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SKIN TUMOR DETECTION THROUGH IMAGE PROCESSING

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Abstract

In this paper a new method for skin tumor detection is developed using image processing. Considered a variation formulation, the energy of which combines a diffuse interface phase-field model (regularization term) and a log-likelihood computed using nonparametric estimates (data attachment term). Adopted CNN with the exact solutions which have the advantage to avoid space discretization and numerical instabilities. The resulting algorithm is simple and easy to implement in multi-dimensions. Concerning applications, focused on skin tumor segmentation. The clinical dataset used for the experiments is composed of 15 images with the ground truth given by a dermatologist. Comparisons with the reference methods, the proposed method is more robust to the choice of the volume initialization. Moreover, the flexibility introduced by the diffuse interface, the sensitivity increases by 12% if the initialization is inside the lesion, and the Dice index increases by 59%, if the initialization covers the entire lesion. The results show that this new method is well designed to tackle the problem of underestimation of tumor volumes.

1. INTRODUCTION

Digital Image is a non-destructive, fast, readily available and affordable means for determining thesize, structure and echoic properties of skin lesions. This imaging modality is useful in the diagnosis,surgeryplanningandmonitoringofbenignormalignanttumorsoftheskin,suchasnevus,melanomaandbasal cell.Thevastmajorityofskincancersarebasalcellcarcinomasandsquamouscellcarcinomas. While malignant, these are unlikely to spread to other parts of the body if treated early. Theymay be locally disfiguring if not treated early. However, it is well known that images suffer from twomajor defects, the low contrast and the presence of speckle noise making processing's more difficult.This explains why many works are still devoted to improve image segmentation algorithms. In thispaper, we focus on the problem of skin tumor segmentation in digital images.Skincanalsoproducemanytypesofcancers.Imageprocessingisusedtodetectthesetumorsbyusingvariousmethodslike segmentation, filtering, feature extraction etc. To get an improved image or to get meaningfulinformation from an image, it is necessary to convert an image into digital form and then performfunctions ontothatimage.Itisapartofsignalprocessing. Theinputisanimageandit may be a video, a photograph and output is also another image having same characteristics as input image.Mostly Image Processing models take input samples as 2-D signals and after that they apply fixedsignal processing methods to them. It is widely used technology now a days and it has variousapplicationsin the areaofbusiness.

2. LiteratureSurvey

The skin cancer rate is increasing day by day because of pollution and climatic changes occurring inour environment. Skin tumors are frequent tumors to every person and various types of infections arebecoming very frequent. You know that all of these tumors are very harmful, especially if notcontrolled at an early stage. Skin tumors can easily transfer from human to human so there is a needto control it their initial stage to prevent it from spreading. This skin cancer is basically of two majortypes theyare melanoma andnon-melanoma.This is mainlycaused due to direct exposuretoultraviolet(UV)radiation duetopollutionozonelayerisdepletingdaybydaywhichprotectsusfromUV rays and now humans are directly exposed to ultraviolet rays based on a report every 10 percentdepletion of the ozone layer will generate 3 million new non-melanoma and 4500 new melanomacases. As per cancer.net statistics this year 1,00,350 people are diagnosed with melanoma type skincancer in the United States out of this 60,190 are men and 40,160 are women. This skin cancer isranked 5th most occurring type of cancer among men and the 6th most occurring type of canceramong women. This is more common in white people than black people the average age of theinfected people with this disease is 65. below 50 years fewer men are diagnosed than women withmelanoma but if we consider the people with age above 65 the infected men are more than two timesof infected women and for above 80 it is about three times, so by this, we can say that melanoma ismore prevalent among the old age people but it is developed in young age people too. It is a commontype of cancer diagnosed in young age adults in the group of young adults it is more in women thanmen this year in the United States 2,400 melanoma cases are diagnosed among the people betweenages 15 to 19. This projectpresents an implementationofaskintumorsdiagnosissystemwhichhelpsusertodetecthumanskintumorsandprovidesmedicaltreatmentstimely.Forthispurpose,user will have to upload a tumor affected skin image to our system and give

