Skin Lesion Detection Using Adaptive Regularized Kernel Based Fuzzy Algorithm

Dr.P.Tamije Selvy, N.Shabarish, M. Anitha

Abstract: Skin cancer is found to be the worst type of cancer which is generally difficult to predict in early stages. In recent days, it has been proved that Computer Aided Diagnosis (CAD) System provides best result in automatic diagnosis of lesions in skin. The purpose of this research paper is early and automatic diagnosis of lesions in skin. Preprocessing, Segmentation by Adaptive Regularized Kernel Based Fuzzy and feature extraction is done in order to achieve a rapid and reliable diagnosis. This proposed work is implemented on 232 images obtained from International Skin Imaging Collaboration (ISIC) archive.

Index Terms: Computer Aided Diagnosis, Melanoma, Region of Interest, Skin Cancer, Adaptive Regularized Kernel Based Fuzzy

1. INTRODUCTION

In the past few years Melanoma type of cancer is rising considerably. This deadly disease is difficult to diagnose. If detected early then mortality rate my lower. Therefore it is suggested that early and accurate detection of melanoma is necessary. This research work deals with more reliable and accurate detection of melanoma cancer using automated system. The proposed system introduces an efficient pre-processing where enhanced filtering and resizing methods are incorporated. In addition segmentation and feature extraction are applied on the images. Input image is resized to a defined format and median filter is used to remove the noise. The de-noised image is later segmented using Adaptively Regularized Kernel-Based Fuzzy –Means and features excluding unnecessary components are extracted. Major goal of this paper is to automatically identify skin lesion. Therefore false positive rates can be highly reduced using automated detection system.

1.1 Skin Lesion

Skin cancer is one of the deadly diseases that affect exposed parts of humans. Skin cancer can be categorized into malignant and benign (Figure 1). Malignant type of skin cancer is considered to be the deadliest form which is caused due to melanocyetes [1]. Benign cancer includes squamous and basal cell skin cancer type which can be treated easily. This type grows slowly which may rarely lead to death. Majority of skin cancers are difficult to diagnose at early stages. Biopsy is necessary to confirm whether lesion may be cancerous or non-cancerous. But in most cases doctors find it difficult to conclude the severity of the disease. Types of biopsies include punch, shave, excisional and incisional. In general detection of malignant melanoma is a challenging task for dermatologists. The most important and inspiring factor is that once melanoma detected early, then there is a possibility of cure.

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(a) (b)

Figure 1: *(a) Malignant melanoma (b) Benign melanoma*

2 LITERATURE SURVEY

Gandini S et al. proposed that malignant melanoma is the most common cancer. If detected early, this type of cancer can be cured with a success rate of over 92%. There have been many attempts by researchers in automatic detection of skin cancer to improve the accuracy. Researchers in the field of dermatology imaging proves that skin cancer diagnosis (melanoma) can be computerized by physical features and color details that are characteristic of this deadly disease [2].

Author proposed that skin cancer (Melanoma) is one of the most deadly cancers [3], but when diagnosed early, it can be cured. Reports reveal that more than a million deaths occur due to melanoma. These properties are analyzed using different image processing techniques like Greyscale conversion, Segmentation, contour tracing, and histogram analysis. Stolz et al suggested that the skill of the dermatologists is critical to achieve accurate diagnostic performance considering dermoscopy images. The use of computer aided diagnosis can be used to tackle this critical situation. The computer aided diagnostic systems are also referred to as “Computerized Dermoscopy” [4]. This paper reveals the latest trends in dermoscopy related to early melanoma diagnosis, management and diagnosis of nodular lesions and their followup digitally. In this paper skin lesion images are semantically analysed using ontology based analysis. The author extracted low level features (shape, color and texture) from each lesion image. Features that are extracted are subjected to classification using Support Vector Machine classifier. The results reveal that ontology based method provided accuracy of 76.9% [5].

3 .PROPOSED SYSTEM

The proposed framework suggests automatic detection of skin lesion which is considered to be the cause for mortality [6].

The proposed work includes the following phases: 1) Preprocessing (Resizing, RGB to grayscale conversion and noise removal using Median filter), 2) Segmentation (Adaptive Regularized Means Kernel Based Fuzzy), 3) Feature extraction (Binary Image conversion and ROI extraction).

