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# Data Hiding Scheme For Side Match Vector Quantization and Arnold Decoding

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**ABSTRACT:** In any communication, security is the most important issue in today's world. Security and data hiding algorithms have been developed, which worked as motivation for the research. This project is a data hiding by using side match vector quantization algorithm may used for data hiding scheme, which provides a strong backbone for its security. The scenario of present day of information security system includes privacy, genuineness, honesty, non-repudiation. This present work focus is hiding for data technique to secure data or message with authenticity and truthfulness. In this project work, the secret message is encrypted before the actual embedding process starts. The entire work has done in MATLAB. The hidden message is encrypted using a simple encryption algorithm using secret key for SMVQ and hence it will be almost unfeasible for the impostor to unhide the actual secret dispatch from the embedded cover file without knowing furtive key. Only receiver and sender know the secret key. SMVQ substitution technique is used as embedding and extraction method. We propose that this method could be most appropriate for hiding any secret message (text, image, audio, and video) in any standard cover media such as image, audio, video files.

**KEYWORDS:** Data hiding, image compression, side match vector quantization, Arnold decoding

## I. INTRODUCTION

The rapid expansion of Internet technology, people can transmit and share digital content with each other conveniently. In order to guarantee communication competence and save system bandwidth, compression techniques can be implemented on digital content to decrease redundancy, and the excellence of the decompressed versions should also be conserved. Nowadays, most digital content, especially digital images and videos are rehabilitated into the compressed forms for transmission [1-4]. Another imperative issue in an open network environment is how to send out secret or personal data steadily. Even though traditional cryptographic methods can encrypt the plaintext into the cipher text [5-6], the meaningless accidental data of the cipher text may also arouse the misgiving from the attacker. To solve this problem, in sequence hiding technique have been broadly urbanized in both academic world and industry, which can embed secret data into the cover data unnoticeably [7-8]. Due to the prevalence of digital images on the Internet, how to compress images and hide secret data into the dense images efficiently deserve in-depth study. Recently, many data-hiding scheme for the compressed codes have been reported, which can be applied to various density techniques of digital images, such as JPEG [9-10], JPEG2000 [11], and vector quantization (VQ) [12-15]. As one of the most accepted lossy data compression algorithms, VQ is widely used for digital image compression due to its simplicity and cost efficiency in implementation [16-17]. During the VQ compression process, the Euclidean distance is utilized to evaluate the similarity between each image block and the codeword in the codebook. The index of the codeword with the negligible distance is recorded to symbolize the chunk. Thus, an index table consisting of the index values for all the blocks is generate as the VQ firmness codes. Instead of pixel principles, only the index values are stored, consequently, the density is achieved effectively. The VQ decompression process can be implement easily and efficiently because only a simple table lookup operation is required for each received index. The proposed scheme in this paper is based on SMVQ. On the sender side, except for the blocks in the leftmost and

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uppermost of the image, each of the other residual blocks in raster-scanning order can be entrenched with secret data and packed in concomitantly by SMVQ. adaptively according to the current embedding bit. VQ is also utilized for some complex residual blocks to control the visual distortion and error diffusion caused by the progressive firmness. After receiving the compressed codes, the receiver can segment the packed in codes into a series of sections by the indicator bits.

## II. JOINT DATA COMPRESSION SCHEME AND ARNOLD DECODING

In the proposed scheme, rather than two separate modules, only a single module is used to realize the two functions, i.e., image compression and secret data embedding, simultaneously. The image compression in mainly on the SMVQ mechanism. According to the secret bits for embedding, the image compression based on SMVQ. After receiving the secret embedded and compressed codes of the image, one can extract the embedded secret bits successfully during the image decompression..

### *A. Image enhancement*

Image compression may be lossy or lossless. Lossless compression is preferred for archival purposes and often for medical imaging, technical drawings, clip art, or comics. Lossy compression methods, especially when used at low bit rates, introduce compression artifacts. Lossy methods are especially suitable for natural images such as photographs in applications where minor (sometimes imperceptible) loss of fidelity is acceptable to achieve a substantial reduction in bit rate. The lossy compression that produces imperceptible differences may be called visually lossless.

