

We have tested KNN classifier for DWT, entropy, KNN neighbors and KNN distances as feature vector respectively TABLE 1 to 11 shows results obtained during testing phase. Obtained results are depicted as true positive (TP) if KNN classifier classifies the given image correctly otherwise it is considered as true negative (TN). True positive percentage is measure of KNN classifier performance of proposed Steganalysis.

Table 1: Result of DWT and Entropy with image size 128x128

Tool	Payload size=5%		Payload size=10%		Payload size=15%		Payload size=20%	
	TP	TN	TP	TN	TP	TN	TP	TN
SteganPEG	90%	10%	90%	10%	92%	8%	94%	6%
Quickstego	88%	12%	88%	12%	90%	10%	92%	8%

Table 2: Result of DWT and Entropy with image size 256X256

Tool	Payload size=5%		Payload size=10%		Payload size=15%		Payload size=20%	
	TP	TN	TP	TN	TP	TN	TP	TN
SteganPEG	90%	10%	92%	8%	94%	6%	96%	4%
Quickstego	88%	12%	92%	8%	92%	8%	94%	6%

Table 3: Result of DWT and Entropy with image size 512x512

Tool	Payload size=5%		Payload size=10%		Payload size=15%		Payload size=20%	
	TP	TN	TP	TN	TP	TN	TP	TN
SteganPEG	92%	8%	92%	8%	94%	6%	98%	2%
Quickstego	90%	10%	92%	8%	94%	6%	96%	4%

Table 4: Result of KNN neighbors and KNN distances with image size 128X128

Tool	Payload size=5%		Payload size=10%		Payload size=15%		Payload size=20%	
	TP	TN	TP	TN	TP	TN	TP	TN
SteganPEG	90%	10%	92%	8%	92%	8%	94%	6%
Quickstego	88%	12%	90%	10%	90%	10%	92%	8%

Table 5: Result of KNN neighbors and KNN distances with image size 256X256

Tool	Payload size=5%		Payload size=10%		Payload size=15%		Payload size=20%	
	TP	TN	TP	TN	TP	TN	TP	TN
SteganPEG	92%	8%	94%	6%	94%	6%	96%	4%
Quickstego	90%	10%	92%	8%	94%	6%	96%	4%

Table 6: Result of KNN neighbors and KNN distances with image size 512X512

Tool	Payload size=5%		Payload size=10%		Payload size=15%		Payload size=20%	
	TP	TN	TP	TN	TP	TN	TP	TN
SteganPEG	92%	8%	94%	6%	94%	6%	96%	4%
Quickstego	90%	10%	94%	6%	94%	6%	96%	4%

Table 7: Result of combination of all features with image size 128X128

Tool	Payload size=5%		Payload size=10%		Payload size=15%		Payload size=20%	
	TP	TN	TP	TN	TP	TN	TP	TN
SteganPEG	90%	10%	92%	8%	94%	6%	96%	4%
Quickstego	90%	10%	92%	8%	92%	8%	92%	8%

Table 8: Result of combination of all features with image size 256X256

Tool	Payload size=5%		Payload size=10%		Payload size=15%		Payload size=20%	
	TP	TN	TP	TN	TP	TN	TP	TN
SteganPEG	92%	8%	94%	6%	94%	6%	96%	4%
Quickstego	90%	10%	92%	8%	92%	8%	94%	6%

Table 9: Result of combination of all features with image size 512X512

Tool	Payload size=5%		Payload size=10%		Payload size=15%		Payload size=20%	
	TP	TN	TP	TN	TP	TN	TP	TN
SteganPEG	94%	6%	94%	6%	96%	4%	98%	2%
Quickstego	92%	8%	94%	6%	94%	6%	96%	4%

V.COMPARISION OF RESULTS

Table 10: Detection percentage of different classifiers

Classifier / Tool	ANN classifier	KNN classifier
SteganPEG	91.16%	97.33%
Quickstego	89.13%	96%
Overall	90.14%	96.6%

VI. CONCLUSION

In this project, a universal Steganalysis method is proposed. The proposed work finds detect the presence of hidden message. All the selected clean images are embedded with relative payload sizes of 5%, 10%, 15% and 20%. Then classifier detection of hidden image. if payloads are increasing detection percentage automatically increasing respectively. Comparing with the ANN classifier the detection percentage increases by considering KNN classifier.

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