



# **A System to Identify Necrotic Center of Erythematous Lesion**

Satyake Bakshi<sup>1</sup>, Sathya A<sup>2</sup>

M.E Student, Department of Systems and Computer Engineering, Carleton University, ON, CANADA<sup>1</sup>

M.Tech Student, Department of Sensors and Biomedical Technology, Vellore Institute of Technology, Vellore, India<sup>2</sup>

**ABSTRACT:** This article explores one of the alternative ways in which dark necrotic portions of most lesions can be identified without relying on complex image processing algorithms. For most treatments of skin lesions the damage done to the epidermis can be assessed by measuring the radius of the necrotic centre. It is often time-consuming for doctors and physicians to assess individual lesions. This paper describes an easier way to map the necrotic zone of the lesion by relying on simple image processing logic. Here the primary focus is on a type of lesion which is a side-effect of excessive drug use i.e. Erythematous lesions. This algorithm has been tested on different types of images of Erythematous lesions and it yields similar results.

**KEYWORDS:** OOPs, ConvexHull, Contours, OpenCV

## **I. INTRODUCTION**

Ruxolitinib is a drug associated with the treatment of certain kind of myeloproliferative neoplasms[1][11]. Sustained use of this drug can lead to the formation of erythematous skin lesion [1]. However, such kind of skin toxicity is very rare[1][9][10]. Physical examination of erythematous lesions might cause further irritation. The best approach for such kind of examination should be non-contact diagnosis.

Most imaging algorithms are processor heavy and required a lot of memory to run[3]. So, memory optimization is a key requirement for the design of such algorithms. Python as a programming language is very versatile and it has a high degree of memory management and OOP capability for streamlined execution. Here we rely on Python as the primary language of instruction to assess medical images. The JupyterIPython would be used as the primary interpreter. More information about the JupyterIPython is available in paper[8].

## **II. LIBRARIES AND FRAMEWORK**

The NumPy package provides a powerful platform for analysing complex numbers. NumPy is based on the successful Numerical array object. NumPy offers flexibility using a dtype object[4][7]. All the arrays have a dtype object which is a descriptor of the layout of the array data[4]. Every dtype object again is associated with a Python type object that decides the type of python object returned when an element of the array is examined[4]. The dtype objects also contain references to the arrays of other dtype objects and therefore can be used for defining nested data. This is one of the fundamental reasons of using NumPy for complex large-scale calculations[4]. The Python version of NumPy is in use for the development of the algorithm.

An Image is virtually a set of matrices which can be realized much easily in NumPy.

The Open CV frame work is the second package in use for this algorithm. Open CV stands for open source computer vision. It is an easier alternative to MATLAB because of its vast collection of pre-defined functions which would be otherwise time-consuming to realize in MATLAB. Open CV is available in both C and Python[5]; however, it was initially designed based on the C language. The C version of Open CV offers multiple advantages over the python counterpart. For instance, the C version is much faster when it comes to processing speed[5]. However, considering all the pros and cons of these two versions it all comes down to “Open” which is open-source. Open source frameworks have a strong community of developer and there are relative fewer to no bindings concerning the use of the code[6].

# International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: [www.ijircce.com](http://www.ijircce.com)

Vol. 6, Issue 7, July 2018

## III. DATA AQUISITION

For the processing to take place certain factors are to be considered. The primary factor is image resolution. A higher resolution would mean a more detailed feature description. High-resolution images of the infected part of the patient is captured and fed in to the system. The file system must be in JPEG format before the algorithm can work. It is observed that .PNG extension images in jupyter leads to longer wait-times before the image can be successfully loaded.



Fig.1[2] Erythematous Skin Lesion

Fig.1 shows a high-resolution image of the infected portion of an erythematous lesion. The black portion is indicative of necrosis. This image has been used as the primary data for the subsequent processing steps.

## IV. PROCESSING FLOW AND DESCRIPTION

The flowchart in figure 2 explains the list of steps involved in the entire process.