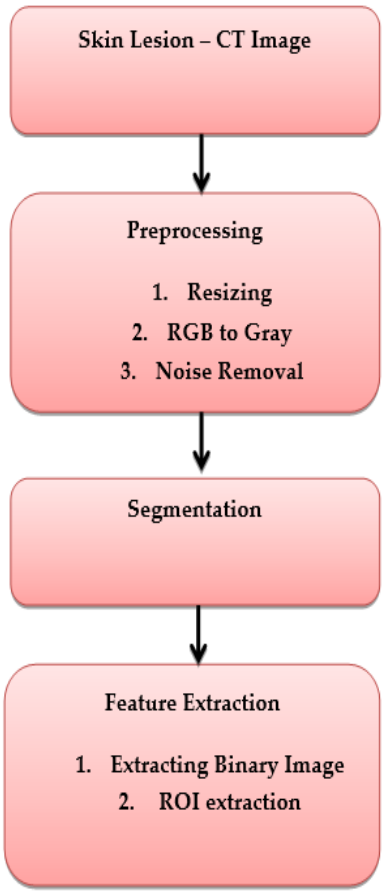

Figure 2: *Overall framework of proposed model.*

3.1 Preprocessing

Image pre-processing is done at the lowest level of abstraction which aims to improve the quality of imaging data. Outliers such as noise can be removed and subjected for further processing. Preprocessing involves extraction of useful information and grouped as radiometric or geometric corrections. The preprocessing techniques such as the resizing, color conversion and noise removal are analyzed in this section. All images obtained vary in size; therefore, a base size should be set to all the digital images for further processing. In order to resize height, width and number of RGB channels must be considered. In resizing phase all skin lesion CT images are resized to 256*256 (Figure 3).

3.1.1 Resizing

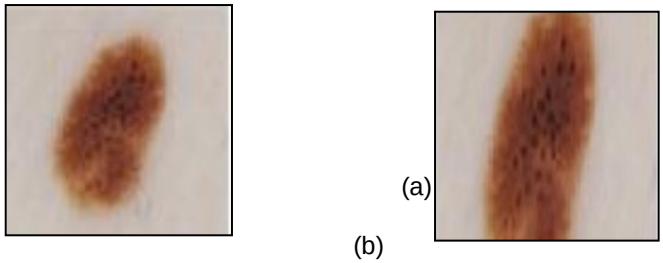

Figure 3: *(a) and (b) represents original CT image of Skin lesion and resized image respectively.*

As all input images are in RGB (3D) format, it must be transformed to 1D i.e., Grayscale form. RGB is converted to grayscale In-order to reduce complexity for further processing (Figure 4)

3.1.2 RGB To Grayscale Conversion

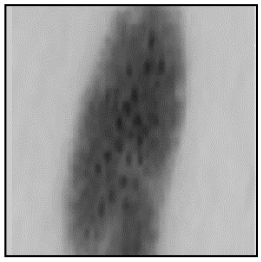

Figure 4: *RGB image to Gray scale image.*

Inorder to remove the entire outiers present in CT images, salt and pepper noise is imposed to the image obtained after resizing. Median filter is used to remove the salt and pepper noise [7]. Median filtering technique is preferred because it preserves the edges of the image even after filtering is done. This effective filering method removes the white and black speckles by replacing the actual value of neighborhood by its median value (Figure 5).

3.1.3 Noise Removal

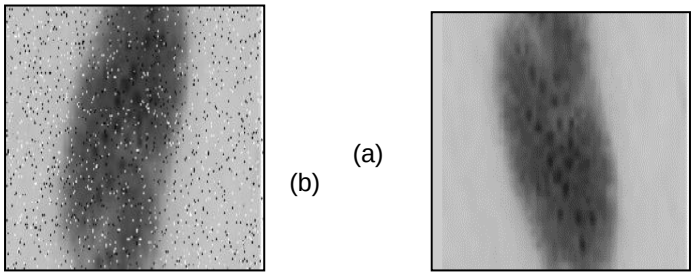

Figure 5: *(a)Salt and pepper noise imposed CT image.(b)Filtered image using Median filter.*

3.2 Segmentation

Image segmentation model is a very important and challenging process in image processing which is used to partition an image into meaningful parts with similar features or attributes. The goal of segmentation is to represent the image in meaningful and analyzable way.

3.2.1 Adaptive Regularized Kernel Based Fuzzy Clustering
Adaptively Regularized Kernel-Based Fuzzy -Means (ARKFCM) algorithm is used to segment the CT images. ARKFCM is preferred mainly as it increases robustness. ARKFCM adopted the heterogeneity of grayscales in the neighborhood and replace the actual Euclidean distance with Gaussian radial basis kernel functions by exploiting local contextual information [8]. In order to improve the efficiency of the kernel-based FCM (KFCM) for image segmentation, the additional spatial context is added to the objective function of KFCM and a new objective function is calculated [9].

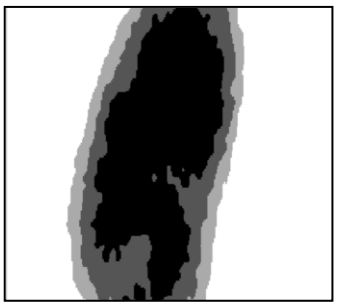

Figure 6: *Segmented CT image using ARK-FCM.*

3.3. Feature Extraction
Feature extraction is considered as an effective-weapon to analyze and process the images appropriately to achieve higher accuracy. Feature extraction is done in order to remove the features like color, shape, texture etc., It includes advantages like improvement in accuracy and decreased complexity. Featue extraction is done on images without losing important or essential or relevant informations. In addition it also reduces the redundant data.