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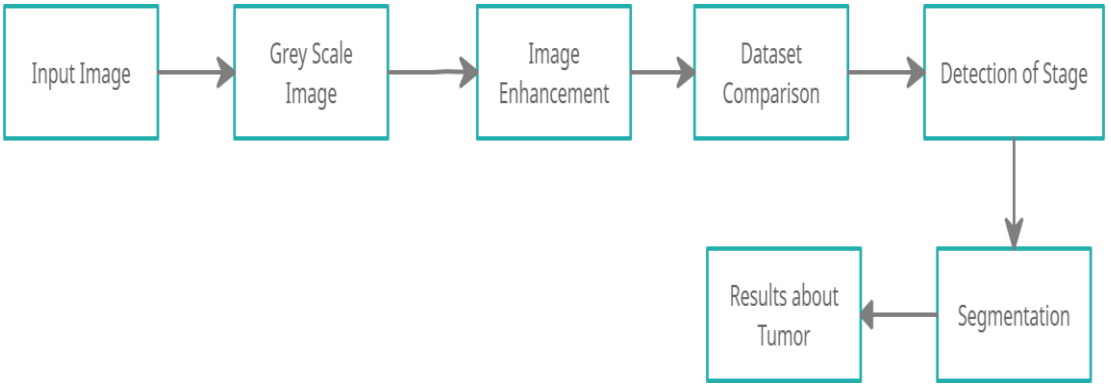
answers to the questionswhich are asked to user according to the symptoms of the skin. These symptoms are used to identifythe tumor and provide a medical treatment. Non-Melanoma skin cancer is more common and mostlycurable it is approximated that more than 3 million cases of non-melanoma are reported every year inthe United States this number is rising every year. The rate of deaths is declining every year due toearly detection and advance medical facilities. Most common types of nonmelanoma are Basal cellcarcinoma,Squamouscellcarcinoma,Merkelcell.EveryyearBasalcellcarcinomaismorediagnosedthantheothert woitconstitutesmorethan80%ofnon-melanomaskincancer.Nearly2000 people die every year with Basal carcinoma and Squamous cell carcinoma. The image of skintumor is taken and various pre-processing techniques are applied onto that image for noise removalandimageenhancement.Thisimageissegmentedbyusingasegmentationtechniquei.e.thresholding segmentation. At last, data mining techniques are used to identify the skin tumor and toprovideрecommendationstousers.

ProposedAlgorithm

Convolutional neural networks, also called ConvNets, were first introduced in the 1980s by YannLeCun, a postdoctoral computer science researcher. LeCun had built on the work done by KunihikoFukushima, a Japanese scientist who, a few years earlier, had invented the neocognitron, a very basicimage recognition neural network. The early version of CNNs, called LeNet (after LeCun), couldrecognizehandwrittendigits.CNNsfoundanichemarketinbankingandpostalservicesandbanking,where they read zip codes on envelopes and digits on checks. But despite their ingenuity, ConvNetsremained on the sidelines of computer vision and artificial intelligence because they faced a seriousproblem: They could not scale. CNNs needed a lot of data and compute resources to work efficientlyfor large images. At the time, the technique was only applicable to images with low resolutions. In2012, AlexNet showed that perhaps the time had come to revisit deep learning, the branch of AI thatusesmulti-layeredneuralnetworks.Theavailabilityoflargesetsofdata,namelytheImageNetdatasetwith millions of labeled pictures, and vast compute resources enabled researchers to create complexCNNsthatcouldperformcomputervisiontasksthatwere previouslyimpossible.

3. BlockDiagram



First, we will create a Graphical User Interface (GUI) to control the operation for the detection oftumor. Here we will consider an input image where we have to detect the tumor. The image can be ofany resolution, so we will change the resolution of the image into 256x256. The input image is inRGB image format so to extract the features from the tumor we have to convert the format of theimage into Grey Scale image format. While capturing the image, there is a probability of occurrenceof the noise in the image. So, to remove the noise from the image and to enhance the quality of theimage we apply Discrete Wavelet Transform (DWT) method on the image. We will have a datasetwhich consists of few images and will apply the same procedure on each and every image in thedataset and we will train them for the detection of the tumor in the input image. Later we willcompare the input image with the images in the dataset to detect the region of the tumor on the skin.Then we will segment the image in order to obtain the exact location of the tumor in the image. Wewillbeabletocalculate theareaofthetumorintheimageand alsothetype oftumor.

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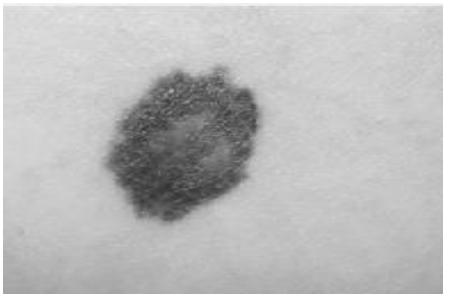
4.1 RGBto Grey-ScaleConversion

The input image is an RGB image. We are converting into Grey-Scale Image because color increasesthe complexity of the model. One may want to introduce an image processing tool using gray levelimages, as opposed to color, not because of the "format" of gray level images, but because theinherent complexityof graylevelimagesislower thanthatofcolorimages.