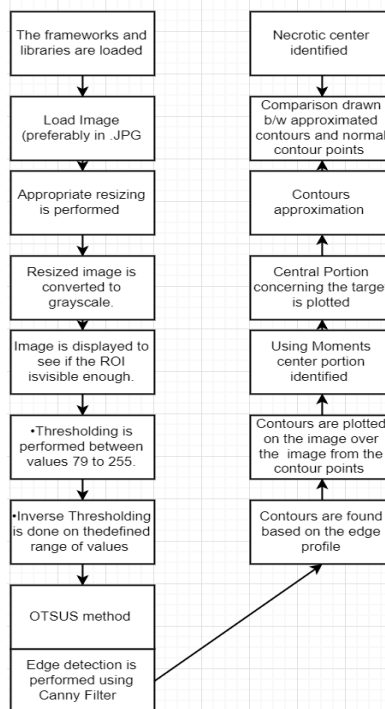


Fig.2 Sequence Chart

# International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: [www.ijirccce.com](http://www.ijirccce.com)

Vol. 6, Issue 7, July 2018

The modules are first imported into the JupyterPython IDLE. The image is then loaded using the appropriate command. The image is then resized so that the targeted portion occupies at least 80% of the image. The image is displayed as a precautionary step within the IDLE test environment as a precautionary measure to address any problems related to blurring. If the captured image is blurry then appropriate filters can be used. Computer Vision framework in python supports a vast array of filter functions which can be used to smoothen and sharpen the image.

Thresholding (255 becomes 0) is needed to find the darkest portion of the image. Inverse thresholding is performed for better clarity. (0 becomes 255). The upper limit of the threshold can be set as per requirement here in this image the ideal range is calculated on a trial and error basis. However to find the exact value the image could be imported into MATLAB and the exact pixel value concerning the dark necrotic portion can be found out using the "impixelinfo" command. We rely on OTSU's method of thresholding to identify the borderline between dark and white i.e. the "mode" value is taken when determining the borderline value beyond which the pixel's to be considered goes 255 or 0. Then performed and additional edge detection using either the gradient method or canny filters.

This gives an idea of the topography of the lesion. This step also helps us filter out the false positives which could be counted as important features i.e. light falling on the skin or any other aberrations

Contours are then found based on the OTSU's threshold. These contour points typically highlight the necrotic portion but for better results the contour points are superimposed using contour approximation technique using the approximate parameter and accuracy set typically between 0.01 to 0.03 for best results. The center of the plotted contours gives the necrotic portion which is found by calculating moments of a pixel location.

## MATHEMATICS

The Moments can be calculated using the Standard relation. Using the basis of finding the center a similar logic in source[12] has been used for the implantation.

$$Cx = \text{Integer of } \frac{m["01"]}{m["00"]}$$

$$Cy = \text{Integer of } \frac{m["10"]}{m["00"]}$$

Here m corresponds to the moment function which is obtained from the individual Contour points. Cx and Cy values are stored in tuples which corresponds to the center of the lesion.

## V. RESULTS AND DISCUSSION



Fig.3 Edge gradient profile of the target area

## International Journal of Innovative Research in Computer and Communication Engineering

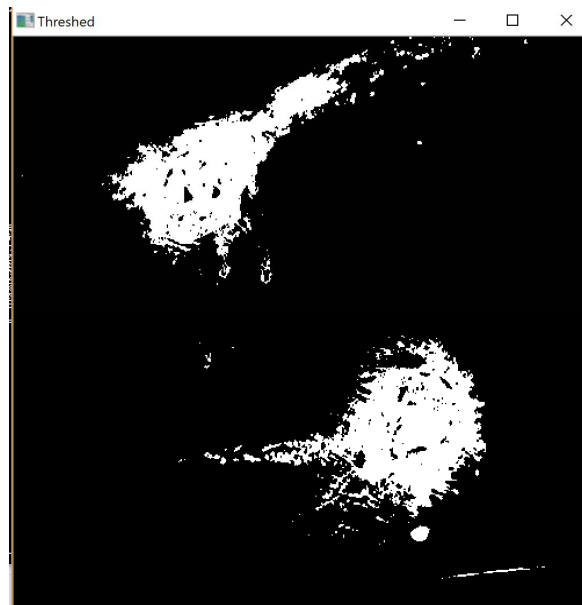
(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: [www.ijircce.com](http://www.ijircce.com)

Vol. 6, Issue 7, July 2018

It is observed from figure 3 that the middle region of the image is not the actual lesion when compared visually to the original image. Our target location is the two extreme circular impressions in Fig 3.

In the next figure it is seen that OTSU's method is quite successful in separation of the two extreme portions from the edge gradient.



**Fig.4** OTSU's Threshold separates the two distinct portions

The next step shows the contour generation with the associated values obtained from the first plot. These contours are again super-imposed by contour approximation followed by calculation of the center. The results are mapped in different colours using the built-in color function to show the difference in accuracy.



**Fig.4** Successful marking and identification

# International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: [www.ijirce.com](http://www.ijirce.com)

Vol. 6, Issue 7, July 2018

The image in Fig.5 explains three things firstly the green marker represents the general portion of the necrosis. The Red lines are basically the convex hull which has been found out separately to account for any border values which may have been missed by the contour function. Convex hull basically forms a polygon from every edge pixel value. The centre red values are generated from the moments function which has been explained in section 5.



