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CLASSIFYING SKIN MOLES USING IMAGE PROCESSING ALGORITHMS

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Abstract: Image processing is an essential field applied in a lot of applications, as medical imaging, astronomy, video, image compression and transmission, and so on. In this paper was proceeded grayscale image converted from RGB (red, green, blue) system. Mathematical morphology in image processing is applied on binary images so that is very important to chosen the adequate binary threshold. Both, mean and standard deviation can determine the optimum binary threshold. The mathematical morphology and optimum binary threshold can be used with success in order to study skin lesion.

Keywords: image processing, mathematical morphology, binary threshold.

1.INTRODUCTION

Skin lesion can growth uncontrolled often developing the melanomas. A lot of people risk to get skin cancer if they do not control in time the skin lesions.

Morphology is a mathematic theory where size and shape of object play an important role. Based on set theory the images can be processed. An important variable of the morphological operators is the structuring element, it can have the different shape as diamond, disk, line, octagon, rectangle, square, cube, cuboid, sphere or arbitrary. With the structuring element the binary images were dilated and eroded and the area was computed.

Previously of applying of mathematic morphology the image must be binaries. In this study was chosen the local thresholding that used the mean and deviation standard.

THEORETICAL BACKGROUND

2.1 Local thresholding

Local thresholds can be determined by mean and standard deviation.

The algorithm is shown hereunder.

I. Computing mean μ;

$$\mu = \frac{1}{mn}\sum_{(r,c)\in W} I(r,c) \quad (1)$$

II. Computing standard deviation σ;

$$\sigma = \sqrt{\frac{1}{mn-1}\sum_{(r,c)\in W}\left(I(r,c) - \sum_{(r,c)\in W} g(r,c)\right)^2} \quad (2)$$

III. Computing threshold T;

$$T = k_1\mu + k_2\sigma \quad (3)$$

where k_1 and k_2 depend by type of image.

2.2 Mathematical morphology

Mathematical morphology is a tool for extracting components from binary image, it is useful in the representation and description of shapes and contours.

Binary dilation

The binary dilation combines tow element, a binary image and a strel. The dilation is defined as:

$$A \oplus b = \left\{ r \mid r = a + b_1 \ \ for \ \ a \in A, b \in B \right\} \quad (4)$$

This operation is commutative, thus $A \oplus b = b \oplus A$,were b is a structuring element and A is original image.
In terms of union operation the dilation can be rewrite as:

$$A \oplus b = \bigcup_{b_1 \in b} T_{b_1}(A) = \left\{ r \mid T_r(B) \cap A \neq \varnothing \right\} \quad (5)$$

Binary erosion

As the dilation the binary erosion is a morphological operation that is defined as:

$$A \oplus b = \left\{ r \mid r = a + b_1 \ \forall b \in B \right\} \quad (6)$$

as a set, the operation can be rewrite:

$$A \Theta b = \bigcap_{b_1 \in B} T_{-b_1}(A) = \left\{ r \mid T_r(b) \subseteq A \right\} \quad (7)$$

Binary dilation closing

The closing operation for a binary image is given by a structuring element b, it is the erosion of the dilation of that set.

$$A \bullet b = (A \oplus b) \Theta b \quad (7)$$

DESCRIPTION OF THE SOLUTION

The solution was implemented in Matlab R2018 and the result is shown for each step.

Step 1.Reading of the RGB images

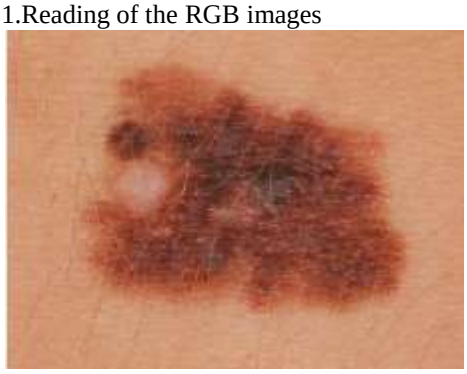


Figure 1. Original image

Step 2.Convert the image from RGB into grayscale

```
I=imread('1.jpg');
J=rgb2gray(I);
```

