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Review: Methods of Steganalysis of Digital Images

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***Abstract* – Nowadays cybercriminals excavate malicious data to your devices in different ways. In such cybercrime, the use of steganography needs an effective technique. Cryptography consists of a scrambled message that is not easily understandable. The main aim of steganography is to hide the data or information, by embedding it into an image, audio, video, or text files. So, unauthorized users cannot access the hidden information. The study of steganography is called steganalysis, which is used to detect hidden messages. So, this paper gives a comparative study between different methods used for the steganalysis process. The comparison network is based on digital images. This method is the best challenge for digital forensic investigation.**

***Keywords* – Malicious, Steganography, Steganalysis, Digital forensic.**

I.INTRODUCTION

Steganalysis and steganography are similar but have some differences, which is a different side of the same coin. Steganography is the art of concealing information. It is a similar purpose to cryptography, which is used to encrypt the data. Communicating secret data in an appropriate multimedia carrier is the main approach of steganography. The objective of steganography is to conceal the very existence of embedded data. The main factors of steganography are undetectability, robustness, and capacity of hidden data. Steganalysis which used to retrieve the embedded data and information from the image. As an application view, digital steganography is growing day by day. Steganalysis is used to detect the hidden messages embedded in digital images using steganography. The main framework for steganalysis is detection performance. And also, to reduce the computational cost, complexity.

Convolutional Neural Networks are based on neural networks that consist of two or more convolutional layers. The convolutional layer is mainly used for image processing, classification, segmentation, and other correlated data. Testing and training process can be done in deep learning convolutional network model and each input will pass through each convolutional layer with filters. To reduce the size of a network model compression is used and to enhance the larger accuracy and performance. One such compression method is called Neural network pruning which removes weights from a trained model. Pruning means to cut off unnecessary branches. In machine learning, pruning is removing unnecessary neurons or weights. The project focused mainly on the channel pruning system. Channel pruning is used to reduce the system's huge memory consumption and high computational complexity of convolutional neural networks. It is a structural compression approach. Different channel pruning techniques can be used. Our system includes a channel pruning technique named as self-adaptive channel pruning technique and also pruning is a technique based on deep learning. The paper is categorized as Section II describes the literature survey which having previous methods such as rich model, ensemble model, deep residual, channel pruning Finally, Section III gives the conclusion

II. LITERATURE SURVEY

In this section explains about the previous methods used in steganography of digital images such as rich model, ensemble classifier etc

1. Ensemble Classifiers for Steganalysis of Digital Media

This paper [1] proposed an ensemble classifiers. Ensemble classifier built as random forests by fusing decisions of an ensemble of simple base learners that are inexpensive to train. The ensemble classifier consists of the many base learners. These learners are independently trained on a group of canopies and stego images. A simple classifier in each base learner is built on a randomly selected subspace of the feature space. Steganalysis is used to train classifiers. To obtain more accurate and robust detectors we have to use more complex cover models and large data sets. For the steganalysis development, proposed an ensemble classifiers built by Fisher Linear Discriminant. Ensemble classifier fuse the decision of weak and unstable base learners. The complexity of the ensemble classifier allows the steganalyst to work with high-dimensional feature spaces and also large training sets. when attacking a new ensemble scheme is used for fast future development. Ensemble classifier even has better performance and accuracy. This paper also shows a particular example to build a high-dimensional feature space for analysis of JPEG images.

2. Rich Models for Steganalysis Of Digital Images

Paper [2] proposed a novel methodology named rich models which are constructing for the steganography method of digital images. The rich model also consists of a large number of sub-models and this sub model consist of some relationships with the noise residuals. To capture a large number of different types of dependencies among neighboring pixels to give the model the ability to detect a wide spectrum of embedding algorithms. However, enlarging a single model is unlikely to produce good results as the enlarged model will have too many underpopulated bins. The rich model constructs in the spatial domain. The rich model achieves the best detection by building the model directly in the domain and then changes in the embedded can be localized.

Cover modification done by the steganography makes only small changes to the pixel. In rich models, models only the noise component than their content. For a given sample of the cover source and stego method are assembled. Final steganalyzer use ensemble classifiers because of their good performance and also that can be achieved with very low complexity model. Several simple sub-model-selection strategies are tested to improve the trade-off between detection accuracy and model dimensionality. Stego algorithms that are used for the paper framework are embedding and two content-adaptive methods are HUGO and an edge-adaptive method. The rich model combined with the ensemble classifier gives better performance and also the rich model is capable of achieving the same level of statistical detectability with dimensions 30 to 100 times smaller. The rich models are built using the philosophy of maximizing the diversity of sub-models while keeping all their elements well-populated and thus statistically significant.

