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**论文列表**

1. **New Framework of Reversible Data Hiding in Encrypted JPEG Bitstreams**

**文献信息：**

Qian Z, Xu H, Luo X, et al. New Framework of Reversible Data Hiding in Encrypted JPEG Bitstreams[J]. IEEE Transactions on Circuits & Systems for Video Technology, 2018, PP(99):1-1.

**摘要：**

This paper proposes a novel framework of reversible data hiding in encrypted JPEG bitstream. We first provide a JPEG encryption algorithm to encipher a JPEG image to a smaller size and keep the format compliant to JPEG decoders. After an image owner uploads the encrypted JPEG bitstreams to cloud storage, the server embeds additional messages into the ciphertext to construct a marked encrypted JPEG bitstream. During data hiding, we propose a combined embedding algorithm including two stages, the Huffman code mapping and the ordered histogram shifting. The embedding procedure is reversible. When an authorized user requires a downloading operation, the server extracts additional messages from the marked encrypted JPEG bitstream and recovers the original encrypted bitstream losslessly. After downloading, the user obtains the original JPEG bitstream by a direct decryption. The proposed framework outperforms previous works on RDH-EI. First, since the tasks of data embedding/extraction and bitstream recovery are all accomplished by the server, the image owner and the authorized user are required to implement no extra operations except JPEG encryption or decryption. Second, the embedding payload is larger than state-of-the-art works.

1. **[A High-Capacity Reversible Data Hiding Method in Encrypted Images Based on Block Shifting](http://www.computer.org/csdl/proceedings/icmip/2017/5954/00/5954a181-abs.html" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Jiang R, Zhang W, Wang H, et al. A High-Capacity Reversible Data Hiding Method in Encrypted Images Based on Block Shifting[C]// International Conference on Multimedia and Image Processing. IEEE Computer Society, 2017:181-186.

**摘要：**

Reversible data hiding in encrypted images (RDH-EI) is a new topic drawing more and more attention because of the privacy-preserving requirements from cloud data management. In this paper, a novel reversible data hiding scheme for encrypted image with large embedding capacity is proposed. And it is a client-free RDH-EI scheme in which the RDH algorithm used by the cloud is irrelevant with both the sender and receiver. Different from the previous methods, we propose a block shifting method to transform the original image into the scrambled image which not only looks throughly meaningless, but also obtains a sharp histogram by keeping block correlation meanwhile. For the scrambled image, it is easy for the data hider to reversibly embed data with any plaintext image RDH algorithm such as histogram shifting or lossless compression. The proposed method can achieve real reversibility, that is, data extraction and image recovery are executed with no error. Compared to the previous methods, the experimental results demonstrate that our proposed method increases the embedding capacity in a big range without loss of perfect secrecy.

1. **Reversible Data Hiding in Encrypted Images Using Reformed JPEG Compression**

**文献信息：**

Xie X, Chang C C. Reversible data hiding in encrypted images using reformed JPEG compression[C]// International Workshop on Biometrics and Forensics. IEEE, 2017:1-5.

**摘要：**

A scheme of reversible data hiding in encrypted image (RDH-EI) with high embedding capacity is proposed in this paper. First, cover image is transformed to the quantized discrete cosine transform (DCT) coefficients, which are reformed and encrypted to generate the encrypted image. Then the secret message is embedded into the encrypted image in the location of zero alternating current (ac) coefficients to generate the marked encrypted image. The JPEG image can be recovered by using the encryption key. The secret message can be extracted using the embedding key. The experimental results showed that the proposed scheme can obtain a high embedding ratio while ensuring that the recovered image will have good quality.

1. **[Reversible data hiding in encrypted AMBTC images](http://link.springer.com/10.1007/s11042-017-4957-6" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Yin Z, Niu X, Zhang X, et al. Reversible data hiding in encrypted AMBTC images[J]. Multimedia Tools & Applications, 2017(12):1-17.

**摘要：**

Signal processing in the encrypted domain has attracted a lot of attention due to the requirement for content security and privacy protection. Reversible data hiding in encrypted images (RDH-EI) is also a hot topic. However, the majority of the published techniques are designed for uncompressed images rather than JPEG-, VQ- and BTC-compressed images. In this paper, for the first time, a RDH-EI method for AMBTC images is proposed. In the proposed method, the higher mean and lower mean of a triple in an AMBTC-compressed image are encrypted by using stream cipher at first. Then, additional data can be embedded into the redundant space by using prediction error histogram modification technique. Experimental results and analysis demonstrate that, with the marked cipher-image, legal receivers are able to extract embedded data exactly by using a data hiding key, decrypt it to recover an image very similar to the original one by using an image encryption key, or extract additional data and recover the original image error free with both keys. The proposed method is applicable to real-time transmission due to the simple implementation of the algorithm and low computational complexity.

1. **[New Framework for Reversible Data Hiding in Encrypted Domain](http://xueshu.baidu.com/s?wd=paperuri:(8c27279dea600c002a42bea47f8efdfd)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://ieeexplore.ieee.org/document/7536102/&ie=utf-8&sc_us=8081323639566771650" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Huang F, Huang J, Shi Y Q. New Framework for Reversible Data Hiding in Encrypted Domain[J]. IEEE Transactions on Information Forensics & Security, 2017, 11(12):2777-2789.