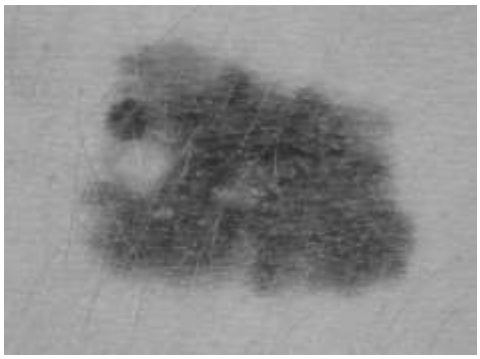


Figure 2. Grayscale image

Step 3. Binary images using the mean and standard deviation

```
I=imread('1.jpg');
J=rgb2gray(I);
subplot(1,2,1);imshow(J),
title('Original image);
media=mean2(J);
devstd=std2(J);
k1=1;
k2=1;
level=(k1*media+k2*devstd)/256;
BW = im2bw(J,level);
subplot(1,2,2);imshow(BW), title('.
Binary images');
```

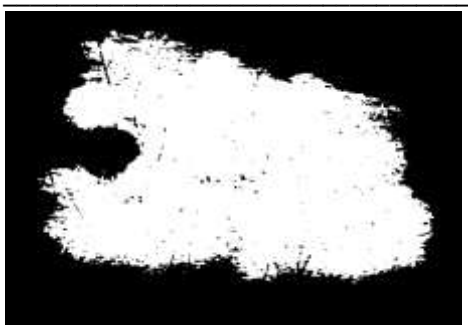


Figure 3. Binary image

Step 4. Closing image with disk structuring element

```
Image = imread('1.png');
se = strel('disk',10);
J = imclose(Image,se);
figure, imshow(J);
```

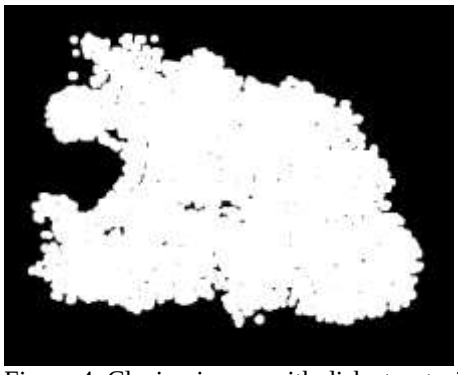
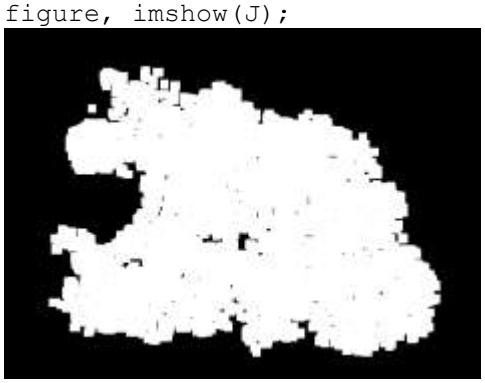


Figure 4. Closing image with disk structuring element

Step 5. Closing image with disk structuring element

```
Image = imread('1.png');
se = strel('disk',10);
J = imclose(Image,se);
figure, imshow(J);
```



Closing image with square structuring element

```
Image = imread('1.png');
se = strel('square',10);
J = imclose(Image,se);
figure, imshow(J);
```

CONCLUSIONS AND FUTURE DEVELOPMENT

The mathematic morphology can be use in segmentation and analyses of skin lesion. With closing operation can be computed correct the area of the mole in order to monitories of the skin lesion.

REFERENCES

Natalie H. Matthews, Wen-Qing Li, Abrar A. Qureshi, Martin A. Weinstock, and Eunyoung Cho, Cutaneous Melanoma: Etiology and Therapy, Chapter 1Epidemiology of Melanoma, 2017

Smith, J.R., Chang, S,F., Local color and texture extraction and spatial query, IEEE International Conference on Image Processing, Lausanne, Switzerland, 1996.

