ПРИЛАГАНЕ НА МОДИФИЦИРАНИ МОРФОЛОГИЧНИ МЕТОДИ ПРИ ОБРАБОТКА НА ЦВЕТНИ ИЗОБРАЖЕНИЯ

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AN APPLYING MODIFIED MORPHOLOGICAL IMAGE PROCESSING METHODS IN COLOUR IMAGE EDITING

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ABSTRACT

In the present article is described a method for removing predefined objects from a digital image. For the purposes of digital image processing, the notion of mathematical morphology is used. It is a tool for studying and extracting individual elements of the internal image structure to support their presentation and description according to selected criteria such as: boundaries of areas, skeletal lines, etc. While the morphological image processing is applied mostly on binary images, the proposed method is also intended for processing of colour images.

Keywords: *morphological image processing, pixel, erosion, structuring element*

Introduction

The advances in computer technologies over recent decades have allowed the wide-ranging implementation of digital image processing in a variety of areas such as image enhancement, artistic effects, medical visualization, astronomy, industrial inspection etc. These technologies are also used in the textile industry for textile identification [2], fabric defect detection [3, 6], determination of yarn production characteristics [1], fabric characteristics identification [4, 7], etc.

As a part of the digital image processing technologies, the morphological image processing includes several major techniques such as erosion, dilation, opening and closing [5]. The erosion, as performance, is most closely to the proposed method (which we will call farther *purifying* method), but there are several significant differences. One of the differences is that the morphological image processing methods, in particular the erosion, are mainly applied on binary images, while the purifying method can be applied on colour images, as well as on binary and grayscale images. Also, the erosion, especially, affects all objects in the image, while the proposed method removes a part of the objects, while the rest remains unchanged. Another difference is in the way the structuring element is applied - in the purifying method the main process is focused on the peripheral contour of the structuring element.

Method Implementation

At first, it should be given more clarity of some terms, used farther. The digital image (raster image in particular) is a finite set of digital values, which

are called *pixels*. The digital image has a fixed number of rows and columns of pixels. The value of the pixel represents the colour of the corresponding point. In summary, each pixel is represented by three values: row, column and colour. There are several different formats for colour representation. In this article we use a 24-bit RGB (Red-Green-Blue) colour format, where every ingredient colour is in the range from 0 to 255.

Initially, there are two parameters that have to be set. One of the parameters (α) specifies the size (in pixels) of the square region that will crawl through the image (***Figure 1***). The value of this parameter is directly proportional to the size (in pixels) of the objects in the image to be removed. The second parameter (β) sets the maximum allowable difference between two adjacent square contour pixels.

The process starts with consistently comparing the values (colours) of pairs of the first contour square pixels (***Figure 3***) at the top left end of the image. Before every comparison, the two values (colours) are decomposed on their three ingredients red, green and blue (***Figure 2***). The comparison is carried out by subtracting the corresponding pre-values (colours) of the two adjacent pixels.

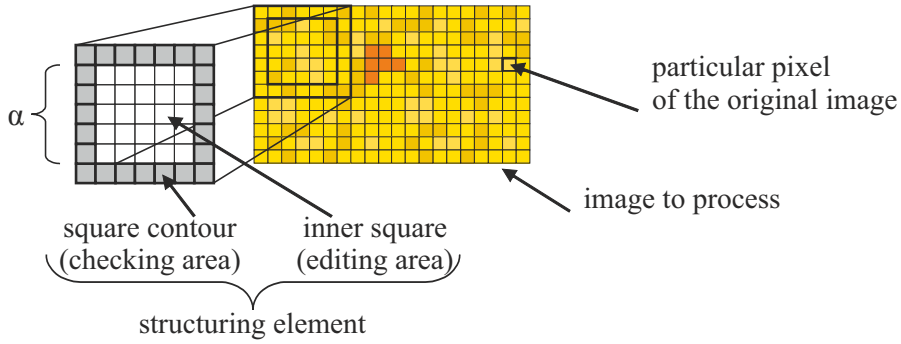

Figure 1 Initial parameters of the structuring element

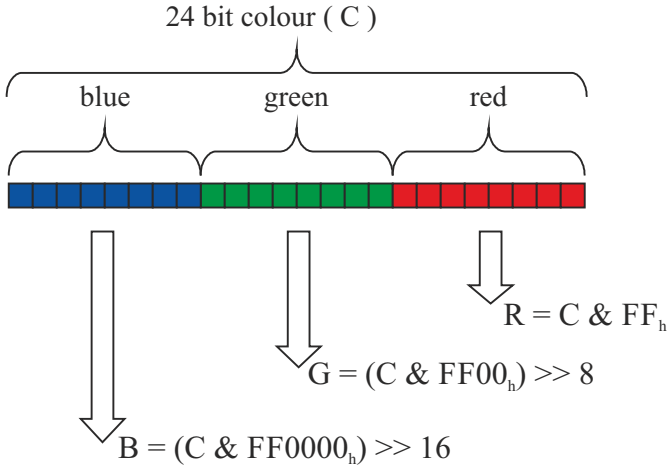

Figure 2 Representation of 24-bit colour format and decomposition to R, G and B components

If no difference between the ingredients exceeding the set value, the next two adjacent contour pixels are compared. The process continues until a difference of any of the ingredients is greater than the set value, or until all the pixels of the contour square are bounced. If a difference, greater than the set value is found, before all pixels of the current square contour are crawled, the process is terminated; the structuring element is shifted one position.