**摘要：**

In the past more than one decade, hundreds of reversible data hiding (RDH) algorithms have been reported. Via exploring the correlation between the neighboring pixels (or coefficients), extra information can be embedded into the host image reversibly. However, these RDH algorithms cannot be accomplished in encrypted domain directly, since the correlation between the neighboring pixels will disappear after encryption. In order to accomplish RDH in encrypted domain, specific RDH schemes have been designed according to the encryption algorithm utilized. In this paper, we propose a new simple yet effective framework for RDH in encrypted domain. In the proposed framework, the pixels in a plain image are first divided into sub-blocks with the size of m × n. Then, with an encryption key, a key stream (a stream of random or pseudorandom bits/bytes that are combined with a plaintext message to produce the encrypted message) is generated, and the pixels in the same sub-block are encrypted with the same key stream byte. After the stream encryption, the encrypted m × n sub-blocks are randomly permutated with a permutation key. Since the correlation between the neighboring pixels in each subblock can be well preserved in the encrypted domain, most of those previously proposed RDH schemes can be applied to the encrypted image directly. One of the main merits of the proposed framework is that the RDH scheme is independent of the image encryption algorithm. That is, the server manager (or channel administrator) does not need to design a new RDH scheme according to the encryption algorithm that has been conducted by the content owner; instead, he/she can accomplish the data hiding by applying the numerous RDH algorithms previously proposed to the encrypted domain directly.

1. **[Separable Reversible Data Hiding for Encrypted Palette Images with Color Partitioning and Flipping Verification](http://xueshu.baidu.com/s?wd=paperuri:(da711594da23d5866140182a10d36df4)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://ieeexplore.ieee.org/document/7457315/&ie=utf-8&sc_us=13754067489707924274" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Wu H Z, Shi Y Q, Wang H X, et al. Separable Reversible Data Hiding for Encrypted Palette Images with Color Partitioning and Flipping Verification[J]. IEEE Transactions on Circuits & Systems for Video Technology, 2017, PP(99):1-1.

**摘要：**

Reversible data hiding (RDH) into encrypted images is of increasing attention to researchers as the original content can be perfectly reconstructed after the embedded data are extracted while the content owner’s privacy remains protected. The existing RDH techniques are designed for grayscale images and, therefore, cannot be directly applied to palette images. Since the pixel values in a palette image are not the actual color values, but rather the color indexes, RDH in encrypted palette images is more challenging than that designed for normal image formats. To the best knowledge of the authors, there is no suitable RDH scheme designed for encrypted palette images that has been reported, while palette images have been widely utilized. This has motivated us to design a reliable RDH scheme for encrypted palette images. The proposed method adopts a color partitioning method to use the palette colors to construct a certain number of embeddable color triples, whose indexes are self-embedded into the encrypted image so that a data hider can collect the usable color triples to embed the secret data. For a receiver, the embedded color triples can be determined by verifying a self-embedded check code that enables the receiver to retrieve the embedded data only with the data hiding key. Using the encryption key, the receiver can roughly reconstruct the image content. Experiments have shown that our proposed method has the property that the presented data extraction and image recovery are separable and reversible. Compared with the state-of-the-art works, our proposed method can provide a relatively high data-embedding payload, maintain high peak signal-to-noise ratio values of the decrypted and marked images, and have a low computational complexity.

1. **Reversible Data Hiding in Encrypted Image Based on Neighborhood Prediction Using XOR-Permutation Encryption**

**文献信息：**

Yan S, Chen F, He H. Reversible Data Hiding in Encrypted Image Based on Neighborhood Prediction Using XOR-Permutation Encryption[J]. Journal of Computer Research & Development, 2018.

**摘要：**

To improve the security of encrypted image as well as the quality of decrypted image, this paper proposes a neighborhood-prediction based reversible data hiding method in encrypted image (RDH-EI) which is generated by XOR-permutation encryption. In this paper, XOR-permutation is conducted to encrypt original image, which can reduce the risk of encrypted content disclosure due to the fact that both statistical information and location information of original pixels are hidden. According to the data hiding key, some encrypted pixels are pseudo-randomly chosen for data hiding, and secret information is embedded into the most significant bit (MSB) of chosen pixels by the bit replacement operation. In the image decryption phase, the possible marked pixels are predicted and corrected by comparing the difference between each pixel and its neighborhood average value to improve the quality of decrypted image. In the image recovery phase, for each marked pixel obtained by the data hiding key, five neighborhood templates are designed to compute its fluctuation value, which is used to deduce whether the MSB of it is changed or not. This paper discusses and analyzes the threshold selection, the prediction accuracy and the security of encrypted image contents. Experimental results demonstrate that the proposed neighborhood prediction method can correctly predict at least 96% marked pixels. The proposed RDH-EI scheme can not only enhance the security of encrypted image content, but also improve the quality of decrypted image, evidenced that the PSNR is about 5~23dB higher than the existing similar RDH-EI methods with the same embedded payload.

1. **An integer wavelet transform based scheme for reversible data hiding in encrypted images**

**文献信息：**

Xiong L, Xu Z, Shi Y Q. An integer wavelet transform based scheme for reversible data hiding in encrypted images[J]. Multidimensional Systems & Signal Processing, 2017:1-12.

