COMPUTER AIDED CALCULATION OF THE SELECTED COLOURED AREAS IN AN IMAGE

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Abstract: *The main purpose in this study is to develop software which will calculate quickly and accurate the area of a specific color in an image obtained from any display device (scanner, digital or standard camera). Since the algorithm of the image processing software was prepared for Bitmap extensional image files, the obtained image is also saved as a bmp extensional file to the data storage (hard disk, CD-Rom, etc). During the process, after opening this file, any specific color taking place in the image file is chosen; the area of this color is displayed on the monitor as* cm^2 *or taken from the printer*
Keywords: *Digital image processing, Image analysis, Area calculation*

INTRODUCTION

As it is known, there are several difficulties for calculating the areas of complex forms. Especially, when the form includes complex colors and or doesn't have regular surface lines, the process becomes much more difficult. For example, the calculation of the morbid areas which become perceptible by color changes on the leaves of alfalfa or tobacco or calculating the forest area in a photograph taken from the space by satellite, it is possible to use this study to obtain results quickly and accurate.

MATERIALS AND METHODS

1. Material

The needed equipment is a PC (CPU P-200MMX, Color display adapter - 2Mbyte, RAM-64 Mbytes) using Windows 98 operating system with a color monitor, a 1200 dpi resolution scanner and 1 Mpixel resolution digital camera, and the main materials are different leaf images together with image files

2. Method

The software was written in Delphi Programming language. The subject area of the object which will be calculated, is being either scanned by a scanner or a picture of the object (fully or partially or the specified area) is taken by a digital camera and saved on the computer as an image file.

At Figure 3, area calculation subroutine flowchart and at Figure 1, main form of the program is given. When the program starts up, by pressing "open" button at the form taken place on Figure 1, file opening form (Figure 2) is displayed.

Figure 1 – Main form.

By this form, the image file which was obtained from scanner or digital camera is loaded, then, by using the data, forming bitmap files (given at Table 1) the area of the image file and dimensions are calculated and sent to "about of loaded picture" frame.

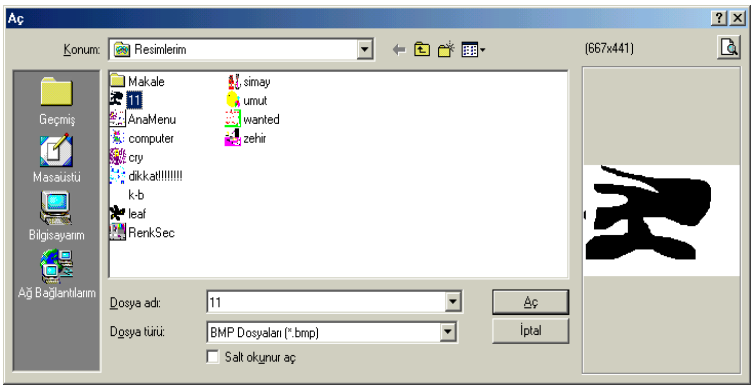

Figure 2 - File opening form.

To select the color which will be calculated, by pressing "Select Color" button at Figure 1, the color toolbox which is shown at Figure 4 is displayed. By using this form, the required standard or specific color is determined and then OK button is chosen.