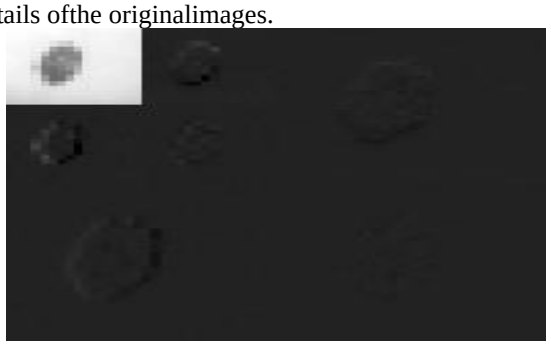
InputImage



Grey-ScaleImage

4.2 DiscreteWaveletTransformMethod

DWTisanalgorithmusedtoreducedimensionalityofanimagetoreducenoiseandtoenhancepicturequality during feature extraction process. In this project, we use Two Level Decomposition foranalyzing 2-D signals like images. So 2-D input signal like digital images is projected on the fourbases and the results are four different set of transform coefficients. 1. LL-Sub band consists of allwavelet coefficients, which is obtained from applying low pass filter to both rows and columns of animage. 2. HL-Sub band consists of all wavelet coefficients results from low pass filtering of the rowsfollowed by high pass filtering of the columns. 3. LH-Sub band consists of all wavelet coefficientsresultsfromhighpassfilteringoftherowsfollowedbylowpassfilteringofthecolumnsandmostlyitcarriesinformationabouttheverticaldetailsoredges.HH-Subbandconsistsofallwaveletcoefficientsresultsfromapplyinghighpassfiltertobothrowsandcolumns.Thisusuallycapturesthediagonaledges ordetails ofthe originalimages.



4.3 ImageSegmentation

Image Segmentation is the process of partitioning a digital image into multiple segments. The goal ofsegmentation is to simplify and/or change the representation of an image into something that is moremeaningful and easier to analyze. So with the help of Image Segmentation with will find the area ofinterestwhichistumorregion.

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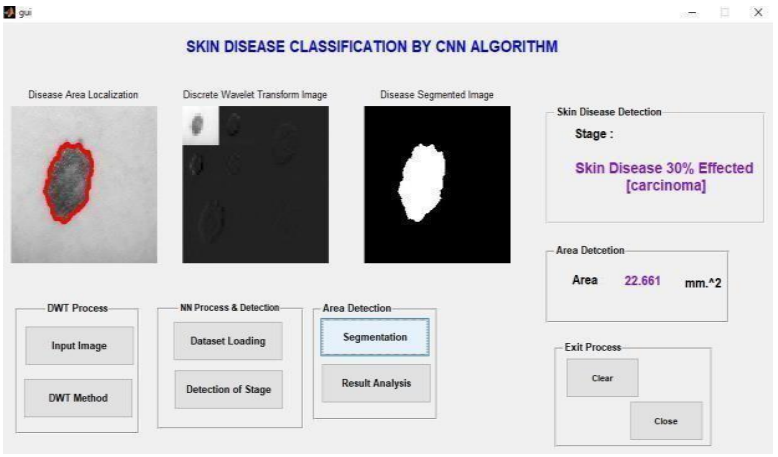
TumorDetection



4. Advantages

- Thepatient will getcurebeforeitturnsintocancer.
- Wecanprovideawarenessaboutthetumoranddiagnosisforit.
- LowCost.
- ItcanbeusedinHospitals,DiagnosticsCentersandMedical ResearchCenters.

5. Disadvantages

- Thisapplicationisimplementedonlyforthreeskintumors(BasalCellCarcinoma,SquamousCell CarcinomaandMelanoma).
- It is implemented only for windows application so that is not yet develop for smart phones likeAndroid,IOS etc.
- When capture the image for this application, it is mandatory to capture it without any lighteffects.
- Itonlysupports Englishlanguage.

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6. FUTURESCOPE

Duetotheperformanceandlesstimecomplexity,proposedalgorithmsareusefulinmanyapplicationsinultrasoundskinimagingandComputeraideddiagnosissystem.Inthefurtherwork,followingissuescanbeinvestigated.

1. Therearesomeimagesthattheproposed algorithmscannot handleproperly.
2. Proposed methods can be integrated with suitable classification algorithms to generate reliableComputer Aided Diagnosissystem.
3. MoreUS skinimagescanbe examinedto validatetheperformanceof proposedmethods.

8. CONCLUSION

In the proposed system, Image Pre-Processing, Image Segmentation for extracting the region ofinterest in the image itself and Image Classification steps are performed for categorizing skin lesionimages into melanoma or carcinoma. We have detected the tumor using CNN algorithm where wewill use DWT method (Two Level Decomposition) for removal of noise by not losing the data in theimage. CNNs display a high performance as state-of-the-art skin lesion classifier. By using CNNalgorithm, we are able to detect the tumor in the image with high accuracy and we are able todifferentiatethetumorandtheskinthroughthesegmentation.Theresultencouragesandmotivatefor future improvement and research for online diagnosing of melanoma in early stages before it istoolate.

9. References

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