**摘要：**

In this paper, a novel reversible data hiding (RDH) scheme for encrypted digital images using integer wavelet transform, histogram shifting and orthogonal decomposition is presented. This scheme takes advantage of the Laplacian-like distribution of integer wavelet high-frequency coefficients in high frequency sub-bands and the independence of orthogonal coefficients to facilitate data hiding operation in encrypted domain, and to keep the reversibility. Experimental results has demonstrated that this scheme outperforms all of other existing RDH schemes in encrypted domain in terms of higher PSNR at the same amount of payload. Compared with the state-of-the-arts, the proposed scheme can be applied to all natural images with higher embedding rate.

1. **Enhanced Joint and Separable Reversible Data Hiding in Encrypted Images with High Payload**

**文献信息：**

Khanam F T Z, Kim S. Enhanced Joint and Separable Reversible Data Hiding in Encrypted Images with High Payload[J]. Symmetry, 2017, 9(4):50.

**摘要：**

Recently, much attention has been paid to reversible data hiding (RDH) in encrypted images, since it preserves the data that the original image can be perfectly recovered after data extraction while protecting the confidentiality of image content. In this paper, we propose joint and separable RDH techniques using an improved embedding pattern and a new measurement function in encrypted images with a high payload. The first problem in recent joint data hiding is that the encrypted image is divided into blocks, and the spatial correlation in the block cannot fully reflect the smoothness of a natural image. The second problem is that half embedding is used to embed data and the prediction error is exploited to calculate the smoothness, which also fails to give good performance. To solve these problems, we divide the encrypted image into four sets, instead of blocks; the actual value of pixels is considered, rather than an estimated value, and the absolute difference between neighboring pixels is used in preference to prediction error to calculate the smoothness. Therefore, it is possible to use spatial correlation of the natural image perfectly. The experimental results show that the proposed joint and separable methods offer better performance over other works.

1. **[An improved block based joint reversible data hiding in encrypted images by symmetric cryptosystem](http://xueshu.baidu.com/s?wd=paperuri:(c18ed4c4ac9fd479b433fa33aa4b4525)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://www.sciencedirect.com/science/article/pii/S0167865518300205&ie=utf-8&sc_us=5130711794539631071" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Bhardwaj R, Aggarwal A. An improved block based joint reversible data hiding in encrypted images by symmetric cryptosystem[J]. Pattern Recognition Letters, 2018.

**摘要：**

Earlier joint EIRDH (Encrypted Image Reversible Data Hiding) techniques divided cover image into equal sized blocks and embedded one secret bit per block and after decryption of stego image with same key as encryption key, secret message is extracted through data hiding key and original cover image is recovered using spatial correlation of the image. After carrying out a feasibility analysis, improved block based joint EIRDH algorithm is employed in this paper which embedded n (n = 2, 3, 4.....) secret bits per block by dividing blocks of same size (4 × 4, 8 × 8, 16 × 16, 32 × 32.....)into n sub-blocks. Optimal visual quality and enhanced embedding rate are acquired by the proposed scheme. Test results and correlations are exhibited to outline the viability and focal points of the proposed technique with conventional ones.

1. **[Improved reversible data hiding in encrypted images using histogram modification](http://xueshu.baidu.com/s?wd=paperuri:(fe78cea742cfe08b2b5eeb510cae79fb)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://ieeexplore.ieee.org/document/7844991/&ie=utf-8&sc_us=14419315874482633614" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Yi S, Zhou Y. Improved reversible data hiding in encrypted images using histogram modification[C]// IEEE International Conference on Systems, Man, and Cybernetics. IEEE, 2017:004819-004823.

**摘要：**

Inspired by Zhang et al.’s method that applies the integer discrete wavelet transform (DWT) to the original image, and embeds the secret data into the middle (LH, HL) and high (HH) frequency sub-bands of integer DWT coefficients with histogram modification based method, we propose a reversible data hiding method that embeds the secret data into the encrypted prediction error values. Compared with the LH, HL and HH integer DWT coefficients, the prediction error values generated by our proposed method are more concentrated to 0, and thus a high visual quality of the marked decrypted image can be achieved. Experimental results show that our proposed method has a better performance than Zhang’s.

1. **[Mean value based reversible data hiding in encrypted images](http://xueshu.baidu.com/s?wd=paperuri:(53dabbc598cd79214b1449357354b504)&filter=sc_long_sign&sc_ks_para=q=Mean value based reversible data hiding in encrypted images&sc_us=3145332982534211194&tn=SE_baiduxueshu_c1gjeupa&ie=utf-8" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Agrawal S, Kumar M. Mean value based reversible data hiding in encrypted images[J]. Optik - International Journal for Light and Electron Optics, 2017, 130:922-934.

**摘要：**

A novel reversible data hiding technique for encrypted images is proposed in this paper. Proposed technique utilizes additive modulo 256 for encryption purpose and a property of mean for embedding watermark in the encrypted image. Preserved mean values are used for watermark extraction and image recovery. In contrast to several state of art reversible data hiding techniques for encrypted images, proposed technique provides complete reversibility in terms of bit by bit recovery of original image after decryption and watermark extraction. Proposed technique is computationally very simple and executes in very less computational time. Experimental results, on various standard grayscale test images, and comparison with recently proposed existing techniques exhibit the superiority of the proposed technique in terms of security, reversibility, privacy protection and computational efficiency.