### *B. Data Embedding*

Data hiding was introduced as part of the OOP methodology, in which a program is segregated into objects with specific data and functions. This technique enhances a programmer's ability to create classes with unique data sets and functions, avoiding unnecessary penetration from other program classes. Because software architecture techniques rarely differ, there are few data hiding contradictions. Data hiding only hides class data components, whereas data encapsulation hides class data parts and private methods.Information hiding for programmers is executed to prevent system design change. If design decisions are hidden, certain program code cannot be modified or changed. Information hiding is usually done for internally changeable code, which is sometimes especially designed not to be exposed. Such stored and derived data is not expounded upon, most generally. Change resilience of classes and ease of use by client objects are two byproducts of hidden data.

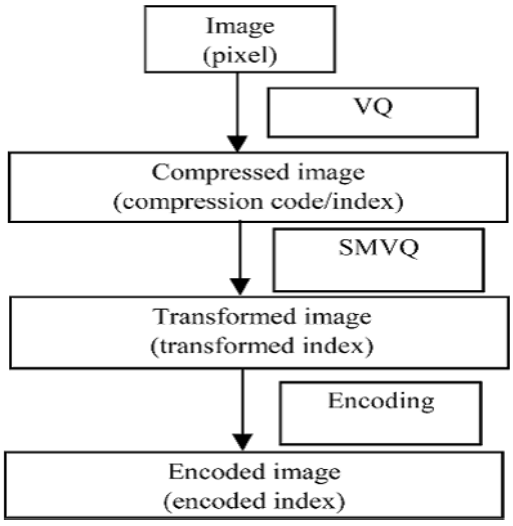


Fig. 1. Flowchart of compression and secret data embedding for each Block

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To behavior the decompression and secret bit extraction of each remaining block, the compressed codes are segmented into a series of section adaptively according to the indicator bits. Explicitly, if the current indicator bit in the packed in codes is 0, this indicator bit and the following log2 *W* bits are segmented as a piece, which means this section corresponds to a VQ compressed block with no embedded secret bit. The decimal value of the last log2 *W* bits in this section is exactly the VQ index that can be used directly to recover the block. Otherwise, if the current indicator bit is 1, this indicator bit and the subsequent log2 (*R* + 1) bits are then segmented as a section, which means this section corresponds to an SMVQ or inpainting compressed block. Denote the decimal value of the last log2 (*R* + 1) bits in this section as λ'. Under this condition, if λ' is equal to *R*, it implies that the residual block parallel to this section was compressed by inpainting and that the embedded secret bit in this block is 1. Otherwise, if λ' ∈ [0, *R* − 1], it imply that the block matching to this section was compressed by SMVQ and that the entrenched secret bit is 0. After all the segmented sections in the packed in codes complete the above describe procedure, the embedded secret bits can be extracted correctly, and the decompressed image **I***d* can be obtain successfully. Due to the decoding of the compressed codes, the decompressed picture **I***d* doesn't surround the embedded secret bits any longer. Note that the process of secret bit extraction can also be conducted separately, the data embedding technique may be used for many algorithms one of the best technique is side match vector quantization technique which means that the receiver can obtain all embedded bits by simply segmenting and analyzing the compressed codes without the decoding. the receiver can obtain the secret bits at any moment if he or she conserve the compressed codes. The proposed scheme can also be used for the integrity corroboration of the images, in which the secret bits for embedding can be regarded as the hash of the image attitude contents. The receiver can calculate the hash of the principle contents for the decompressed picture, and then compare this calculated hash with the extracted secret bits (embedded hash) to judge the integrity of the received compressed codes and the corresponding decompressed image. If the two hashes are equal, it earnings the image is genuine. Otherwise, the received compressed codes must be tampered.