(Image copyrights acknowledged)

Fig.5 The Same programming logic applied to a lesion in a different location

## VI.REMARKS

This algorithm can be further improved by implementation of neural networks the process of identifying the most suited value to be considered as a contour point could be found using ANN. Being developed on an open -source platform this algorithm is well suited for modification for other detection purposes .

## REFERENCES

- [1]Constantin A Dasanu. Erythematous skin lesions with necrotic centers on lower extremities due to the use of ruxolitinib for primary myelofibrosis. *Journal of Oncology Pharmacy Practice*, page 1078155218768875, 2018
- [2] Ulcerous lesions disclosing cutaneous infection with *Fusarium solani* - Scientific Figure on ResearchGate. Available from: [https://www.researchgate.net/Two-well-delimited-rounded-ulcerous-lesions-with-necrotic-centres-and-erythematous\\_fig1\\_6118021](https://www.researchgate.net/Two-well-delimited-rounded-ulcerous-lesions-with-necrotic-centres-and-erythematous_fig1_6118021) [accessed 11 Jul, 2018]
- [3] Rafael Dominguez-Castro, Member, IEEE, Servando Espejo, Member, IEEE, Angel Rodr'iguez-Vazquez, ' Fellow, IEEE, Ricardo A. Carmona, Peter F ' oldesy, ' AkosZar ' andy, P ' eterSzolgay, Tam ' as Szir ' anyi, and Tam ' as Roska, ' Fellow, IEEE A 0.8- m CMOS Two-Dimensional Programmable Mixed-Signal Focal-Plane Array Processor with On-Chip Binary Imaging and Instructions Storage. *IEEE JOURNAL OF SOLID-STATE CIRCUITS*, VOL. 32, NO. 7, JULY 1997
- [4] Travis E Oliphant. *A guide to NumPy*, volume 1. Tregol Publishing USA, 2006
- [5] Gary Bradski and Adrian Kaehler. *Opencv. Dr.Dobbs journal of software tools*, 3, 2000
- [6] Adrian Kaehler and Gary Bradski. *Learning OpenCV 3: computer vision in C++ with the OpenCV library*. O'Reilly Media, Inc, 2000
- [7] Aaron Watters,James, James C Ahlstrom, and Guido Van Rossum. *Internet programming with Python*. Henry Holt and Co., Inc. ,1996
- [8] Ragan-Kelley,Min and Perez, F and Granger, B and Kluyver, T and Ivanov, P and Frederic, J and Bussonnier, M. *The Jupyter/IPython architecture: a unified view of computational research, from interactive exploration to communication and publication*. AGU Fall Meeting Abstracts,2014
- [9] Fournier,John Byrne and Cummings, Francis and Cannella, Jonathan and Breen, Catherine and Zhou, Linda and Iwamoto, Satori.*Drug-associated skin lesions in a patient with myeofilbrosis receiving ruxolitinib*. *Dermatology online journal*.VOL 20,NO.10, 2014
- [10] Chatterjee, Basabi and Rqieh, Usama and Greaves, Paul and Piras, Daniela and Firth, John and Saja, Khalid.*Sweet syndrome as terminal event in ruxolitinib-treated myelofibrosis*. *British journal of haematology*, Wiley Online Library.VOL.169,NO. 3,2015
- [11]Michael Del Rosario, Henry Tsai, Constantine A Dasanu. Persistent foot ulcer due to ruxolitinib therapy for primary myelofibrosis. *Journal of Oncology Pharmacy Practice*, Volume 24 Issue 3, 2018
- [12] OpenCV 2.4.13 Documentation imgprocmodule.Image processing. Accessed on 27/7/2018 Available at [https://docs.opencv.org/2.4/doc/tutorials/imgproc/imgtrans/hough\\_circle/hough\\_circle.html](https://docs.opencv.org/2.4/doc/tutorials/imgproc/imgtrans/hough_circle/hough_circle.html)



ISSN(Online): 2320-9801  
ISSN (Print): 2320-9798

# International Journal of Innovative Research in Computer and Communication Engineering

*(A High Impact Factor, Monthly, Peer Reviewed Journal)*

Website: [www.ijircce.com](http://www.ijircce.com)

Vol. 6, Issue 7, July 2018

## BIOGRAPHY

Satyake Bakshi completed his undergraduate in Biomedical Engineering from VIT Vellore. He has shared interest in medical image processing and neural networks . He is an adept programmer with experience in image analysis. He is currently pursuing master's in biomedical engineering from Carleton University ,ON, CANADA.

SathyaAis pursuing his master's in Biomedical Engineering from VIT Vellore, INDIA. He has shared interest in medical image