1. **[Separable and Reversible Data Hiding in Encrypted Images using Parametric Binary Tree Labeling](http://www.researchgate.net/publication/325638494_Separable_and_Reversible_Data_Hiding_in_Encrypted_Images_using_Parametric_Binary_Tree_Labeling" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Yi S, Zhou Y. Separable and Reversible Data Hiding in Encrypted Images using Parametric Binary Tree Labeling[J]. IEEE Transactions on Multimedia, 2018, PP(99):1-1.

**摘要：**

This paper first introduces a parametric binary tree labeling scheme (PBTL) to label image pixels in two different categories. Using PBTL, a data embedding method (PBTL-DE) is proposed to embed secret data to an image by exploiting spatial redundancy within small image blocks. We then apply PBTL-DE into the encrypted domain and propose a PBTLbased reversible data hiding method in encrypted images (PBTLRDHEI). PBTL-RDHEI is a separable and reversible method that both the original image and secret data can be recovered and extracted losslessly and independently. Experiment results and analysis show that PBTL-RDHEI is able to achieve an average embedding rate as large as 1.752 bpp and 2.003 bpp when block size is set to 2 × 2 and 3 × 3, respectively.

1. **[Separable Reversible Data Hiding in Encrypted Images Based on Two-Dimensional Histogram Modification](http://www.researchgate.net/publication/323013868_Separable_Reversible_Data_Hiding_in_Encrypted_Images_Based_on_Two-Dimensional_Histogram_Modification" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Xu D, Chen K, Wang R, et al. Separable Reversible Data Hiding in Encrypted Images Based on Two-Dimensional Histogram Modification[J]. Security & Communication Networks, 2018, 2018:1-14.

**摘要：**

An efcient method of completely separable reversible data hiding in encrypted images is proposed. Te cover image is frst partitioned into nonoverlapping blocks and specifc encryption is applied to obtain the encrypted image. Ten, image diference in the encrypted domain can be calculated based on the homomorphic property of the cryptosystem. Te data hider, who does not know the original image content, may reversibly embed secret data into image diference based on two-dimensional diference histogram modifcation. Data extraction is completely separable from image decryption; that is, data extraction can be done either in the encrypted domain or in the decrypted domain, so that it can be applied to diferent application scenarios. In addition, data extraction and image recovery are free of any error. Experimental results demonstrate the feasibility and efciency of the proposed scheme.

1. **[Adopting secret sharing for reversible data hiding in encrypted images](http://www.researchgate.net/publication/319907506_Adopting_secret_sharing_for_reversible_data_hiding_in_encrypted_images" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Wu X, Weng J, Yan W Q. Adopting secret sharing for reversible data hiding in encrypted images[J]. Signal Processing, 2017, 143.

**摘要：**

Secret sharing is an alternative method for protecting an image by dividing it into multiple encrypted shares. When sufficient shares are collected, the image can be losslessly recovered. In this paper, secret sharing is adopted to reversible data hiding in encrypted images. A basic model by using secret sharing for reversible data hiding in encrypted images is firstly introduced. Then, an image encryption algorithm by using Shamir’s secret sharing is proposed. Theoretical analysis is provided for substantiating that the shares generated by the proposed encryption algorithm are suitable for data embedding. Finally, two basic methods by using difference expansion and difference histogram shifting are given, as well as some extensions. Experimental results are demonstrated, illustrating the merits of the proposed methods such as low computational complexity, high embedding capacity and real reversibility are achieved.

1. **[Parametric Reversible Data Hiding in Encrypted Images using Adaptive Bit-level Data Embedding and Checkerboard based Prediction](http://xueshu.baidu.com/s?wd=paperuri:(a407e4e1ac8fe7e65b927a0a1d1bad51)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://www.sciencedirect.com/science/article/pii/S0165168418301427&ie=utf-8&sc_us=10681228340945507784" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Yi S, Zhou Y. Parametric Reversible Data Hiding in Encrypted Images using Adaptive Bit-level Data Embedding and Checkerboard based Prediction[J]. Signal Processing, 2018, 150.

**摘要：**  
In this paper, we first propose an adaptive bit-level data embedding (ABDE) method to embed secret data into a cover image and an adaptive checkerboard based prediction (ACBP) method to predict 3/4 of the pixels in an image using its remaining 1/4 of the pixels. Based on ABDE and ACBP, we further propose a parametric reversible data hiding method in encrypted images (PRDHEI). When parameter 07=1 07 = 1 mathContainer Loading Mathjax (ε62∈62[1, 255]), PRDHEI is a full reversible method that both the original image and secret data can be completely recovered. The embedding rate is much higher than state-of-the-art RDHEI methods. Moreover, when ε62>621, the embedding rate of PRDHEI increases significantly. The receiver can fully recover the secret data and reconstruct the original image with very high quality. When 07=255, 07 = 255 , mathContainer Loading Mathjax PRDHEI reaches its maximum embedding rate of 4.5 bpp while the recovered images are of an average peak signal-to-noise ratio larger than 32 dB.