## III. EXPERIMENTAL RESULTS AND ANALYSIS

Experiments were conducted on a group of gray-level images to verify the effectiveness of the proposed scheme. In the experiment, the sizes of the divided non-overlapping image blocks were 4 × 4, i.e., $n = 4$. Accordingly, the length of each codeword in the used VQ codebooks was 16. The parameter *R* was set to 15. Six standard, 512 × 512 and 256 × 256 test images, i.e., Lena, Airplane, Lake, Peppers, Sailboat, and Tiffany,The luminance components of the color images in this database were xtracted and used in the experiments. The performance of compression ratio, decompression quality, and beating capacity for the proposed scheme were evaluated.


Fig.2. Six standard different test images

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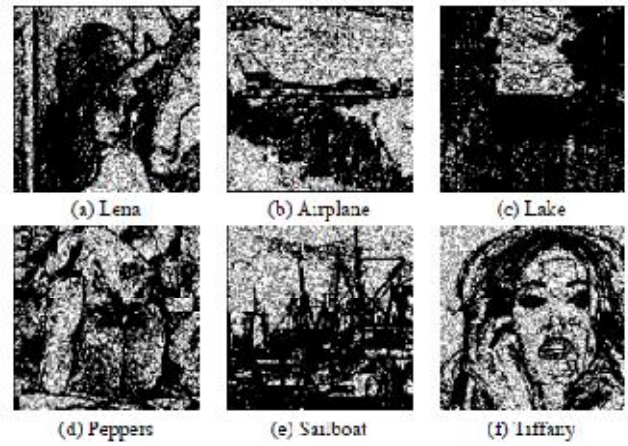


Fig.3. Labels of image blocks with different types ($T$ = 16). The black block, gray block, and white block in Figures 5(a)-(f) correspond to the blocks compressed by VQ, SMVQ, and Arnold decoding, respectively.

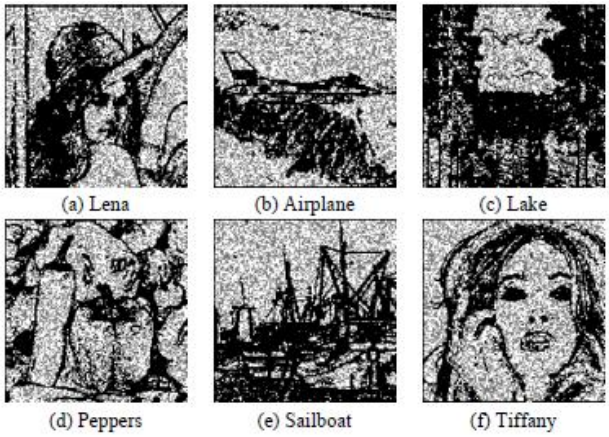


Fig. 4. Labels of image blocks with different types ($T$ = 28). The black block, gray block, and white block in Figures 6(a)-(f) correspond to the blocks compressed by VQ, SMVQ, and Arnold coding, respectively.


Fig 5: the above figures first two images are original images and second two are embedded data.

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Because the threshold *T* used in the procedure of image density and secret data embedding is closely related to the compression method for each residual block and also influences on the performance of the proposed scheme, the testing for unlike values of *T* was first conducted in the compression and secret embedding procedure. Figures 4 and 5 show the labeling results of image blocks with different compression method, in which the black block, gray block, and white block correspond to the blocks compressed by VQ, SMVQ, and image inpainting, respectively. The VQ codebook size *W* used in Figures 54and 5 was 256, and secret bits for embedding were generated by (PRNG). Note that the blocks in the topmost row and the leftmost column must be black, i.e., compressed by VQ. It can be obviously found that the number of SMVQ blocks and blocks increase with *T*, while the number of VQ blocks decreases. As describe in Section 2, the blocks compressed by VQ are not used for secret bit embed, and the secret bits are only entrenched in the SMVQ and Arnold decoding. Thus, the hiding capacity of the proposed scheme is equal to the sum of the numbers of SMVQ Figures 4(a)-(d) show the relationships between hiding capacity and threshold *T* for the six test images in Figure 4 with codebook sizes *W* = 128, 256, 512, and 1024, respectively. We can observe that, with the same codebook, the hiding capacity increases with the threshold *T*. It can also be seen from Figure 7 that, under the same threshold *T*, the hiding capacity also increases with the codebook size *W*. We compare the hiding capacity of the proposed scheme with three typical schemes [31-33].

