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STUDY ON MORPHOLOGICAL DILATION AND EROSION FOR SKIN TEXTURE ANALYSIS

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ABSTRACT

Morphological filtering process includes plethora of operations. Two important operations are dilation and erosion. In this paper we proposed a methodology to classify skin texture images. It is a supervised learning process containing both training and testing phases. The training phase takes input skin texture images and subjects them to erosion and dilation in order to have transformed images. With the transformed images a classifier is built. The classifier has a resultant model that is used for classification of testing set. In the classification phase, the unknown skin texture images given as input are subjected to morphological filteringas this approach is time and power consuming, a new feature-based classification for the detection of skin in various features of images as described in this paper. This approach reduces the professional's work. The morphological operation is used to differentiate the cancerous cell from the image. The skin texture features are obtained from processed image and used for classification of images as malignant and non-malignant.

Keywords: Skin Texture, Morphological filtering

1.0 INTRODUCTION

Morphology in context of image processing means description of shape and structure of the object in an image. Morphological operations work on the basis of set theory and rely more on relative ordering of the pixel instead on their numerical value. This characteristic makes them more useful for image processing. The input data for the mathematical morphological operations are two images: raw image and primitive image. Morphological operations are well defined for binary images but are equally valid and are found useful for gray scale images also. Structuring element is a binary matrix of very small size. The structuring element is applied to interact with the image to get the resultant. The important characteristics to be considered for a structuring element are its shape, size and origin. Shape of the structuring element is the arrangement of ones and zeros in a pattern within the matrix. Size of the structuring element, acts as a 'window' over which the interaction takes place. It also helps to differentiate image objects or features. The origin of the structuring element identifies the pixel of interest that is to be processed. The mechanism of structuring element resembles that of masks used in spatial filtering, it is moved all around the image to be probed to find hit or miss at that location.Skin is one of the complex parts of human body. Modelling it is very challenging for different reasons. Reflection of light and interreflection of light have their impact on the skin while capturing it. Skin exhibits optical properties that are complex in

nature. It involves pores and wrinkles with different surface microgeometry besides having different optical properties of layers of skin. Like any other surface in the real world, skin is also affected by the direction of light which illuminates it. This fact is illustrated in Figure where lip part of human face is considered with three different directions of light for illumination. The texture of lip part appears differently in each image due to direction of incident illumination. For human eye, the images look differently though same lip surface is captured with different directions in illuminating the surface while capturing the images.

Applications of morphological operations

Morphological operations are useful in many applications. To list a few, they are used in hole filling, boundary extraction of objects, extraction of connected components, Thinning and thickening and so on. Among these applications the boundary extraction is shown below. For comparison it is done with Sobel edge extraction.

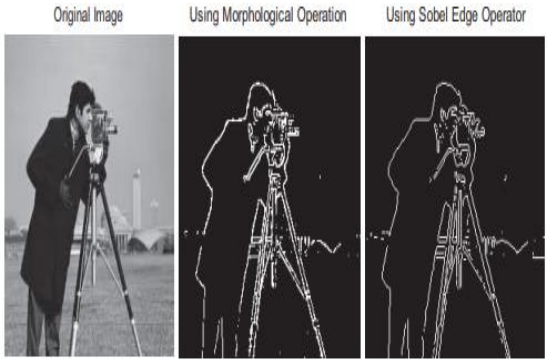

Figure: Different morphological image operations

3.0 LITERATURE REVIEW

Morphological image processing [1]. It can be used for filtering, thinning and pruning. It is constructed with operations on sets of pixels. More sophisticated mathematical development are been required to Morphological processing for gray scale images [2,3]. Dilation and erosion are the main morphological operations [4]. The objects are expanded in dilation operation, thus small holes probably are filled and disjoint objects are connected. The objects are diminished in erosion operation with etching away (eroding) their boundaries. An application with the ability to select the proper structuring element and how erode or dilate the objects is proposed. These operations can be customized for an application by the proper selection of the structuring element, which determines exactly how the objects will be dilated or eroded [5]. The state of any given pixel in the output image is determined by applying a rule to the corresponding pixel and its neighbour's in the input image in the morphological dilation and erosion operations [6]

4.0 RESEARCH METHODOLOGY

Morphological techniques typically probe an image with a small shape or template known as a structuring element which is positioned at all possible locations in the image and is compared to the pixels in the corresponding neighbourhood. The way these comparisons are carried out is the difference in Morphological Operations. A noisy and cluttered image can be processed morphologically and editing can be done based on the size and shape of the objects of interest so that the noise and clutter will be removed. Morphological Image Processing, where the information of the image is not lost, can be substituted for a Linear Image Processing as it sometimes distorts the underlying geometric form of an image Morphological Image Processing

is used to reconstruct the original image through Dilation, Erosion, Opening and Closing techniques for a finite no of times.