1. **[Reversible data hiding in encrypted images using adaptive block-level prediction-error expansion](http://xueshu.baidu.com/s?wd=paperuri:(0cc6c0a9594b4d8794d38d4cc27d3991)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://www.sciencedirect.com/science/article/pii/S0923596518302042&ie=utf-8&sc_us=4353959780635705205" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Yi S, Zhou Y, Hua Z. Reversible data hiding in encrypted images using adaptive block-level prediction-error expansion[J]. Signal Processing Image Communication, 2018.

**摘要：**

As directly reserving room from the encrypted image for data embedding is difficult and inefficient, many encryption domain based reversible data hiding schemes have disadvantages such as small embedding rate and low visual quality of the directly decrypted image. In order to solve these problems, this paper first introduces a reversible data hiding method for natural images using the block-level prediction-error expansion. The method can embed secret data into 2 × 2 image blocks by exploiting the pixel redundancy within each block. Extending this concept to the encrypted domain, we then propose a reversible data hiding method in encrypted images using adaptive block-level prediction-error expansion (ABPEE-RDHEI). ABPEE-RDHEI encrypts the original image by block permutation to preserve spatial redundancy for data embedding, and applies a stream cipher to the block permutated image to further enhance the security level. Due to the adaptive pixel selection and iterative embedding processes, the proposed ABPEE-RDHEI can achieve a high embedding rate and pleasing visual quality of the marked decrypted images. Experimental results and analysis show that ABPEE-RDHEI has a better performance than several state-of-the-art methods.

1. **[Reversible data hiding in encrypted images with high capacity by bitplane operations and adaptive embedding](http://link.springer.com/10.1007/s11042-017-5498-8" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Di F, Huang F, Zhang M, et al. Reversible data hiding in encrypted images with high capacity by bitplane operations and adaptive embedding[J]. Multimedia Tools & Applications, 2017(5):1-19.

**摘要：**

Reversible data hiding in encrypted images (RDHEI) is a technique that makes contributions to cloud data management in privacy preservation and data security. A novel framework of RDHEI with high embedding capacity based on bitplane operations and adaptive embedding is proposed. Three parties constitute the proposed system: the content owner, the data hider and the receiver. First, the content owner encrypts the original image for privacy protection. A data hider partitions the encrypted image into two sub images by bitplane-level operations and embeds additional data with an adaptive embedding strategy. With the encrypted image containing the embedded data, the receiver can extract the embedded data without any error and losslessly recover the original image according to specific requirements. The proposed framework can not only work for many different specific image encryption methods but also accomplish hundreds of reversible data hiding (RDH) algorithms directly in the encrypted domain. Extensive experiments demonstrate that the proposed framework can significantly increase the embedding capacity of some existing RDHEI frameworks, although it may reduce the PSNR value.

1. **Real-time reversible data hiding in encrypted images based on hybrid embedding mechanism**

**文献信息：**

Zhang W, Kong P, Yao H, et al. Real-time reversible data hiding in encrypted images based on hybrid embedding mechanism[J]. Journal of Real-Time Image Processing, 2018:1-12.

**摘要：**

In this paper, we propose a novel real-time scheme of separable reversible data hiding in encrypted images, which consists of image encryption, data embedding, data extraction and image recovery. In image encryption phase, the content owner divides the original image into a number of non-overlapping blocks and encrypts blocks by stream cipher and permutation. During the data embedding phase, the data hider classifies encrypted blocks into smooth region and complex region according to the threshold and replaces the MSB layer of a part of pixels in blocks of smooth region with the secret data. Then, the LSB layers of other pixels are collected and compressed to generate a room for embedding the secret data again. When the receiver receives the marked image, he can divide the marked image into blocks and decrypt them by the encryption key to obtain a similar image with good quality. If the receiver only has the data hiding key, he can classify the blocks into smooth region and complex region according to the threshold and extract the embedded data by the data hiding key. If the receiver has both encryption key and data hiding key, he can extract the embedded data from the marked image and recover the original image perfectly. The proposed scheme can achieve satisfactory quality of decrypted image and high embedding rate. Experimental results demonstrate the effectiveness and computational efficiency of our scheme.

1. **An Efficient MSB Prediction-Based Method for High-Capacity Reversible Data Hiding in Encrypted Images**

**文献信息：**

Puteaux P, Puech W. An Efficient MSB Prediction-Based Method for High-Capacity Reversible Data Hiding in Encrypted Images[J]. IEEE Transactions on Information Forensics & Security, 2018, 13(7):1670-1681.

**摘要：**

Reversible data hiding in encrypted images (RDHEI) is an effective technique to embed data in the encrypted domain. An original image is encrypted with a secret key and during or after its transmission, it is possible to embed additional information in the encrypted image, without knowing the encryption key or the original content of the image. During the decoding process, the secret message can be extracted and the original image can be reconstructed. In the last few years, RDHEI has started to draw research interest. Indeed, with the development of cloud computing, data privacy has become a real issue. However, none of the existing methods allow us to hide a large amount of information in a reversible manner. In this paper, we propose a new reversible method based on MSB (most significant bit) prediction with a very high capacity. We present two approaches, these are: high capacity reversible data hiding approach with correction of prediction errors and high capacity reversible data hiding approach with embedded prediction errors. With this method, regardless of the approach used, our results are better than those obtained with current state of the art methods, both in terms of reconstructed image quality and embedding capacity.

