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BORDER DETECTION OF SKIN TUMOR IMAGES

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Abstract

Color border programs are used to try to obtain a border for skin tumors. A series of programs are used to obtain a color segmented image. This color segmented image can then be passed through a program that searches for the border, "Colborder.simple". Problems have occurred in trying to obtain the color segmented image. Normal images were used instead of the color segmented image as input to the color border detection program. The program was unsuccessful in finding the border.

Introduction

A line separating the skin tumor from healthy skin is referred to as the border. The border detection of skin tumor images is an important part of a research project which is trying to identify important features of skin tumor. The project proposes to identify skin tumor features in order to aid dermatologists in making a more accurate diagnoses.

Once the border has been found the programs can concentrate on features inside the border and they can ignore the skin outside the border. The features found can provide an indication if the tumor is malignant. If the border of the tumor is highly irregular it indicates a malignant tumor.

If the border detected is incorrect it is misleading in several ways. It gives an inaccurate irregularity index as well as providing an incorrect area for the subsequent programs which may try to find different features of the tumor. It may find features that are not a part of the tumor if the border includes the surrounding skin; it may miss some of the key features if part of the tumor is not included within the

border.

Border Detection

The first border detection program used radial search method on luminance image. In the original image each pixel includes red, green, and blue values, these can be converted to a gray scale luminance image by adding a weighted sum of the three values. The luminance border program searches radially from the center of the image to the edge. The search continues until a condition of a change in luminance followed by a sustained length is met. If no point is found than the restrictions are eased and the process is repeated until a point is found.

The above method has several disadvantages. By choosing the first point that satisfies the condition and not searching along the whole length of the radius the program looses an opportunity to find a better candidate. It takes a long time to process an image since the program may search several times along each radial line. A program which searches the radial line once and returns several candidates should be able to solve this problem.

The use of luminance instead of all three colors causes a substantial information loss which, if utilized, may lead to a more accurate border detection.

Color border detection

Colborder.simple tries to find the border by using a color segmented image with a small number of colors. This program outputs a data file containing the coordinates of the selected data points.

The colborder program requires that a color segmented image be provided to it for it to function correctly. It has not been possible to check the accuracy of the colborder program since a color segmented image could not be generated.

The color segmented image is generated by running eight programs. The programs are: avecolor.c, mask.c, spher_xform.c, find_covtrx.c, remap.c, seuccc.c, seuuccc.c, colfilter.c. The first three programs are functioning properly but from then on the programs produce unintelligible output.

When the original image is processed the first program it passes through is avecolor.c. This program takes as input a five hundred and twelve by five hundred and twelve image that is pixel interleaved. A pixel interleaved image is constructed by storing the red, green, and blue values of each pixel one after another. A four by four block of pixels is averaged to provide one pixel in the output image.

The mask.c looks at the feature file and masks out everything except the blocks which contain the tumor. The remaining image is written to an output file.

The spher_xform.c takes the image array and transforms it into spherical coordinates (Angle A / Angle B / Length). The image is then remaped. The output is the transformed, remaped image array.

The remap.c program takes an image array and the eigne vectors for the PCT transform (or any other linear transform matrix that may be desired). This program transforms an image array into the principle components transform and remaps to byte size (1-254). The output is a transformed and remaped image array.

Colborder.simple accepts as input a color segmented image. The user has the option to specify the coordinates of the center of the tumor. If not specified, the default value for center is the center of the image. The number of radii used for the radial search can also be specified, the default value used is sixty four.

Colborder.sample uses an algorithm that assumes that the origin of the radial search is the brightest color in the tumor. This program takes the upper left hand corner of the image as the origin. The x value of the pixels increases from left to right and is the column number. The y value of the pixels increases from top to bottom of the image and is the row number.

Colborder.simple uses a radial search and color information for determining four border candidates along each radii. A sustained length condition is specified which must be met before a point is considered a candidate. Colborder searches for changes in color segmented image which satisfy the sustained length condition. The point which has the greatest sustained length is chosen as the initial border candidate.

The radial length of the next radius is then compared to the previously chosen radius and the border point which has the least radial difference is chosen. This is repeated until a border point has been selected for each radii.

The accuracy of the colborder program is improved if the user limits the area of the search by placing a circle inside the tumor and another circle outside the tumor. The length of these radii can be found using another program and then passing the radii to colborder as the last two arguments in the command line.

Up to this point I have been unable find the errors in those programs. I am presently working on trying to debug those in order to obtain reasonable results.

When an unprocessed image was given to colborder.simple it was unable to find the border. If the correct point was found it was rejected because the difference in the radial length of the correct border point and the surrounding incorrect points was greater than the difference in the radial length of two incorrect points.

In order to obtain a correct border it is neccessary to provide the Colborder.simple with a color segmented image. I am currently working to this end.