3. A New Cost Function for Spatial Image Steganography

This paper [3] works develops a new cost function, which ensures all pixels within textural regions. The textural region relatively has low. The cost function is employing a high-pass filter and two low-pass filters and also making more embedding changes concentrated in textural areas. With the new cost function, some pixels with high cost values being inside a textural region is avoided, and low-cost values are clustered in a larger area. The proposed cost function uses a steganographic method called HILL which achieves a better performance. Cost function also consist of the convolution operation which makes a fast implementation of the steganographic method possible. The coefficients in the three filters are all integers. Since the low-pass filtering operation can be taken as the mutual dependencies among cost values into consideration and it leads to a better security performance Experimental results show that the steganographic method performs better by using the proposed cost function.

4.Structural Design of Convolutional Neural Networks for Steganalysis

This paper [4] firstly introduced the proposed CNN then presented the design of CNN to improve statistical modeling is presented. And finally, discussed the design considerations on the nonlinear activations and spatial sizes of convolutional kernels. The paper proposed whole CNN divided into a convolutional module. This transforms the images to feature vectors and a linear classification module. The convolutional module consists of five groups of layers.

Each layer starts with a convolutional layer, which generates feature maps. And then layers end with an average pooling layer which performs local averaging as well as subsampling on the feature maps. CNN equipped with hyperbolic tangent nonlinear activations to enhance the power of statistical modeling. Finally, through global averaging, the pooling layer in Group 5 merges each spatial map to at least one element. The whole CNN has to perform the same operations to every pixel in the original images. This is to prevent statistical modeling from grasping the location information of embedded pixels from the training data. If the embedding key is reused for all the images, resulting in leakage of embedding locations. A well-designed CNN may be a good steganalysis tool and would have the potential to supply a far better detection performance compared thereupon achieved by the traditional feature-based steganalysis.

5. Deep Residual Network for Steganalysis of Digital Images

This paper [5] proposed a novel convolutional neural network architecture called SRNet for steganalysis of digital images. The first steganalysis network is SRNet that is free of many externally introduced design elements. Consequently, SRNet can be trained in an end-to-end fashion from randomly initialized convolutional kernels and in the same fashion independently of the embedding domain. The set consists of seven residual layers in the front part itself. Pooling has been disabled to allow the network to learn relevant “noise residuals” for different types of embedding changes in both spatial and JPEG domain.

The design of SRNet is validated experimentally based on six steganographic algorithms and standard data sets. The main aim of SRNet is to minimize the use of heuristic design elements specific to steganalysis it still benefits from being informed about the probabilistic impact of embedding in the form of the selected channel Since steganalysis detectors detect the inconsistencies in the noise patterns of images, they often find applications in forensics, such as for establishing the processing history of images or detecting inconsistencies within a single image to identify locally manipulated regions. Large advancements in steganalysis need to be followed by revisiting the inner workings of steganographic methods because they are often designed from feedback provided by detectors.

6.CALPA-NET: Channel-pruning-assisted Deep Residual Network for Steganalysis of Digital Images

This paper [6] proposed CALPA-NET, a channel-pruning assisted deep residual specification search approach. Mainly this technique is used to shrink the network structure of existing vast, overparameterized deep-learning-based steganalyzer. We observe that the established "doubling the number of channels alongside halving the dimensions of output feature maps" rule might undermine the range of output features of deep steganalytic models. CALPA-NET also proposed a hybrid criterion to adaptively determine the amount of each channel of every involved convolutional layer.

ThiNet scheme and the l1-norm based scheme is also combined with hybrid criteria. CALPA-NET abandoned the training pruning-finetuning pipeline methods. The experiments conducted on datasets show that trained from scratch, the shrunken model can still achieve state-of-the-art detection performance. The major contributions of this work are, a broad inverted-pyramid structure of existing deep-learning-based steganalyzer cannot boost detection performance even with fifty fold parameter. A theoretical reflection is proposed to argue that such a structure might contradict the well-established model diversity-oriented philosophy. The extensive experiments conducted on de-facto benchmarking image datasets show that CALAP-NET is able to do comparative detection performance with just a couple of percent of the model size and a little proportion of the computational cost.

III. PROPOSED SYSTEM

The above-mentioned literature surveys explained existing methods for steganalysis of digital images. To reduce the computational cost and to get high accuracy than the existing methods, this paper initiated a channel pruning system. The Channel pruning method is used to filter the network layer without changes in the results and also to reduce the complexity of the layer. A method called the hybrid method also combined with the pruning method to shortcut the connection in the network structure

IV. CONCLUSION

In this paper, we propose a pruning method combined with hybrid criteria. The pruning method is used to filter the network structure therefore it reduces the complexity. The algorithm used here is a thinet algorithm. The aim is to avoid the larger computational cost.

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