1. **[Separable reversible data hiding in encrypted images with improved security and capacity](http://link.springer.com/article/10.1007/s11042-018-6187-y" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Li Q, Yan B, Li H, et al. Separable reversible data hiding in encrypted images with improved security and capacity[J]. Multimedia Tools & Applications, 2018(2):1-20.

**摘要：**

Reversible data hiding (RDH) has to be conducted in the encrypted images when original images are encrypted for privacy protection in some open environments, including the cloud computing. However, the current RDH algorithms in encrypted images with errorfree decryption may lead to leakage of image content and low embedding rate. In this paper, a novel RDH algorithm for image in encryption domain is proposed. To improve security, we propose a combined block permutation and a stream cipher into the encryption step, which considers data hiding in later steps. We further increase the embedding rate by proposing bit replacement in prediction error. This scheme has the advantages of built-in embedding flag, error-free decryption and high embedding rate. It can be applied to a wide variety of scenarios: If the recipient has only the data-hiding key, he can extract the hidden data but cannot restore the image; If the recipient has only the image encryption key, he can read the distorted image but cannot extract the hidden data; If the recipient has both keys, he can extract the hidden data and restore the original image completely.

1. **[Adaptive code embedding for reversible data hiding in encrypted images](http://xueshu.baidu.com/s?wd=paperuri:(d004ba6f76bdb5ae683bdaa671e3410e)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://ieeexplore.ieee.org/abstract/document/8297098/&ie=utf-8&sc_us=2486702645816052085" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Yi S, Zhou Y. Adaptive code embedding for reversible data hiding in encrypted images[C]// IEEE International Conference on Image Processing. IEEE, 2018:4322-4326.

**摘要：**

In this paper, we propose an adaptive code embedding method for reversible data hiding in encrypted images (ACE-RDHEI). It encrypts the original image into a noise-like one by block permutation and modulation, and no reserving room process is needed before image encryption. The secret data is then embedded into the encrypted image using adaptive code embedding (ACE). At the receiver side, using different security keys, users are able to extract the secret data and recover the original image separately and losslessly. Compared with existing RDHEI methods, ACE-RDHEI significantly improves the embedding rate. Experimental results are provided to show the excellent performance of our proposed algorithm.

1. **[Reversible data-hiding in encrypted images by redundant space transfer](http://xueshu.baidu.com/s?wd=paperuri:(0119d33b52b475b1643881639441556d)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://www.sciencedirect.com/science/article/pii/S0020025517311635&ie=utf-8&sc_us=8436148900837709161" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Liu Z L, Pun C M. Reversible data-hiding in encrypted images by redundant space transfer[J]. Information Sciences, 2018, s 433–434:188-203.

**摘要：**

Reversible data-hiding in an encrypted image (RDHEI) embeds additional data into the encrypted image content, in a manner such that the data-hiding operation does not affect the lossless recovery of the encrypted image content. In previous RDHEI methods, the encrypted images contain little redundant space; thus, these approaches may feature a low embedding rate and burden content owners with too many tasks. In contrast, in this paper, we propose a novel RDHEI by redundant space transfer (RST) scheme, which involves transferring redundant space from the original image to the encrypted image. Then, the encrypted image will necessarily contain redundant space. Thus, reversibly embedding data into this encrypted image becomes easy and efficient, and general reversible datahiding (RDH) algorithms can be used. The proposed scheme has the advantages of a high embedding rate and requires few tasks of the content owner. The experimental results show that the performance of the proposed scheme outperforms other RDHEI algorithms.

1. **[Reversible data hiding in encrypted images based on adaptive local entropy analysis](http://xueshu.baidu.com/s?wd=paperuri:(e3b59931b71f26598acfec22d40800be)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://ieeexplore.ieee.org/document/8310143/&ie=utf-8&sc_us=15203517280467580082" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Puteaux P, Puech W. Reversible data hiding in encrypted images based on adaptive local entropy analysis[C]// Seventh International Conference on Image Processing Theory, TOOLS and Applications. IEEE, 2018:1-6.

**摘要：**

With the development of cloud computing, the growth in information technology has led to serious security issues. For this reason, a lot of multimedia files are stored in encrypted forms. Methods of reversible data hiding in encrypted images (RDHEI) have been designed to provide authentication and integrity in the encrypted domain. The original image is firstly encrypted to ensure confidentiality, by making the content unreadable. A secret message is then embedded in the encrypted image, without the need of the encryption key or any access to the clear content. The challenge lies in finding the best tradeoff between embedding capacity and quality of the reconstructed image. In 2008, Puech et al. suggested using the AES algorithm to encrypt an original image and to embed one bit in each block of 16 pixels (payload = 0.0625 bpp) [12]. During the decryption phase, the original image is reconstructed by measuring the standard deviation into each block. In this paper, we propose an improvement to this method, by performing an adaptive local entropy measurement. We can achieve a larger payload without altering the recovered image quality. Our obtained results are very good and better than most of the modern state-of-the-art methods, whilst offering an improved security level with the use of the AES algorithm, defined as the encryption standard by the NIST.