Shen, L., Bai, L., 2006. MutualBoost lerning for selecting Gabor featurea for face recognition, Pattern Recognition Letters, 27, 1758-1767.

Jing.X.Y.,Zhang. D., 2004. A face and Palmprint Recgnition Approach Based on Discriminant DCT Feature Extraction, IEE Transactions on Dystems, Manm and Cybernetics, 34. 2405-2414.

Pentland, A, Choudhury, T., 2000. Face recognition for smart environments. Computer, 33, 50-55.

Boland, M.V., Murphy, R.F., 2001. A Neural Classifier Capable of Recognizing the Patterns off all Major Subcellular Structures in Fluorescence Microscope Images of HeLa Cells.

Awate, S.P., Tasdizen T,. Foster N., Whitaker, R.T., 2006. Adaptive Markov modeling for mutualinformation-based, unsupervised MRI beaintissue classification. Medical Image Analysis, 10, 726-739.

Cocosco, A., Zijdenbos, P., Evans, A.C., 2004. A fully automatic and robust brain MRI issue classification method. Medical Image Analysis, 7, 513-527.

Ranzato, M., Taylor, P.E., House, J.M., Flagan, R.C., LeCun, Y., Perona, P., 2007. Automatic recognition of biological particles in microscopic images. Pattern Recognition Letters, 28, 31-39.

Naheed R. Abbasi, MPH, MD; Helen M. Shaw, PhD; Darrell S. Rigel, MD; et al December 8, 2004. Early Diagnosis of Cutaneous MelanomaRevisiting the ABCD Criteria

Reda Kasmi, Karim Mokrani, Classification of malignant melanoma and benign skin lesions: implementation of automatic ABCD rule IET Image Processing , Volume: 10 , Issue: 6 , 2016

Shivangi Jain, Vandana jagtap, Nitin Pise, International Conference on Intelligent Computing, Communication & Convergence (ICCC-2014) Conference Organized by Interscience Institute of

Management and Technology, Bhubaneswar, Odisha, India, Computer aided Melanoma skin cancer detection using Image Processing, Procedia Computer Science 48 (2015) 735 – 740

J. A. Almaraz-Damian ; V. Ponomaryov ; E. Rendon-Gonzalez, Melanoma CADe based on ABCD Rule and Haralick Texture Features 2016 9th International Kharkiv Symposium on Physics and Engineering of Microwaves, Millimeter and Submillimeter Waves (MSMW), Date of Conference: 20-24 June 2016, Conference Location: Kharkiv, Ukraine

Korotkov K., Garcia R. Computerized analysis of pigmented skin lesions: a review. Artificial Intelligence in Medicine. 2012;56(2 69–90. doi: 10.1016/j.artmed. 2012

R. Dummer, A. Hauschild, M. Guggenheim, L. Jost & G. Pentheroudakis, Melanoma: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-u, Annals of Oncology Vol.21 (Supplement 5): pp.194–197, 2010

Cavalcanti PG, Scharcanski J, Baranoski GV., A two-stage approach for discriminating melanocytic skin lesions using standard cameras, Expert Systems with Applications , vol. 40, pp. 4054–4064, 2013.

Maryam Ramezani, Alireza Karimian, Payman Moallem, Automatic Detection of Malignant Melanoma using Macroscopic Images, Journal of Medical Signals & Sensors, vol 4, pp.281-290, 2014

Muthiah Mary, Lekshmi Padma, Maria John, Modified Image Segmentation Method based on Region Growing and Region Merging, The International Arab Journal of Information Technology, Vol. 13, No. 6A, pp.899-907, 2016

S. Moldovanu, L. Moraru, D. Bibicu, Computerized Decision Support in Liver Steatosis Investigation, International Journal of Biology and Biomedical Engineering,Vol. 6(1), pp. 69-76, 2012.

N. Otsu, A threshold selection method from grey-level histograms, IEEE Transactions on Systems, Man, and Cybernetics, Vol.8, pp. 62-66, 1978

Angel Garrido, Symmetry and Asymmetry Level Measures, Symmetry — Open Access Journal, vol. 2, pp.707-721, 2010.