3.3.1 Extracting Binary Image
It is a important factor to extract binary image from background. As it generates unique featues or attributes this phase is vital. Pattern recognotion is made easy by extracting binary image from a grayscale image. In order to extract features of object, that image must be undergone any morphological filtering technique. In this proposed system, median filter is used to remove the noise. Therfore such denoised images are well suitable for binary image extraction as it can be labeled and processed independently. All the labeled object is denoted as '1' and others as '0'. Once labeling is done an image is obtained with object numbers. Binary object features may be are, aspect ratio, thinness. To extract these features separate image is created individually [10].

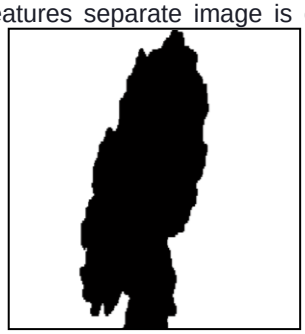

Figure 7: *Binary Image of Extracting*

3.3.2 ROI Extraction

Extracting Region of Interest from binary images is a very much challenging because it is the base for future image analysis and classification [11]. In general, ROI extractions involve edge detection. Edge detection is done to find the areas of an image where intensity changes occur [12].

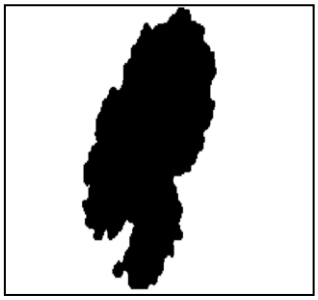

Figure 8: *ROI extracted image*

4 CONCLUSION

Manual detection of lesions in skin may lead to wrong diagnosis. To overcome this drawback, certain machine learning techniques are proposed. This proposed work included the preprocessing, segmentation and feature extraction phases. Finally the lesion region is extracted automatically and accurately. Future enhancement includes classification by Multi class multi level classification algorithm followed by an enhanced optimization technique.

REFERENCES

[1] Argenziano, G., Soyer, H. P., De Giorgi, V., Piccolo, D., Carli, P., Delfino, M., Wolf, I. H., "Interactive atlas of dermoscopy CD: EDRA" Medical Publishing and New Media, Milan, 2000.

[2] Gandini S., Sera F., Cattaruzza M.S., Pasquini P., Zanetti R., Masini C., Boyle P., Melchi C.F, "Meta-analysis of risk factors for cutaneous melanoma: III. Family history, actinic damage and phenotypic factors". Eur. J. Cancer. 2005;41:2040–2059. doi: 10.1016/j.ejca.2005.03.034.

[3] Diepgen T.L., Mahler V, "The epidemiology of skin cancer". Br. J. Dermatol. 2002;146:1–6. doi: 10.1046/j.1365-2133.146.s61.2.x.

[4] Stolz W., Riemann A., and Cognetta A., "ABCD rule of dermatoscopy: A new practical method for early recognition of malignant melanoma," Eur. J. Dermatol., vol. 4, pp. 521–527, Sep. 1994.

[5] WiemAbbes, DorraSellami, "Automatic Skin Lesions Classification Using Ontology-Based Semantic Analysis of Optical Standard Images", 21th International Conference on Knowledge Based and Intelligent Information and EngineeringSystems-ELSEVIER, Proceedia in Computer Science 112(2017) 2096-2105.

[6] D. Gutman, N. C. Codella, E. Celebi, B. Helba, M. Marchetti, N. Mishra, and A. Halpern, "Skin lesion analysis toward melanoma detection: A challenge at the international symposium on biomedical imaging (isbi) 2016",The international skin imaging collaboration (ISIC)," arXiv preprint arXiv:1605.01397,

2016.

[7] Bhaswati Das ; Jesmine Saikia ; S.R. NirmalaJayanta Das, “Removal of salt and pepper noise using selective adaptive median filter”, IEEE-2016 International Conference on Accessibility to Digital World (ICADW), 2016.

[8] Hemalatha K. L., Dr. Sunilkumar Manvi, Dr. H.N. Suresh, “Adaptive Weighted-Covariance Regularized Kernel Fuzzy C Means Algorithm For Medical Image Segmentation”, Journal of Theoretical and Applied Information Technology,31st July 2017. . Vol.95. No 14 © 2005 – ongoing JATIT & LLS ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195 3365.

[9] Guang Hu* and Zhenbin Du, “Adaptive Kernel-Based Fuzzy C-Means Clustering with Spatial Constraints for Image Segmentation”, International Journal of Pattern Recognition and Arti¯cial Intelligence Vol. 33, No. 1 (2019) 1954003 (15 pages) World Scienti¯c Publishing Company DOI: 10.1142/S021800141954003X,July 2018.

[10] M. Allili ; D. Ziou, “Topological feature extraction in binary images”, Proceedings of the Sixth International Symposium on Signal Processing and its Applications (Cat.No.01EX467),IEEE.

[11] M. E. Celebi, N. Codella, and A. Halpern, “Dermoscopy image analysis: overview and future directions,” IEEE journal of biomedical and health informatics, vol. 23, no. 2, pp. 474–478, 2019.

[12] Selvy P.T, Palanisamy V, Purusothaman T, “Performance analysis of clustering algorithms in MR Images”, European Journal of Scientific Research, Vol. 62, Issue 3, 321-330, 2011.