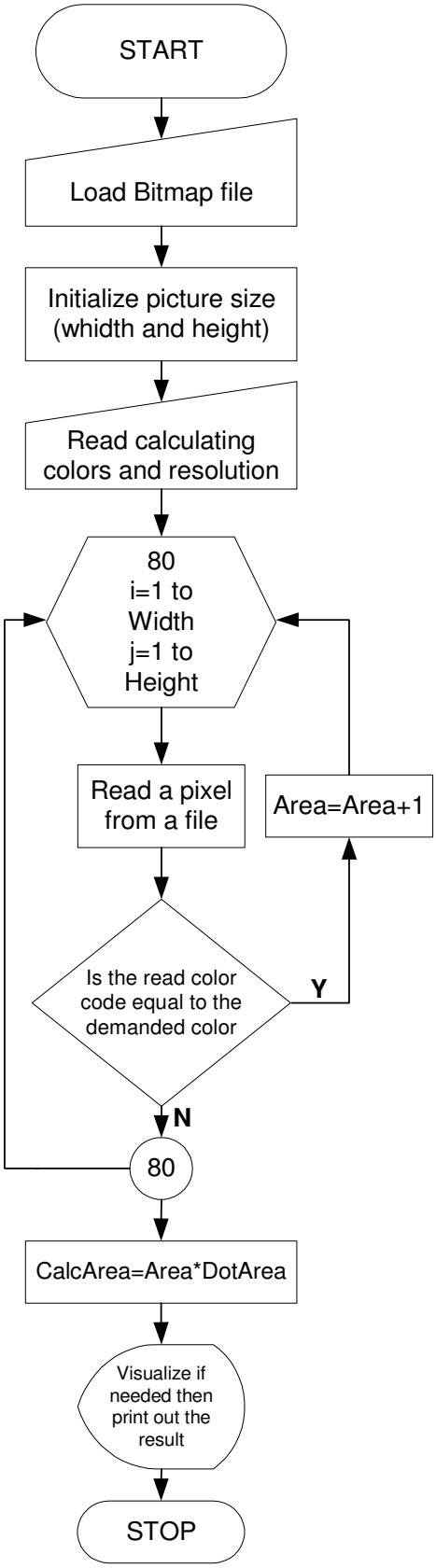

Figure 3 - Flow chart of software.

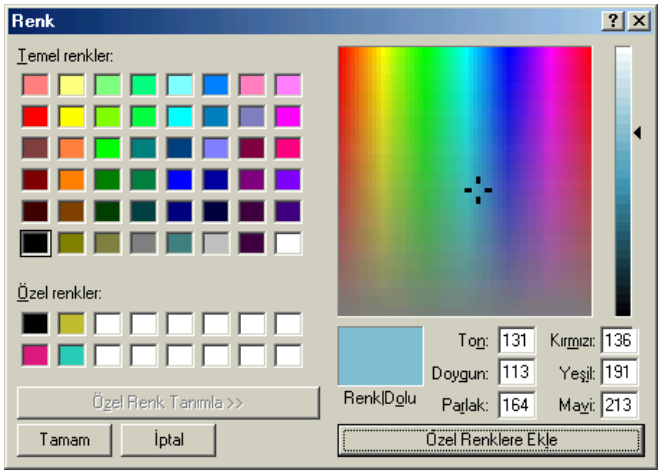

Figure 4 – Form of selected color.

When the color is selected, by pressing the "Calculate Area" button at Figure 1, program subroutines are started up following the flowchart by referencing the length and height of the file. In this subroutine, by referencing the color code of the selected color, the pixels (the dots form the image) is read one by one and compared with the color code of the specified color, if the color code is identical to the required color code, counter value increased one; if not variable value of other colors increased one.

At the end of the subroutines, after all colors in the bitmap file were read, the area of the specific color is precisely calculated by way of multiplying the value of the counter variable with value of resolution. Result is shown at the related fields on the Figure 1. Here, the area of specified color and total area of all other colors are given in cm^2. These values can be printed out whenever needed by pressing the Print menu on the form. The sample leaves used in the experiments are given at Figure 5.

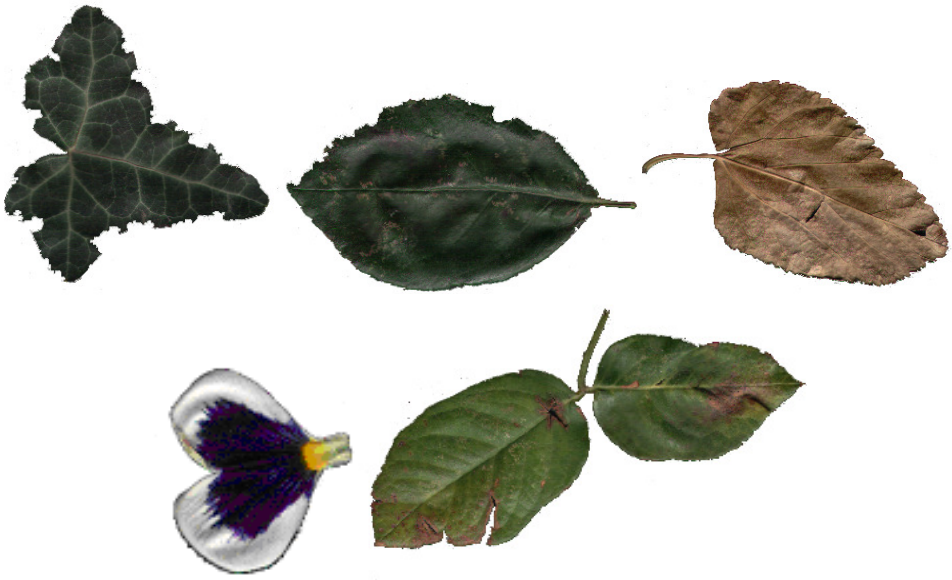

Figure 5 – Leaf samples.