1. **High-payload completely reversible data hiding in encrypted images by an interpolation technique**

**文献信息：**

Di XIAO, Ying WANG, Tao XIANG, Sen BAI. High-payload completely reversible data hiding in encrypted images by an interpolation technique[J]. 信息与电子工程前沿 (英文), 2017, 18(11):1732-1743.

**摘要：**

We present a new high-payload joint reversible data-hiding scheme for encrypted images. Instead of embedding data in the encrypted image directly, the content owner first uses an interpolation technique to estimate whether the location can be used for embedding and generates a location map before encryption. Next, the data hider embeds the additional data through flipping the most significant bits (MSBs) of the encrypted image according to the location map. At the receiver side, before extracting the additional data and reconstructing the image, the receiver decrypts the image first. Experimental results demonstrate that the proposed method can achieve real reversibility, which means data extraction and image recovery are free of error. Moreover, our scheme can embed more payloads than most existing reversible data hiding schemes in encrypted images.

1. **[Separable reversible data hiding in encrypted image based on pixel value ordering and additive homomorphism](http://xueshu.baidu.com/s?wd=paperuri:(e49bacb75473e1838730f4d89203c0e2)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://www.sciencedirect.com/science/article/pii/S104732031730038X&ie=utf-8&sc_us=5981535522848363429" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Xiao D, Xiang Y, Zheng H, et al. Separable reversible data hiding in encrypted image based on pixel value ordering and additive homomorphism[J]. Journal of Visual Communication & Image Representation, 2017, 45:1-10.

**摘要：**

This work proposes a separable reversible data hiding scheme in encrypted images based on pixel value ordering (PVO). After the original image is encrypted using homomorphism encryption by the content owner, the data hider embeds the secret data in encrypted domain. The PVO strategy realizes hiding data in each block. Additive homomorphism guarantees the performance of PVO in encrypted domain is close to that in plain domain. Besides, the homomorphism encryption does not cause data expansion, and the payload can be further improved. With the watermarked encrypted image, if the receiver has only the data hiding key, he can extract the additional data. If the receiver has only the encryption key, he can obtain a decrypted image similar to the original one. If the receiver has both the data hiding key and the encryption key, he can extract the additional data without any error and recover the original image losslessly.

1. **[Efficient reversible data hiding in encrypted image with public key cryptosystem](http://link.springer.com/10.1186/s13634-017-0496-6" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Xiang S, Luo X. Efficient reversible data hiding in encrypted image with public key cryptosystem[J]. Eurasip Journal on Advances in Signal Processing, 2017, 2017(1):59.

**摘要：**

This paper proposes a new reversible data hiding scheme for encrypted images by using homomorphic and probabilistic properties of Paillier cryptosystem. The proposed method can embed additional data directly into encrypted image without any preprocessing operations on original image. By selecting two pixels as a group for encryption, data hider can retrieve the absolute differences of groups of two pixels by employing a modular multiplicative inverse method. Additional data can be embedded into encrypted image by shifting histogram of the absolute differences by using the homomorphic property in encrypted domain. On the receiver side, legal user can extract the marked histogram in encrypted domain in the same way as data hiding procedure. Then, the hidden data can be extracted from the marked histogram and the encrypted version of original image can be restored by using inverse histogram shifting operations. Besides, the marked absolute differences can be computed after decryption for extraction of additional data and restoration of original image. Compared with previous state-of-the-art works, the proposed scheme can effectively avoid preprocessing operations before encryption and can efficiently embed and extract data in encrypted domain. The experiments on the standard image files also certify the effectiveness of the proposed scheme.

1. **[Reversible Data Hiding with Pixel Prediction and Additive Homomorphism for Encrypted Image](http://doi.org/10.1155/2018/9103418" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Yu C, Zhang X, Tang Z, et al. Reversible Data Hiding with Pixel Prediction and Additive Homomorphism for Encrypted Image[J]. 2018.

**摘要：**

Data hiding in encrypted image is a recent popular topic of data security. In this paper, we propose a reversible data hiding algorithm with pixel prediction and additive homomorphism for encrypted image. Specifically, the proposed algorithm applies pixel prediction to the input image for generating a cover image for data embedding, referred to as the preprocessed image. The preprocessed image is then encrypted by additive homomorphism. Secret data is finally embedded into the encrypted image via modular 256 addition. During secret data extraction and image recovery, addition homomorphism and pixel prediction are jointly used. Experimental results demonstrate that the proposed algorithm can accurately recover original image and reach high embedding capacity and good visual quality. Comparisons show that the proposed algorithm outperforms some recent algorithms in embedding capacity and visual quality.

1. **[Separable Reversible Data Hiding in Encrypted Halftone Image](http://xueshu.baidu.com/s?wd=paperuri:(3f8c06c9352927f4723bb5aca401bccf)&filter=sc_long_sign&tn=SE_xueshusource_2kduw22v&sc_vurl=http://www.sciencedirect.com/science/article/pii/S0141938218300052&ie=utf-8&sc_us=7529703337056072141" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Kim C, Shin D, Leng L, et al. Separable Reversible Data Hiding in Encrypted Halftone Image[J]. Displays, 2018.

