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Determine Blocks of Image for Hiding Operation Based on Quad Chain Code and DCT

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Abstract:

This paper displays a new idea for determining some regions of an image for embedding .feature extraction will determine blocks of an image by using Quad Chain Code (QCC) to collect the values of pixels that are similar with each other in a block of size 8x8, and perform number of operations on this block as following: apply Discrete Cosine Transform (DCT), calculate the features (number of zeros in DCT coefficients), use the block that contains large number of zeros for embedding based on features values. In the next step, shrink the original image after removing the values of previous block and repeat the above operation until no data exists with more similarity.

Key words: feature extraction, Chain code, DCT, information hiding, QCC

1. Introduction

Information hiding is a way that prevents the detection of hidden message; the secret message is embedded in some regions of an image (cover) according to many algorithms and different techniques [1] .A picture is worth a thousand words. Human beings are able to tell the story from an image based on what they have seen. Computer program is able to discover semantic concepts from images. The first step for a computer program in semantic understanding, however, is to extract efficient and effective visual features and create models from them rather than human background knowledge. So we can see how to extract an image with low-level visual features and what type of features will be extracted to play an important role in different tasks of image processing. The most common visual features include color, texture and shape, etc. [2]. Feature extraction includes the image features to a distinguishable degree. Average RGB, Color Moments, Co-occurence, Local Color Histogram, Global Color Histogram and Geometric Moments are used to extract features from the original image. Feature matching, on the other hand, includes matching the extracted features to return results that display visual similarities [3]. The extraction task converts rich content of images into several content features. Feature extraction is the process of creating features to be used in the selection and classification tasks. Feature extraction is most critical because the particular features made available for discrimination directly affect the effectiveness of the classification task. The end result of the extraction task is a set of features, generally called a feature vector, which represent the image. The various features currently used are shown as following*:*

General features: Application independent features such as color, texture, and shape. According to the abstraction, they can be divided into*:*

-*Pixel-level features*: Features calculated at each pixel, e.g. color, location*.*

-*Local features*: Features calculated over the results of subdividing the image band on the image segmentation or edge detection*.*

-*Global features*: Features calculated over the full image or just regular sub-area of an image*.*

Domain-specific features: Application dependent features such as human faces, fingerprints, and conceptual features. These features are often a fusion of low-level features for a specific domain [4]. In this paper we use number of zeros as a feature for the image.

1.1 Chain Code.

Chain codes are one of the shape representations which are used to represent a border of image by a linked sequence of straight line segments of specified length and direction .This representation is based on 4- connectivity or 8-connectivity of the sections [5]. The 4-connectivity uses only vertical and horizontal movements between adjacent pixels, whereas the 8-connectivity also allows diagonal connections, the example as shown in Fig. (1). [6]

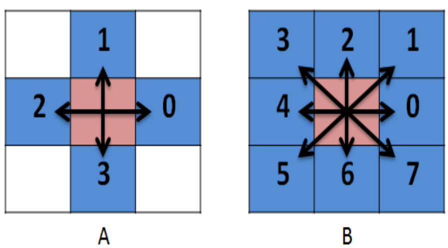
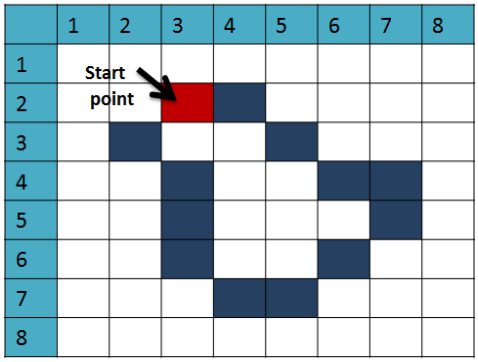


Figure (1)

A. chain code for 4-conectivtiy B. chain code for 8-conectivtiy

The chain code of a segment can start at any pixel on the boundary. It profits by finding the next adjacent pixel on the boundary in a clockwise direction by save the direction (0-7) in an output buffer, and then continuing the process from the next pixel. When we reach at the starting pixel again, the chain code is complete. The output buffer contains a set of direction values which include the chain code itself, and from which the original set of pixels can be recreated starting at any pixel position in an image. As an example, a chain code for the region is shown in figure (2).