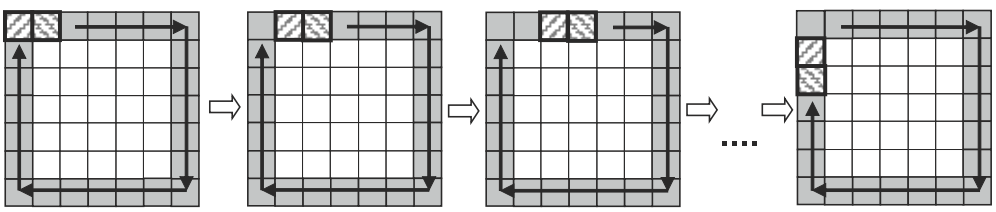

Figure 3 Process sequence

If no difference exceeding the set value is detected, after scrolling all the pair pixels of the current contour square, all pixels inside the contour square acquire a value equal to that of the first pixel of the contour square. As a result, objects that fall inside the contour square and are substantially different from the background around them are removed and replaced with the background colour. The process continues until the structuring element reaches the bottom right end of the image.

Results

In the figure below are shown results after applying the purifying method on two sample images. All images (***Figure 4/a/c***) have dimensions of 200 x 200 pixels. The size of the processed square, applied on the first image (***Figure 4/a/b***) is set to 9 pixels, and 5 pixels for the second image (***Figure 4/c/d***). The maximum difference between two adjacent pixels is set to 20 for both processed images.

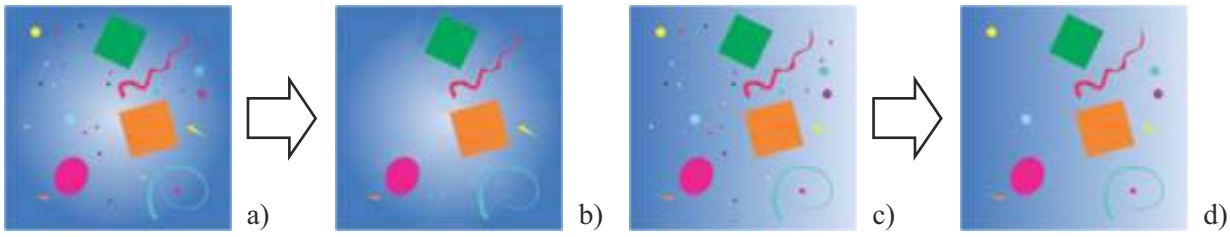

Figure 4 Results, after applying the purifying method: a/c/ original images; b/d/ processed images

Another opportunity of the developed method is using for edge detection (***Figure 5***). This becomes possible after some changes in the algorithm. If a difference, greater than the set value is found, before all pixels of the current contour square are crawled, all pixels inside the contour square acquire a predefined colour (for example black).

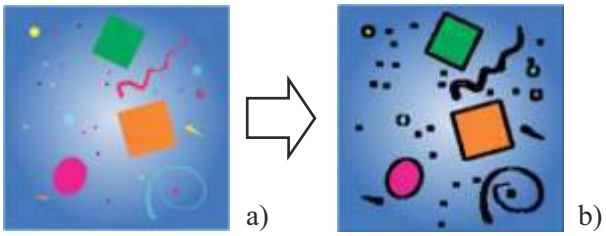

Figure 5 Using the purifying method for edge detection. a/ original image; b/ processed image

The original image from Fig. 6/a is processed in MATLAB, applying erosion (Figure 6/b), dilation (Figure 6/c) and the purifying method (Figure 6/d) where the size of the processed square is set to 9 pixels, and the maximum difference is set to 20.

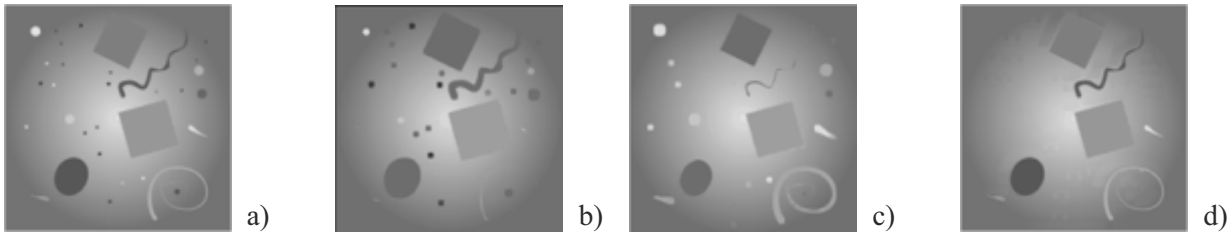

Figure 6 Results after application of different processing techniques:
a) original; b) erosion; c) dilation; d) purifying method

Conclusion

A novel method for editing colour images, similar to the morphological methods is developed. Based on predefined parameters, the purifying method allows removing objects from colour images with fairly uniform background, while the rest of the objects stay unchanged. The proposed method can be applied in the field of image correction and stylization, noise reduction etc. By applying more sophisticated algorithms to the contour square processing, it may be possible to process images with more colourful background.

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