**摘要：**

In this paper, new high-capacity separable reversible data hiding in an encrypted halftoned image is proposed. The proposed scheme used Hamming code to exploit embedding efficiency with a halftoned image. Our proposed scheme is meeting a condition of separable reversible data hiding in the encrypted image (SRDHEI) and can achieve a high embedding efficiency of a halftoned image with low distortion. Experimental results also show that the scheme provides a large embedding payload and reconstructs about the same original halftoned image and embedded additional information.

1. **[A reversible image data hiding scheme in Homomorphic encrypted domain](http://lxbwk.njournal.sdu.edu.cn/EN/Y2017/V52/I7/104" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

### [Y Ding,](http://xueshu.baidu.com/s?wd=author:(DING%20Yitao)%20&tn=SE_baiduxueshu_c1gjeupa&ie=utf-8&sc_f_para=sc_hilight=person" \t "http://xueshu.baidu.com/_blank) [H Yang,](http://xueshu.baidu.com/s?wd=author:(YANG%20Haibin)%20&tn=SE_baiduxueshu_c1gjeupa&ie=utf-8&sc_f_para=sc_hilight=person" \t "http://xueshu.baidu.com/_blank)  [X Yang,](http://xueshu.baidu.com/s?wd=author:(YANG%20Xiaoyuan)%20&tn=SE_baiduxueshu_c1gjeupa&ie=utf-8&sc_f_para=sc_hilight=person" \t "http://xueshu.baidu.com/_blank) [T Zhou](http://xueshu.baidu.com/s?wd=author:(ZHOU%20Tanping)%20&tn=SE_baiduxueshu_c1gjeupa&ie=utf-8&sc_f_para=sc_hilight=person" \t "http://xueshu.baidu.com/_blank). [A reversible image data hiding scheme in Homomorphic encrypted domain](http://lxbwk.njournal.sdu.edu.cn/EN/Y2017/V52/I7/104" \t "http://xueshu.baidu.com/_blank). [JOURNAL OF SHANDONG UNIVERSITY(NATURAL SCIENCE)](http://lxbwk.njournal.sdu.edu.cn/). [2017](http://lxbwk.njournal.sdu.edu.cn/EN/article/showTenYearVolumnDetail.do?nian=2017), [Vol. 52](http://lxbwk.njournal.sdu.edu.cn/EN/article/showTenYearVolumnDetail.do?nian=2017), [Issue (7)](http://lxbwk.njournal.sdu.edu.cn/EN/volumn/volumn_209.shtml): 104-110

**摘要：**

A reversible image data hiding scheme was proposed in homomorphic encryption domain. To reserve space for the embedded message, the original data is handled first of all. Then the image-owner used the receivers public key to encrypt the image and the sender embedded the message into the encrypted image. The receiver decrypted the encrypted image with the private key. The receiver got an image with contrast enhancement. The embedded message would be extracted and the image will be recovered if the receiver had the extracting key. At last, the MATLAB experiment proves the correctness of the scheme and better embedding rate.

1. **[High-capacity data hiding in encrypted images using MSB prediction](http://www.researchgate.net/publication/312571419_High-capacity_data_hiding_in_encrypted_images_using_MSB_prediction" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

### Puteaux P, Trinel D, Puech W. High-capacity data hiding in encrypted images using MSB prediction[J]. Electronic Imaging, 2017, 2017(7):1-6.

**摘要：**

With the development of cloud computing, data privacy has become a major problem. Reversible data hiding in encrypted images (RDHEI) is an effective technique to embed data in the encrypted domain. Indeed, a lot of methods have been proposed, but none allows a large amount of embedding capacity with a perfect reversibility. In this work, we present a new method of reversible data hiding in encrypted images using MSB (most significant bit) prediction. In order to reconstruct the original image without any errors during the decryption phase, we adapt the to-be-inserted message. Some of the pixels’ MSB values are used to highlight the prediction errors and the remaining values are replaced by bits of the secret message. Results show that it is still possible to embed a large message (payload close to 1 bpp).

1. **[Reversible Information Hiding Method in Encrypted Image Based on Surface Interpolation](http://www.researchgate.net/publication/325083891_Reversible_Information_Hiding_Method_in_Encrypted_Image_Based_on_Surface_Interpolation" \t "http://xueshu.baidu.com/_blank)**

**文献信息：**

Chen Y, Yu C Q, Hou X J, et al. Reversible Information Hiding Method in Encrypted Image Based on Surface Interpolation[J]. Journal of Applied Sciences, 2018, 36(2):220-236.

**摘要：**

提出一种基于曲面插值的加密图像可逆信息隐藏算法．对原始图像进行加密，利用随机函数确定加密图像中的载体像素，根据载体像素取反位的不同采取不同的隐藏方法．对载密图像进行解密以确定载体像素，在载体像素5×5邻域中选取与载体像素距离最近的6个非载体像素，采用曲面插值的方法计算载体像素的预测值，应用该预测值提取秘密信息并恢复载体像素．实验结果表明，该算法提取秘密信息的错误率较低，恢复图像的视觉效果较好．