IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

MULTIPLE DEEP CODER NETWORKS FOR MEDICAL IMAGES USING IMAGE SEGMENTATION

ABIRAMI.N[1], DR.S.SARASWATHI[2], DR.D.CHITRA[3]

1 PG STUDENT, 2, 3 ASSOCIATE PROFESSOR

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MAHENDRA ENGINEERING COLLEGE (AUTONOMOUS), TAMILNADU, INDIA

ABSTRACT

Image segmentation is commonly used to detect objects and boundaries. It is vital in many clinical claims, such as the pathological diagnosis of hepatic diseases, surgical planning, and postoperative assessment. The segmentation mission is hindered by fuzzy boundaries, complex backgrounds, and appearances of objects of interest, which vary considerably. The success of the approach is ability highly based on the operator's abilities and the level of hand-eye coordination. Thus, this project was strongly motivated by the necessity to obtain an early and accurate diagnosis of a detected object in medical images. In this project, propose a segmentation method based on the architecture of a Multiclass Support Vector Machines (MSVM). The architecture cannot only hold multi-level contextual information by extracting discriminative features at different effective fields-of-view and multiple image scales but also learn rich information features from missing pixels in the training phase. Moreover, the network is also able to capture object boundaries by using multi scale effective decoders. It also proposes a strategy for improving the method's segmentation performance based on a combination of a boundary-emphasization data augmentation method and a new effective dice loss function. The goal of this project is to make our deep learning network available with poorly defined object boundaries, which are caused by the non-specular transition zone between the back ground and fore ground regions.

Keywords: Skin Lesion, CT Images, Support Vector Machines, Gray Level Co-occurrence Matrix (GLCM)

1. INTRODUCTION

The widespread emergence of computer networks and the popularity of electronic managing of medical records have made it possible for digital medical images to be shared across the world for services such as telemedicine, teleradiology, telediagnosis, and teleconsultation. Instant diagnosis and understanding of a certain disease as well as cutting down the number of misdiagnosis has had extensive social and economic impact, clearly showing the need for efficient patient information sharing between specialists of different hospitals. In the handling of medical images, the main priority is to secure protection for the patient's documents against any act of tampering by unauthorized persons. Thus, the main concern of the existing electronic medical system is to develop some standard solution to preserve the authenticity and integrity of the content of medical images. Currently, most of the medical object screening systems are manually operated by clinicians. Owing to the limitation of human vision and the low sensitivity and specificity of the systems, physicians can, therefore, miss the target object during the checking phase. Furthermore, undetected objects often have a diameter smaller than 9 mm, which cannot be observed and localized clearly by the clinicians.

Besides, some objects are not detected because they are located in a dangerous area or are even hidden by an intestine fold. They may also be too fat and blurred in appearance to allow them to be seen visually. The high missing rate of clinicians can put patient's lives at risk.

1.1 COLORECTAL CANCER ACCORDING TO THE REPORT OF THE AMERICAN CANCER SOCIETY

For example, in terms of colorectal cancer, according to the report of the American Cancer Society, the number of newly diagnosed cancer cases in the United State was approximately 97,220 cases of colon cancer and 43,030 cases of rectal cancer in 2018. Besides, skin lesions are also a hot medical topic, especially as Melanoma is the most aggressive type of skin cancer and is responsible for a majority of skin cancer deaths. Furthermore, in the US, according to a publication of the American Cancer Society, the estimated number of new cases of melanoma and deaths due to melanoma were m91, 270 and 9,320, respectively. With regards to liver cancer, the estimated number of new cases of live cancer was 42,220 (including intrahepatic bile duct cancers) in 2018. Strikingly, liver cancer is about three times more common in men than in women. An estimated 30,200 liver cancer deaths occurred in 2018. The mortality trends of liver cancer have more than doubled, from 2.8 (per 100,000) in 1980 to 6.6 in 2015, with an increase of 2.5% per year from 2006 to 2015. Early diagnosis of cancer can greatly reduce its associated mortality; for example, if melanoma is diagnosed in its early stages, it can be cured with prompt excision.

1.2 COMPUTER AIDED SEGMENTATION

The medical image analysis community has taken notice of these pivotal developments. However, the transition from systems that require manual manipulation to systems that learn features from the data has been increased gradually. To help clinicians make faster and more accurate decisions, automatic medical image segmentation approaches have been introduced, and for the last two decades, they have been the most successful methods for medical image analysis. Computer aided segmentation systems can significantly reduce the missing rates of medical objects and help clinicians identify regions of interest despite the complexity of the case. By using apriority knowledge models that contains feature information about the expected shape and appearance of the objects of interest, model-based segmentation methods strive to interpret this knowledge using smart algorithms that have prior knowledge about the object structures. Owing to the information in the dataset, a model-based segmentation method is more stable and more accurate compared to traditional methods, whose performances are sensitive to local image artifacts and perturbations. However, common networks are usually generic models developed for commercial and industrial applications, and if peculiar biological objects with unique attributes need to be detected, their performances are not high enough to allow clinicians to make correct decisions. Therefore, many researchers have developed and investigated fast and precise medical object segmentation algorithms for providing early indications of the diagnosis. Nevertheless, because of restricted clinical requirements, their performances have not convinced doctors, especially as objects of interest always have unpredictable shapes and a large variety of sizes and aspects. Furthermore, in some cases, the shapes of wrinkles and folds are similar to those of tumors and objective cells.

