

# A Novel Image Zooming Scheme for Indexed Color Images

Yu-Chen Hu, Bing-Hwang Su, Wu-Lin Chen, and Wan-Yu Lu

Dept. of Computer Science & Information Management, Providence University  
200 Chung Chi Rd., Taichung 43301, Republic of China (Taiwan)  
{ychu, bhsu, wlchen, g1000575}@pu.edu.tw

**Abstract.** In this paper, a novel image zooming scheme for indexed color images is proposed. In the proposed scheme, the bilinear interpolation technique is employed to enlarge the original image. Then, the enlarged image is compressed by the color image quantization technique to generate the enlarged indexed color image. From the experimental results, it is shown that the proposed scheme provides better image quality than the pixel copy technique.

**Keywords:** image zooming, color image quantization, color palette, bilinear interpolation

## 1 Introduction

Among the common image processing operations, image zooming [1]-[10] is a basic function of digital image processing. It can be used to adjust the size of the digital image and it is commonly applied to multimedia applications, such as digital camera, image database, electronic publishing, and medical imaging. In general, the original image to be enlarged is often called the low-resolution image and the enlarged image is called the high-resolution image. From the literature, the image zooming schemes can be classified into two approaches: fixed image zooming [1]-[3] and adaptive image zooming [4]-[10].

From the literature concerning the image zooming techniques, most of them work on the color or grayscale images in raw format. However, the zooming of the color indexed images is also important because the color indexed images that were compressed by the color image quantization (CIQ) technique [11-17] are commonly used for multimedia. Basically, the CIQ scheme can be divided into three procedures: palette design, image encoding and image decoding. In the image encoding procedure, the closest color in the color palette for each color pixel is searched. The index of the closest color in the color palette is recorded. The compressed codes of CIQ for the RGB color image consist of the index table and the color palette.

## 2 The Proposed Scheme

Given the indexed color image of  $w \times h$  pixels, the indexed color image consists of  $w \times h$  indices, and the color palette  $CP$  consists of  $N$  colors. The scaling factor  $SF$  is set to 2 in the proposed scheme. The enlarged indexed color image  $E$  of  $W \times H$  pixels is to be generated where  $W = w \times 2$  and  $H = h \times 2$ .

The indexed color image is first decoded to generate the decoded image  $DI$  of  $w \times h$  pixels in raw format. The image decoding procedure of CIQ can be done by recovering each color pixel by the color in  $CP$  corresponding to its index. Then, the bilinear interpolation technique is employed to enlarge  $DI$ . After the bilinear interpolation technique is executed, the enlarged image  $EI$  of  $W \times H$  pixels is generated. The flowchart of the first procedure is depicted in Fig. 1.

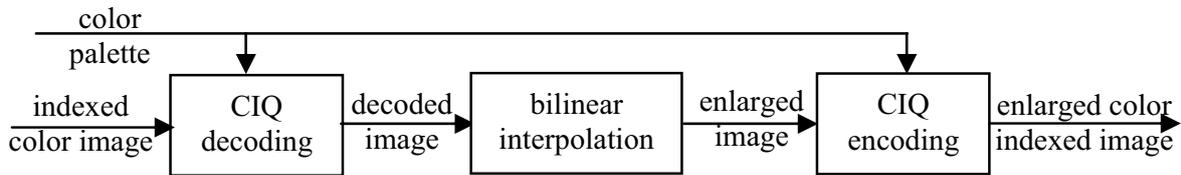


Fig. 1. Flowchart of the proposed scheme.

The enlarged image  $EI$  is then compressed by CIQ to generate the enlarged indexed color image  $E$  of  $W \times H$  pixels. The closest color in the color palette is determined and the corresponding index is recorded. By successively compressing each pixel in  $EI$  by the same way, the resultant indexed color image  $E$  is thus generated.

## 3 Experimental Results

The simulations are executed on Microsoft windows XP with an Intel Core Duo 2.2GHz CPU and 512Mbytes RAM. The codes are implemented by using Bloodshed Dev C++. In the simulations, six color images of  $512 \times 512$  pixels “Airplane”, “Lenn Pepper”, “Sailboat”, “Splash” and “Toys” are used as the testing images for performance comparison.

## 4 Conclusions

A novel image zooming scheme for indexed color images is introduced in this paper. The indexed color images are compressed by the color quantization scheme to cut down the storage cost of the RGB color images. To improve the image qualities of the enlarged indexed color images is a great challenge because of the limitation of the color palette. From the results, it is shown that the proposed scheme outperforms the pixel copy technique for the zooming of the indexed color images.

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