A. The chain code 4-conectivtiy=0,0,3,0,3,0,3,2,3,2,3,2,1,2,1,1,1,2
B. The chain code 8-conectivtiy=0,7,7,0,6,5,5,4,3,2,2,3

Figure (2) Example of chain code (clockwise)

1.2. Discrete Cosine Transform (DCT).

DCT methods are one of the popular techniques that are used for feature extraction [7]. The discrete cosine transform is fast and a good transformation. It has an excellent compaction for highly correlated data and gives good settlement between information packing ability and computational difficulty [8]. DCT is the most commonly used transform in the image processing applications for feature extraction. The method includes taking the transformation of the whole image and splitting the relevant coefficients. The DCT of an image basically involves three frequency components that is low, middle and high each having some detail and information in an image. The low frequency in general contains the average intensity of an image [9].The number in zeros of DCT coefficients transform important feature of the image .In this paper, will be equip some regions of the image to embedded payload secret message depending on DCT block coefficients that contains high number of zeros.

2. The proposed system

The proposed system as illustrated in Figure (3) is the extract features (number of zeros) from the image depending on (QCC) Quad Chain Code and (DCT) Discrete Cosine Transform.

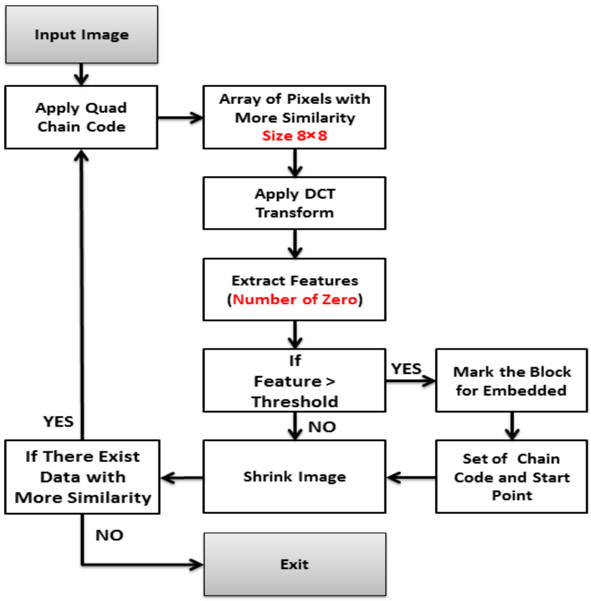


Figure (3) the proposed system block diagram.

There are several steps to extract features from image in the proposed system, it consist of:

2.1. Read input image.

The image will be converted to gray level image (0-255) value.

2.2. Apply Quad Chain Code.

In this paper we are using the 8-connected FCC (freeman chain code) each code can be considered as the angular direction in multiple of 45 degree that we must move to go from on contour pixel to the next. The Proposed method is that we will develop the chain code by using Quadruple pixel (vector of 4 pixels), and find the chain code for image depending on one of the measures similarity that is used to find alike two vectors Adjacent. Figure (4) show an example that illustrates how the Quad chain code computed in image.

start	1	2	3	4	5	6	7	8	9	10
1	3	1	10	70	10	70	55	33	3	1
2	2	2	20	210	20	210	11	5	2	2
3	7	7	3	1	11	70	3	1	10	70
4	2	6	2	2	21	210	2	3	21	210
5	14	60	3	1	9	71	110	1	3	1
6	51	7	2	5	20	211	3	4	2	2
7	4	2	10	70	3	1	3	1	10	70
8	2	2	20	210	2	2	2	2	22	205
9	12	33	3	1	10	70	10	70	15	1
10	27	55	2	1	20	210	20	210	3	29

The first quad chain code in location (1,1)=7,6,7,0,1,3,2

The blocks = B1,B7,B12,B18,B19,B15,B9,B5

The second quad chain code in location (1,2)=0,6,6,5,7,0,1

The blocks= B2,B3,B8,B13,B17,B23,B24,B20

Figure (4). Quad chain code example.