1.3 ARTIFICIAL INTELLIGENCE

Moreover the transition zone between the object and its surrounding area usually does not exhibit a significant change in texture or color that would enable clinicians to distinguish it from all other normal regions. In order to deal with these main problems, we primarily focused on building a deep convolutional neural network to generate discriminative features that are Artificial Intelligence (AI) is an important field of computer science which thriving enormous research hotspots and applications. AI is an attempt of human intelligence and generates intelligent machines that process information. Its main agenda is to cultivate brain–like machines. AI has been part of many fields like robotics, NLP (Natural Language Processing), Expert-System, Image Processing, etc. Machine Learning (ML) is act as a core for AI and comprises different kinds of disciplines like convex analysis, approximation, probability and complexity theory. Machine learning technology provides computers the capability to computations without any pre-programmed. In order to improve performance of a computer, Machine Learning utilizes induction as well as synthesis concepts. Machine Learning technology implemented in different kinds of fields especially diagnosing diseases and bioinformatics. Machine and Deep learning technology plays a vital role in computer field and it act as an expert for predictions and making decisions.

2. LITERATURE REVIEW

BICLUSTERING MINING

In Breast cancer is now considered as one of the leading causes of deaths among women all over the world. Aiming to assist clinicians in improving the accuracy of diagnostic decisions, Computer-Aided Diagnosis (CAD) system is of increasing interest in breast cancer detection and analysis nowadays. In this paper, a novel computer-aided diagnosis scheme with human-in-the-loop is proposed to help clinicians identify the benign and malignant breast tumors in ultrasound. In this framework, feature acquisition is performed by a user-participated feature scoring scheme that is based on Breast Imaging Reporting and Data System (BI-RADS) lexicon and experience of doctors. Biclustering mining is then used as a useful tool to discover the column consistency patterns on the training data. The patterns frequently appearing in the tumors with the same label can be regarded as a potential diagnostic rule. Subsequently, the diagnostic rules are utilized to construct component classifiers of the AdaBoost algorithm via a novel rules combination strategy which resolves the problem of classification in different feature spaces. Finally, the AdaBoost learning is performed to discover effective combinations and integrate them into a strong classifier. The proposed approach has been validated using a large ultrasonic dataset of 1062 breast tumors instances (including 418 benign cases and 644 malignant cases) and its performance was compared with several conventional approaches. The experimental results show that the proposed method yielded the best prediction performance, indicating a good potential in clinical applications.

LARGE SCALE DERMOSCOPY IMAGES

The malignant melanoma has one of the most rapidly increasing incidences in the world and has a considerable mortality rate. Early diagnosis is particularly important since melanoma can be cured with prompt excision. Dermoscopy images play an important role in the non-invasive early detection of melanoma. However, melanoma detection using human vision alone can be subjective, inaccurate and poorly reproducible even among experienced dermatologists. This is attributed to the challenges in interpreting images with diverse characteristics including lesions of varying sizes and shapes, lesions that may have fuzzy boundaries, different skin colors and the presence of hair. Therefore, the automatic analysis of dermoscopy images is a valuable aid for clinical decision making and for image-based diagnosis to identify diseases such as melanoma. A deep Residual Network (Res Nets) has achieved state-of-the-art results in image classification and detection related problems. Compared with many deep networks, e.g., VGG Net, adding extra layers (beyond certain depth) results in higher training and validation errors. Therefore, it is challenging to optimize a very deep network with many layers. Res Nets architecture consists of a number of residual blocks with each block comprising of several convolution layers, batch normalization layers and Re Lu layers. The residual block enables to bypass (shortcut) a few convolution layers at a time.

DEEP RESIDUAL ARCHITECTURE

A proposed an automatic approach to skin lesion region segmentation based on a deep learning architecture with multi-scale residual connections. The architecture of the proposed model is based on U-Net with residual connections to maximize the learning capability and performance of the network. The information lost in the encoder stages due to the max-pooling layer at each level is preserved through the multi-scale residual connections. To corroborate the efficacy of the proposed model, extensive experiments are conducted on the ISIC 2017 challenge dataset without using any external dermatologic image set. An extensive comparative analysis is presented with contemporary methodologies to highlight the promising performance of the proposed methodology.

