Synchronously Image Size Reduction using Modified Vector Quantization with Data Hiding

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Abstract

This paper represents the scheme of data hiding and image size reduction based on side match vector quantization (SMVQ). On the sender side, residual blocks of an image compressed consecutively by SMVQ. Except for the blocks in the leftmost and topmost of the image, each of the other residual blocks is embedded with secret data. As the scheme of data compression is followed by data hiding technique. The goal of technique is to reduce the size of original image and to save storage. Compressed image is output of scheme which can be decompressed to get original image. It can be reused for various applications. Experimental results demonstrate the effectiveness of the proposed scheme in terms of compression ratio.

Keywords: SMVQ, DSMVQ, Vector Quantization, Search Order Coding

I. INTRODUCTION

With the fast expansion of internet technology, public be capable of transmission and sharing digital content with all easily. With the purpose of assurance of communication efficiency and save network bandwidth, compression techniques can be introduced on digital content to decrease or remove redundancy of image. Currently, the majority digital content, especially digital images as well as videos are transformed into the compressed forms for transmission. One more vital issue in an open network atmosphere is how to pass on secret or secretive data securely. Even though conventional cryptographic methods are able to encrypt the plaintext into the cipher text, the meaningless unsystematic data of the cipher text may also arouse the suspicion from the attacker. To resolve this problem, information hiding techniques have been broadly developed in educational and business. Due to the pervasiveness of digital images on the Internet, how to compress images and hide secret data into the compressed images proficiently in depth study. Among the many image compression techniques that have been proposed Vector Quantization is one of the popular.

However, in all of the above mentioned schemes, data hiding is constantly conducted following image compression, which means the image compression process and the data hiding process are two self-sufficient parts on the server or sender side. Under this circumstance, the attacker may have the opportunity to capture the compressed image with no watermark information rooted. Thus, in this work, we are not only center of attention on the high hiding capacity and improvement quality, but also establish a combined data hiding in addition to compression concept with integrate the statistics hiding and the image compression into a single module effortlessly, which can avoid the threat of the attack commencing interceptors and boost the implementation efficiency. The proposed combined data hiding and image compression scheme in this paper is based on SMVQ and image in painting. On the sender side, apart from the blocks in the leftmost column and topmost row of the image, each of the other residual blocks in raster-scanning order can be embedded with secret data and compressed simultaneously by SMVQ or image in painting adaptively according to the current embedding bit. VQ is applied for some difficult residual blocks to have power over the visual distortion and fault dispersion caused by the progressive compression. After receiving the compressed codes, the receiver can segment the compressed codes into a series of sections by the marker bits. According to the index values in the segmented sections, the embedded secret bits can be extracted properly, and the decompression for every block can be achieved successfully.

The remaining paper is structured as follow. In section II methodology of SMVQ and DSMVQ are described. SMVQ is data compression scheme initiates from formation of codebook. After that reducing the redundancy of codebook; we can transform image into compressed image. Side match vector quantization methodology is evaluated in detail. Experimental result is represented in section III. Conclusion and future scope of SMVQ technique are mentioned in section IV.

II. PROPOSED METHOD

A. Reduction of an image size using SMVQ

Here, in SMVQ scheme, sender and receiver both have the same codebook \( Y \) with \( W \) codewords and all codeword of length is equal to \( n^2 \). Denote the original input image (I) sized \( M \times N \). Image I is divided into \( n \times n \) non-overlapping blocks. \( B_{i,j} \) is residual block where SMVQ is applied. Raster scan is performed on \( B_{i,j} \) on \( k \) divided blocks.

Where,
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\[ k = \frac{M \times N}{n^2} \]

\( i=1, 2, 3 \ldots M/n \) and \( j=1, 2, 3 \ldots N/n \). Scrambling of secret bit is done by secret key to ensure security.

\[ UD(y) = \sum_{j=1}^{4} (U_{ij} - y_{ij}) \]

Similarly, the left distortion \( LD(y) \) between the codeword \( y \) and the left block \( L \) is computed as-

\[ LD(y) = \sum_{i=1}^{4} (L_{ij} - y_{ij}) \]

The side matches distortion \( SMD(y) \) of the codeword \( y \) is defined as-

\[ SMD(y) = UD(y) + LD(y) \]

To decode a block \( X \), the previously encoded upper and left blocks are used to predict the sub codebook with the least side match distortion for the current block \( X \). The generated sub codebook is then searched to find the corresponding codeword to approximate the current block. Compared with VQ, SMVQ succeeds in reducing the number of bits required to digitize the image and improves the illustration quality. As SMVQ is prediction based scheme may used to compress and concept of data hiding implemented using steganography.

III. EXPERIMENTAL RESULT AND ANALYSIS

To maintain the advantages of SMVQ can make sure the original size if image is reduced after compression. Also we can hide the secret data in the compressed image after scrambling secret data by secret key and at receiver side extraction of secret data is achieved successfully. The procedures for hiding and extracting and reversing are straightforward.

The compression ratio \( CR \) can be calculated as-

\[ CR = \frac{\text{Original Size}}{\text{Compressed Size}} \]
$C_R[1] = \frac{8 \times M \times N}{L_c}$

Where,
M and N are size of image
And $L_c$ is length of compressed code.

### Table - 1
Evaluation of various parameters for various images

<table>
<thead>
<tr>
<th>Parameters/images</th>
<th>Elaina</th>
<th>Penguin</th>
<th>Girl</th>
<th>Cam-man</th>
<th>Monarch</th>
<th>Tree leaf</th>
<th>Lena</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original size of image in (kb)</td>
<td>121</td>
<td>109</td>
<td>84.7</td>
<td>65</td>
<td>549</td>
<td>197</td>
<td>500</td>
</tr>
<tr>
<td>Compression ratio</td>
<td>23.19</td>
<td>25.95</td>
<td>25.86</td>
<td>24.40</td>
<td>20.48</td>
<td>17.34</td>
<td>28.94</td>
</tr>
<tr>
<td>Size after compression in (kb)</td>
<td>4.42</td>
<td>4.87</td>
<td>3.83</td>
<td>4.41</td>
<td>4.91</td>
<td>5.6</td>
<td>4.56</td>
</tr>
<tr>
<td>Data hide</td>
<td>Hello Elaina</td>
<td>Hello penguin</td>
<td>Hello girl</td>
<td>Hello camera</td>
<td>Hello monarch</td>
<td>Green leaf town</td>
<td>Lena</td>
</tr>
</tbody>
</table>

### IV. CONCLUSION
We propose an image size reduction and data hiding scheme based on SMVQ which has the flexibility in adjusting the data hiding size. The flexibility makes the proposed scheme suitable for more applications such as transmission of data over networks, security and also less storage. We got admirable results with side match vector quantization technique and goal to reduce the size of image is proved. In the future, we will try to design a decompression algorithm to reconstruct the original image.

### REFERENCES


[13] www.google.co.in