Morphological Operations:

The process of the structuring element B on the image A and moving it across the image in a way like convolution is defined as dilation operation. The two main inputs for the dilation operator are the image which is to be dilated and a set of coordinate points known as a structuring element which define also as a kernel

- Suppose that X is the set of Euclidean coordinates corresponding to the input binaryimage, and that K is the set of coordinates for the structuring element.
- Let Kx denote the translation of K so that its origin is at X.
- Then the dilation of X by K is simply the set of all points X such that the intersection of Kx with is X is non-empty.

The operation of erosion: The erosion process is as same as dilation, but the pixels are converted to 'white', not 'black'. The two main inputs for the erosion operator are the image which is to be eroded and a set of coordinate points known as a structuring element which define also as a kernel. The exact effect of the erosion on the input image is determined by this structuring element.

- Suppose that X is the set of Euclidean coordinates corresponding to the input binary image, and that K is the set of coordinates for the structuring element.
- Let Kx denote the translation of K so that its origin is at X.

System Description: The defined approach is developed to categorize the skin lesion based on the system/computer vision to classify them with removal of selective set of options from skin diseases. The summary of the projected technique is shown below in the figure.

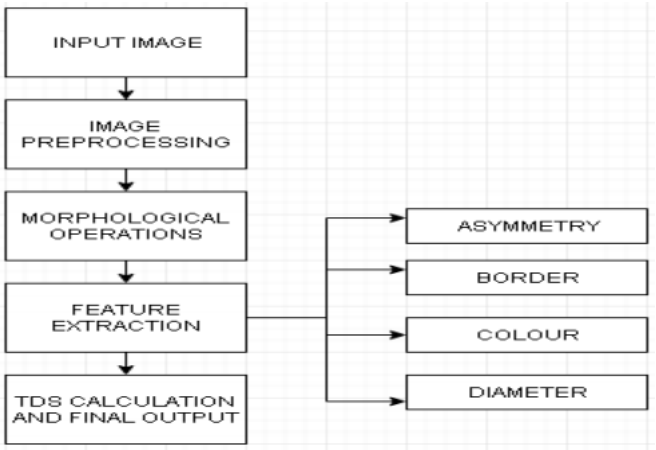

Figure: System Architecture of proposed method

Pre-processing: The first and the foremost step in the regular and automated analysis is to pre-process the image. The pre-processing techniques differs with various dataset of the images with various applications. The pre-processing techniques is done to classify the images based on image enhancement and image restoration. Due to clatter in image, we have a tendency to conduct filtering technique referred to as Gaussian filter In this work, 5*5 Gaussian filter is used to smoothen the image, since second convolution is used in Gaussian to 'blur' the images and to get rid of hair and noise.

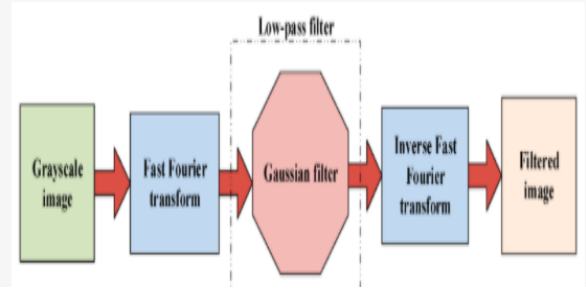

Figure: Filtering process.

Morphological Operations:

Morphological operations like dilation and erosion are applied to the image before the filter image is preceded. Figure shows the image filtering the image that is morphological operations. Morphological operations are applied on binary image Dilation continued by erosion is the closing operation and opening operation is the reverse of closing operation. In a binary image, the object can be thickened by distension and shrinkened by using the method erosion.

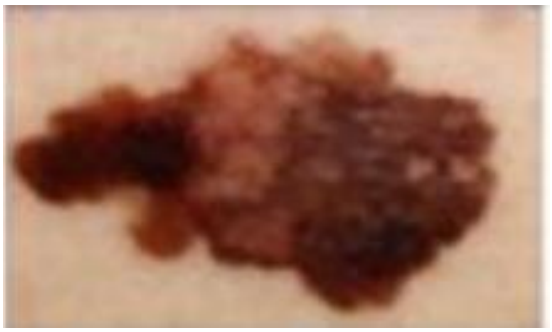

Figure: Filtered image after Morphological operations

5.0 RESULTS AND DISCUSSIONS

Morphological filtering is one of the image processing techniques. It involves in a set of non-linear operations that are pertaining to shape or morphology of different features of given input image. The features include skeletons, boundaries and so on. There are many techniques related to morphological filtering. In every technique there is a common thread which is nothing but probing an input image with structuring element. Structuring element is a template or small shape which can define a neighbourhood or region of interest (ROI) around a pixel in the image.is an operation that sets a pixel given location such as (i,j) to the minimum when compared with all other pixels in the neighbourhood. A structuring element is computed and used in the erosion process. The structuring element is nothing but a Boolean array which represents neighbourhood. The dilation on the other hand is another morphological activity which sets a given pixel at position (i,j) to the maximum when compared with all other pixels in the neighbourhood. Dilation process shrinks dark regions and enlarges bright regions. Opening is the process in which erosion takes place followed by dilation. It is meant for removing small regions containing bright spots or salt in other words. It also helps in connecting small dark cracks. Closing is a morphological operation which is nothing but the dilation followed by erosion. It is used to remove small dark spots or pepper. It is also used to connect small bright cracks. White tophat operation is nothing but the result of an image when morphological opening is carried out. In the same fashion, black tophat is nothing but morphological closing operation minus the given original input image. It is meant for returning dark spots of given image which is smaller when compared to structuring element. Skeletonize is the process of thinning applied to a binary image to reduce each connected component.