2.3. Array of pixels with more similarity .

In this step we will be Collecting the quad pixels that were extracted from the above step for equip block with size 8×8 .each quad pixel of the 8×8 block (16 Quad pixels,64 pixels) is similar with each other. The similarity measures that can be applied in the proposed system that is used to find alike values between Quad pixel or blocks Quartet are:

(1) **Cosine Similarity**: If B1 and B2 are two Quad pixels (vector), then

$$Cos(B1, B2) = (B1 \cdot B2) / ||B1|| \; ||B2||$$

Where • indicates vector dot product and || B || is the length of vector B .

For example let B1=(3,1,2,2) and B2=(3,1,2,5) then the cosine similarity between B1 and B2 is:

$$B1 \cdot B2 = 3*3 + 1*1 + 2*2 + 2*5 = 24$$

$$||B1|| = (3*3+1*1+2*2+2*2)0.5 = (18)\ 0.5 = 4.242$$

|| B2||= (3*3+1*1+2*2+5*5) 0.5 = (39) 0.5 = 6.244

Cos(B1,B2)=0.90610.

As long as the cosine similarity value is closer to 1 that mean blocks is more alike and Vice versa.

(2) Extended Jaccard Coefficient (Tanimoto): If p and q are two Quad pixels(vector), then

$$T(p,q) = \frac{p \bullet q}{\|p\|^2 + \|q\|^2 - p \bullet q}$$

2.4. Apply DCT Transformation.

DCT is the most commonly used transform in the image processing applications for feature extraction. The method includes taking the transformation of the image as an entire and splitting the relevant coefficients. DCT performs energy compaction. The DCT of an image mainly consists of three frequency components namely low, middle, high each covering some detail and information in an image. The low frequency generally contains the average intensity of an image [9]. Mathematically, the tow dimension-DCT of an image is given by :

$$F(u,v) = \frac{1}{4} C(u)C(v) \sum_{x=0}^{7} \sum_{y=0}^{7} f(x,y) \cos\left[\frac{\pi(2x+1)u}{16}\right] \cos\left[\frac{\pi(2y+1)v}{16}\right]$$

for $u = 0,\ldots,7$ and $v = 0,\ldots,7$

$$\text{where } C(k) = \begin{cases} 1/\sqrt{2} & \text{for } k = 0 \\ 1 & \text{otherwise} \end{cases}$$

in this step each block of the image is converted from spatial domain to frequency domain .The first coefficient in this 2D-DCT is known as the DC component, representing the average intensity of an image, whereas the rest are the AC coefficients corresponding to high frequency components of the image.

2.5. Extract features.

In this step we will be extracting features on DCT coefficients that were obtained from the above step. There are several features that can be extracted. In this proposed system we will be extracting feature from 2D-DCT (64 coefficients) that represents number of zeros in 2D-DCT transform.

2.6. Test feature with threshold.

In this step we will be checking the value of the feature that was extracted above with threshold: if the Feature is larger than the threshold then, the current block will be marked for embedding through saving the index of the start location point and stream of chain code in boundary of original image and next, must shrink the original image. On the other hand if the feature that was extracted smaller than threshold then the original data must go to the next step, shrinking the image.

2.7. Shrink image.

In this step we will be shrinking the original image to discard the block extracted from the above steps raw by raw.to explain this process as shown the example in figure(4), the shrink image will be in Table (1) after applying tow level of proposed system. For each level was a cancel (8) Quad pixel (32) pixel.

Table (1) the image data after Apply Shrink process.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	55	33								
2	11	5								
3	7	7	10	70						
4	2	6	21	210						
5	14	60	110	1						
6	51	7	3	4						
7	4	2								
8	2	2								
9	12	33	3	1	15	1				
10	27	55	2	1	3	29				

2.8. Check image.

In this step we will checked the image if it contain 8×8 pixels with more similarity depending on Quad chain code ,if it found must go to step number 2.2 and so on. Another hand if the image does not have 8×8 pixels with more similarity then must finish algorithm.