Table 1 - Structure of bitmap files

Offset	Field	Size	Contents
0000h	Identifier	2 bytes	The characters identifying the bitmap. The following entries are possible: 'BM' - Windows 3.1x, 95, NT 'BA' - OS/2 Bitmap Array 'CI' - OS/2 Color Icon 'CP' - OS/2 Color Pointer 'IC' - OS/2 Icon 'PT' - OS/2 Pointer
0002h	File Size	1 dword	Complete file size in bytes.
0006h	Reserved	1 dword	Reserved for later use.
000Ah	Bitmap Data Offset	1 dword	Offset from beginning of file to the beginning of the bitmap data.
000Eh	Bitmap Header Size	1 dword	Length of the Bitmap Info Header used to describe the bitmap colors, compression, The following sizes are possible: 28h - Windows 3.1x, 95, NT 0Ch - OS/2 1.x F0h - OS/2 2.x
0012h	Width	1 dword	Horizontal width of bitmap in pixels.
0016h	Height	1 dword	Vertical height of bitmap in pixels.
001Ah	Planes	1 word	Number of planes in this bitmap.

001Ch	Bits Per Pixel	1 word	Bits per pixel used to store palette entry information. This also identifies in an indirect way the number of possible colors. Possible values are: 1 - Monochrome bitmap 4 - 16 color bitmap 8 - 256 color bitmap 16 - 16bit (high color) bitmap 24 - 24bit (true color) bitmap 32 - 32bit (true color) bitmap
001Eh	Compression	1 dword	Compression specifications. The following values are possible: 0 - none (Also identified by BI_RGB) 1 - RLE 8-bit / pixel (Also identified by BI_RLE4) 2 - RLE 4-bit / pixel (Also identified by BI_RLE8) 3 – Bit fields (Also identified by BI_BITFIELDS)
0022h	Bitmap Data Size	1 dword	Size of the bitmap data in bytes. This number must be rounded to the next 4 byte boundary.
0026h	HResolution	1 dword	Horizontal resolution expressed in pixel per meter.
002Ah	VResolution	1 dword	Vertical resolution expressed in pixels per meter.
002Eh	Colors	1 dword	Number of colors used by this bitmap. For a 8-bit / pixel bitmap this will be 100h or 256.
0032h	Important Colors	1 dword	Number of important colors. This number will be equal to the number of colors when every color is important.
0036h	Palette	N * 4 byte	The palette specification. For every entry in the palette four bytes are used to describe the RGB values of the color in the following way: 1 byte for blue component 1 byte for green component 1 byte for red component 1 byte filler which is set to 0
0436h	Bitmap Data	x bytes	Depending on the compression specifications, this field contains all the bitmap data bytes which represent indices in the color pal.

RESULTS AND DISCUSSION

With this program, it is calculated not only the areas of all unique colors one by one but it is possible to calculate the total area of all colors as well. At once, the program performs only one color's area calculation by using the matching color code, hence, calculation for an area that consists of close colors; program should be operated several times for the calculation of the areas of each color tones. To remove this disadvantage, the software algorithm should be developed to provide the calculation of total areas of a specified color group consists of close tones instead of a single color area calculation.

CONCLUSION

When the area calculations are performed for the loaded shapes which their areas can be calculated mathematically, it is seen that the error margin is 0. With this software, the areas of several leaves scanned by a scanner were calculated and the results were compared with the results of other calculation methods. As a result of this comparison, this software provides more accurate calculations.

REFERENCES

[1]. Kranzler, G.A.,1985. Applying Digital Image Processing in Agriculture. *Agricultural engineering*. Volume 6 Number 3, pp11-13

[2]. Shatadal, P., Jayas, D.S. and Bulley N.R., 1995. Digital Image Analysis for Software Separation and Classification of Touching Grains. TRANSACTIONS of the ASAE, Vol. 38(2), pp 635-643.

[3]. Wolfe, R.R. and Sandler, W.E., 1985. Algorithm for Stem Detection Using Digital Image Analysis. TRANSACTIONS of the ASAE, pp 641-643.

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