SKIN TEXTURE ANALYSIS

Analysing skin textures and classification of the same have wide range of

applications in multiple disciplines. For instance, skin texture can be used as biometric in the form of face recognition in various security applications. Skin appearance and modelling it accurately helps in biomedical evaluation and medical treatments. It can also be used to evaluate the effectiveness of treatments given to patients besides measuring progress from previous treatments. Skin texture analysis is especially useful in the computer aided diagnosis in healthcare units of dermatology. Thus, it is a potential application in dermatology as dermatologist can use representations of textures for preliminary diagnosis with respect to lesions, moles etc. It can be used in data mining applications as well. It can provide representative image surface that can be used to match with textures in databases. This kind matching is useful in e-commerce applications also as customers can find materials from product imagery.

Figure: Same skin surface appearing differently

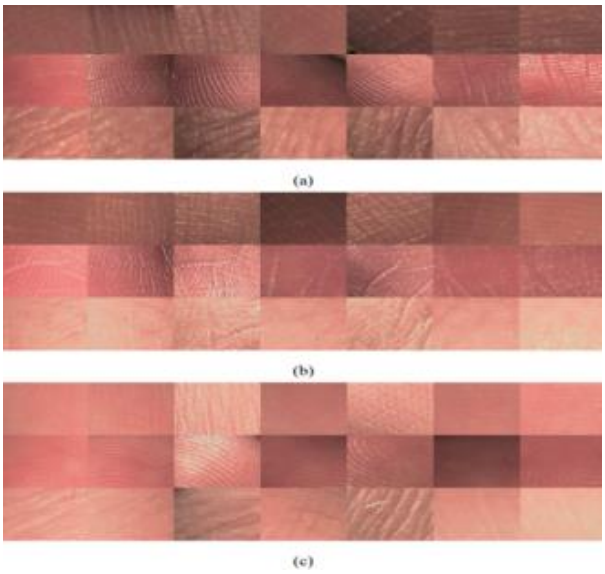

Figure: Skin texture images corresponding to class 1(a), class 2(b) and class 3 (c)

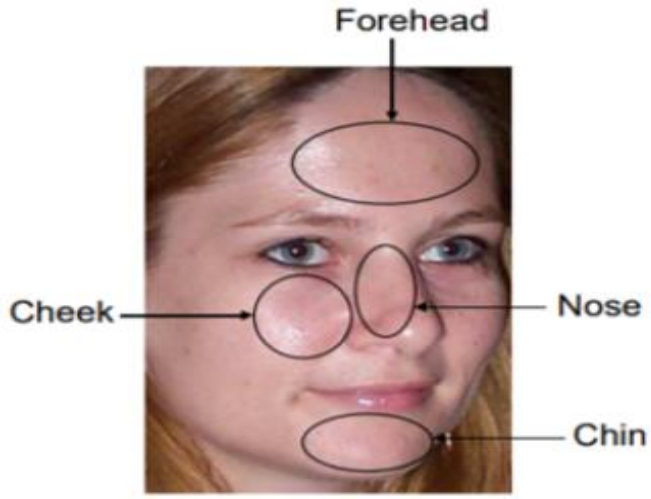

Figure: Shows different face locations that can have texture differently in face texture database

In the training phase, a set of unknown skin texture images are considered for input. Then the input images are subjected to morphological filtering that comprises of erosion and dilation. With these morphological operations, the input images are transformed and a model is built. The resultant classifier is further used in the classification phase.

CONCLUSION:

The proposed novel based method is used to classify the dermoscopic images which gives the correctness of result by classifying them either with their presence or absence of melanoma. Also, this method can easily partition the mole and detect the cancer on skin automatically. In addition to this, some other derived features may be used in identifying skin lesion. This is a innovative idea that needs more examination and evaluation and has a good potential for potential research. Furthermore, we believe that the same scheme with different features can also be useful for extracting other skin patterns.Then the resultant classifier is used for testing new images. In the testing phase the given testing skin texture images are transformed using morphological filtering approach and the help of classifier is taken to classify them. The accuracy of classification is measured and presented in the experimental results. The results revealed that the classification accuracy is influenced by the size of training set. In future we take more measures to evaluate the proposed methodology and improve it further to make it robust and adapt it to specific applications.

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