Photorealistic Computer Graphics Identifying Algorithm Based on Improvement Local Binary Pattern

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ABSTRACT

As for the problem of high computational complexity and low detection rate of existing computer-generated image recognition algorithm, in this paper by analyzing the differences between photorealistic computer graphics and natural image on image texture, we put forward a photorealistic computer graphics identifying algorithm based on Improvement Local Binary Pattern. This algorithm can describe the details of the image and then we extract the feature value according to detail of the image. At last we use support vector machines to classify. The results show that the presented method can not only identify the photorealistic computer graphics and natural image but also have better identification rate.

KEYWORDS
Photorealistic Computer Graphics, natural image, Image Authenticity, SVM.

INTRODUCTION

With the rapid development of digital cameras and smart phones, it has great necessary to research image processing technique in the application and operation of recaptured image. It is difficult to identify the natural image and photorealistic computer graphics with the naked eye. The photorealistic computer graphics has given us a tremendous threat. For example in Fig.1, these images were photorealistic computer graphics.

In recent years, there are some studies on identification of the photorealistic computer graphics and natural image. Dehnie et al. proposed that, although different cameras had different types of pattern noise, natural images taken by different cameras showed that their pattern noises had common property compared with CG images [1]. Farid, et al. gave an algorithm based on wavelet coefficient statistics. The test image is decomposed in horizontal, vertical and diag directions on the three color channels by QMF [2]. Wu Etc. achieve to identify the photorealistic computer graphics and natural image by difference image histogram features [3].
In this paper, it was used that by analyzing the differences between the photorealistic computer graphics and natural image generated in the imaging process, we adopt Improvement Local Binary Pattern (ILBP) method to extracting feature values. At last the SVM was used to identify the photorealistic computer graphics and natural image. The results show that the presented method can not only identify the photorealistic computer graphics and natural image.

ORGANIZATION OF THE DIFFERENCES BETWEEN PHOTOREALISTIC COMPUTER GRAPHICS AND NATURAL IMAGE

Natural light will be converted into the RGB Pixels by digital camera CCD sensor. The figure.1 is the process of natural image. In this process, the image is formed by CFA interpolation in digital camera. Due to the complexity of real scenarios and Impact of hardware, the natural image must produce some noise. But the photorealistic computer graphics can be obtained by all kinds of image-editing software. Then these images will be Retouching, sharpening, smoothing by image-editing software. So the photorealistic computer graphics containing the pattern noise is different from the natural image generated by digital cameras.

Due to the current increasingly powerful image editing software, it is difficult to identify photorealistic computer graphics by eyes. Therefore, we put forward an identification algorithm based on gradient.

ALGORITHM FRAMEWORK

We put forward a photorealistic computer graphics identifying algorithm based on edge detection. The detected image is divided into two parts that are the training and
testing. Firstly, we extract the gradient features for image, and then we use the SVM classifier to train samples. Last we use the SVM classifier to test image. It is shown in Figure 3:

![Algorithm Flow Chart](image)

**Figure 3. Algorithm Flow Chart.**

![Figure 4. Charts of Improve Local Binary Pattern](image)

**Figure 4. Charts of Improve Local Binary Pattern.**

![Figure 5. Example charts of Improved Local Binary Pattern](image)

**Figure 5. Example charts of Improved Local Binary Pattern.**

### FEATURE EXTRACTION ALGORITHM

The LBP algorithm is shown [4]. In this paper it was improved for LBP algorithm in Figure 4. The improved algorithm is around 8 pixels larger than the middle point pixels denoted as 1, the smaller denoted as -1 and the equivalent denoted as 0 in the range of 3*3.

In the improved algorithm, it will be larger than or equal to the central pixel combination into a string, and at the same time, it will be less than or equal to the center point into a string. Thus, the pixel values of the middle point can be represented by 2 binary strings, followed by 1000111 and 01110000 in clockwise order. The advantage of this improvement is that it can highlight the edge information of the image, and the edge information is the important difference between the photorealistic computer graphics and the real image.

In Figure 5, figure (a) is the original image, in figure (b) the pixel value is consist of greater than or equal to the center pixel value, and in figure (c) the pixel value is
less than or equal to the center pixel value. Each pixel gray value in image is replaced by binary string, and then the 128 statistical features of each histogram feature images are extracted as feature vector.

Table 1. The experimental results and comparison with other algorithm.

<table>
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<tr>
<th>Algorithm</th>
<th>Accuracy rate</th>
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<tbody>
<tr>
<td>Proposed method</td>
<td>83.30%</td>
</tr>
<tr>
<td>Literature 5</td>
<td>78.75%</td>
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</table>

TEST RESULTS

The experimental programming environment is on Microsoft Visual 2010 and the programming language is C language. We use support vector machine (SVM) as classifier. The experiments images are from Columbia University Digital Image Library. In order to the effectiveness of algorithm we take a large number of tests and we get satisfactory results. Every experiment we randomly choose the number of 600 train images and 300 test images.

The feature vectors in our algorithm are extracted from the statistical histogram, so these have 256-dimensions vector. In the experimental results, the recognition rate of the algorithm is in line with the actual situation. For more texture information image our algorithm has higher recognition rate while there is lower recognition rate for less texture information image.

SUMMARY

There are so many algorithms to identify photorealistic computer graphics and natural image and these algorithms are relying on the classification. Because of photorealistic computer graphics and natural image having different imaging principle, these have great difference in texture. In this paper we extract ILBP feature from photorealistic computer graphics and natural image. The experimental results show that the detection algorithm in this paper is feasible.

REFERENCES