i.e., Tsai *et al.*'s scheme [31] and Qian *et al.*'s scheme [32], and is comparable to the scheme in [33] that embedded secret information by histogram shifting in the uncompressed domain. The assessment results also demonstrate that the image compressed codes based on SMVQ can be used to carry more secret bits than the JPEG packed together codes.

$$C_R = \frac{8 \times M \times N}{L_c},$$

$$\mathrm{PSNR} = 10 \times \log_{10} \frac{255^2 \times M \times N}{\sum_{x=1}^{M} \sum_{y=1}^{N} [I(x,y) - I_d(x,y)]^2},$$

The above equation may be consisting for to calculate the peak signal to noise ratio.

The PSNR values are improved for depending upon previous technique for data hiding. And data hiding for improved algorithm is Arnold coding may applied for to improve the PSNR results. Luminance and contrast synthetically for the image quality assessment [20].with the increase of *T*, more blocks are processed by SMVQ & ARNOLD.

| Schemes | $W = 128$ | | | $W = 256$ | | | $W = 512$ | | | $W = 1024$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $C_R$ | PSNR | SSIM | $C_R$ | PSNR | SSIM | $C_R$ | PSNR | SSIM | $C_R$ | PSNR | SSIM |
| VQ | 18.29 | 29.70 | 0.8371 | 16.00 | 30.40 | 0.9101 | 14.22 | 31.13 | 0.9287 | 12.80 | 31.67 | 0.9412 |
| SMVQ | 20.66 | 29.70 | 0.8371 | 19.80 | 30.40 | 0.9100 | 19.16 | 31.12 | 0.9269 | 18.32 | 31.64 | 0.9413 |
| Scheme in [31] | 20.66 | 28.86 | 0.8353 | 19.80 | 29.75 | 0.9037 | 19.16 | 30.49 | 0.9254 | 18.32 | 30.93 | 0.9347 |
| Scheme in [27] | 21.98 | 26.62 | 0.8754 | 20.20 | 28.11 | 0.8986 | 19.73 | 28.24 | 0.9038 | 19.65 | 28.94 | 0.9105 |
| Proposed Scheme | 20.66 | 29.85 | 0.9086 | 19.80 | 30.57 | 0.9353 | 19.16 | 31.27 | 0.9447 | 18.32 | 31.78 | 0.9526 |

**Table: Comparison of compression technique WITH DIFFERENT CODEBOOK SIZES FOR different images**

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Therefore, the compression ratio *CR* increases accordingly, and the decompression quality also becomes better because image inpainting has superior recovery capability for smooth blocks compared with VQ. The side matches vector quantization technique and Arnold decoding technique may use for data hiding for proposed method. The proposed method by using data embedded for secrets data for data transmission for channel. In data transfer channel may used is a process in which the characristics of a carrier wave is varied in accordance with the instantaneous values of a modulated data.

## IV. CONCLUSIONS

In this paper, we proposed a joint data-hiding and compression scheme by using SMVQ and PDE-based image Arnold decoding. The blocks, except for those in the leftmost and topmost of the image, can be embedded with covert data and packed in at the same time, and the adopted compression method switches between SMVQ and SVD adaptively according to the embed bits. SVD (singular value decomposition) is also utilized for some complex blocks to control the visual distortion and error dissemination. The SVD method may be used for better results coming to existing system. On the recipient side, after segmenting the packed in codes into a series of sections by the indicator bits, the embedded secret bits can be easily extract according to the index values in the segmented sections, and the decompression for all blocks can also be achieved productively by VQ, SMVQ, and Arnold coding. The experimental results show that our scheme has the acceptable performance for hiding capacity, compression ratio, and decompression quality. Furthermore, the proposed scheme can integrate the two functions of data hiding and image compression into a single module seamlessly. In feature work would be better results coming to receiver and transmitter part.

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