3. Experimental results

Experiments of proposed method in this paper are performed on 6 color images with size 256 ×256 as given in Fig.(5):

image1

image2

image3

image4

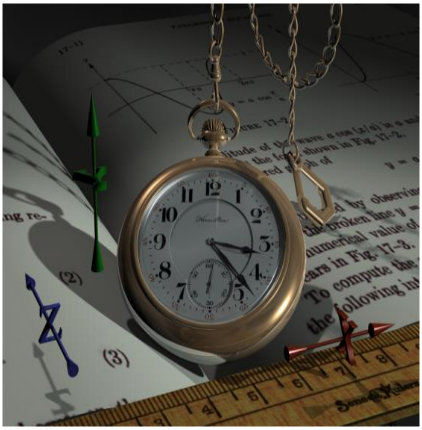


image5

image6

Figure (5) Experimental images.

When apply the proposed system in this paper for each image in the above figure when the threshold is (32). We get the following results in Table (2).

Table (2) the Experimental images

Image	**No. of blocks**	**No. of mark block**	**Similarity ratio**	**Time**
Image1	771	25	99%	2 sec
Image2	928	333	99%	3 sec
Image3	877	17	99%	3sec
Image4	1041	33	99%	3 sec
Image5	751	13	99%	2 sec
Image6	1018	17	99%	3sec

6. CONCLUSIONS

This paper, presents a new idea for determine blocks of mage that is more secure for hiding depending on chain code and DCT. The proposed method is developing the traditional freeman chain code to quad pixels of chain code that select blocks of pixels with same similarity. The DCT coefficients are used to find features for each block depending on number of zeros, the main contribution of this paper is:

1. The proposed system of this paper is more secure for embedded secret message in marking blocks because of the quad chain code that is used to determine regions from the image for hiding.
2. Data with similar values will give large numbers of zero coefficients after applying the DCT transformation. The system uses this feature as a benefit for embedding.

REFERENCES:

[1] Komal Patel, Sumit Utareja, Hitesh Gupta, A Survey of Information Hiding Techniques, International Journal of Emerging Technology and Advanced Engineering, Volume 3, Issue 1, January 2013

[2] Dong ping Tian, A Review on Image Feature Extraction and Representation Techniques, International Journal of Multimedia and Ubiquitous Engineering ,Vol. 8, No. 4, July, 2013.

[3] Aman Chadha, Sushmit Mallik, Ravdeep Johar, Comparative Study and Optimization of Feature-Extraction Techniques for Content based Image Retrieval, International Journal of Computer Applications (0975 – 8887)Volume 52– No.20, August 2012.

[4] Ryszard S. Chora´s, Image Feature Extraction Techniques and Their Applications for CBIR and Biometrics Systems, International Journal Of Biology And Biomedical Engineering, Issue 1, Vol. 1, 2007.

[5] Nor Amizam Jusoh , and Jasni Mohamad Zain , Application of freeman Chain Codes: An Alternative Recognition Technique for Malaysian Car Plates, IJCSNS International Journal of Computer Science and Network Security, VOL.9 No.11, November 2009.

[6] Tawfiq Abdulkhaleq Abbas, Fanar Ali Joda, Locational Image Compression based on Chain Code Representation, IOSR Journal of Engineering (IOSRJEN), Vol. 04, Issue 01 (January. 2014), ||V3|| PP 24-29.
[7] P. A. Hemalatha, Image Retrieval by content using DCT and RGB Projection, International Journal of Computer Science & Communication Networks, Vol 3(3), 134-140.
[8] Arvind Sharma, Dr. Sanjeev Sharma, Nishchol Mishra, Image Retrieval Based on Combined features of DCT and Shape Descriptor , Int. J. Comp. Tech. Appl., Vol 2 (4), 993-998, July-August 2011.
[9] K Manikantan, Vaishnavi Govindarajan, V V S Sasi Kiran, S Ramachandran, Face Recognition using Block-Based DCT Feature Extraction, Journal of Advanced Computer Science and Technology, 1 (4) (2012) 266-283.
[10] Pawan Sinha, Benjamin Balas, Yuri Ostrovsky, Richard Russell, Face Recognition by Humans: Nineteen Results All Computer Vision Researchers Should Know About, In proceedings of IEEE, Vol. 945 (2006.)