3. SYSTEM ANALYSIS

3.1 EXISTINGSYSTEM

The methodology on which the existing method is based, including the set of sample images used for evaluation, as well as detailing the theoretical basis of the proposed medical object segmentation. The model used for analyzing image is called as Convolutional Neural-Networks. Classification followed by finding of objects and its localization is the subsequent level of CNN techniques. The cascade architecture of dilated convolutions is used at the end of our network to extract multi-scale context information in local regions and does not require an increased number. This architecture can also effectively learn important information and recover parts related to object boundaries that are lost when the data passes through many convolutions and pooling layers because the second network always learns patterns that were missed in the best network training phase. The proposed method enlarges the perceived ability size without missing important information. Besides, by combining these techniques with loss function, which will be discussed below, found that the continuous encoder-decoder network can achieve a considerably better intersection over union (IoU) and give a better Prediction. The results of extensive experiments revealed that our algorithms significantly outperform state-of-the-art algorithms.

4. SYSTEM DESIGN

4.1 PROPOSED SYSTEM

In this system, the methodology on which the proposed method is based, including the set of sample images used for evaluation, as well as detailing the theoretical basis of the proposed medical object segmentation. Melanoma skin cancer detection at an early stage is crucial for an efficient treatment. Recently, it is well known that, the most dangerous form of skin cancer among the other types of skin cancer is melanoma because it’s much more likely to spread to other parts of the body if not diagnosed and treated early. The non-invasive medical computer vision or medical image processing plays increasingly significant role in clinical diagnosis of different diseases. Such techniques provide an automatic image analysis tool for an accurate and fast evaluation of the lesion. The proposed method is based, skin cancer detection using Support Vector Machines (SVM). In this study are collecting dermoscopy image databases, pre processing, segmentation, feature extraction using Gray Level Co-occurrence Matrix (GLCM) and then classification using Support Vector Machines. The results show that the achieved classification accuracy compared to convolution neural network.

SVM Vs Neural Network:

SVM:

Relatively new concept

Deterministic algorithm

Nice Generalization properties

Neural Network:

Relatively old

Nondeterministic algorithm

Generalizes well but doesn’t have strong mathematical foundation

4.2 METHODOLOGY OF SUPPORT VECTOR MACHINES

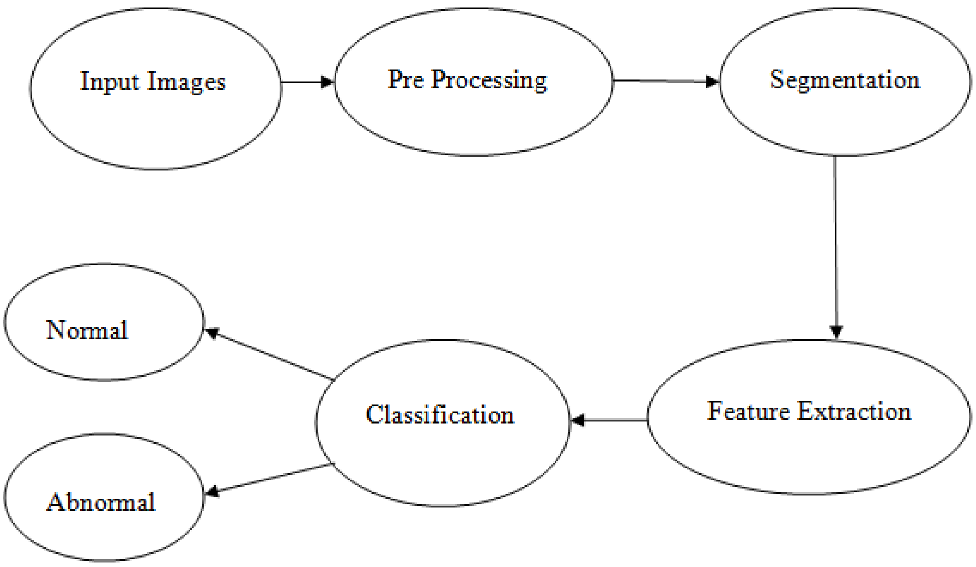


Fig 1: Block Diagram

4.3 INPUT IMAGE

The database was generated by collecting images from different category (Normal/Melanoma).

4.4 PRE-PROCESSING

Pre-Processing is a common name for operations with image at the lowest level of abstraction both input and output are intensity images. The aim of Pre-Processing is an improvement of the image data that suppresses unwanted distortions or enhance some image features important for further processing.

Four categories of image Pre-Processing methods according to the size of the pixel neighborhood that is used for the calculation of new pixel brightness:

Pixel brightness transformations,

Geometric transformations,

Pre-Processing methods that use a local neighborhood of the processed pixel, and

Image restoration that requires knowledge about the entire image.

Image Pre-Processing methods use the considerable redundancy in images. Neighboring pixels corresponding to one object in real images have essentially the same or similar brightness value. Thus, distorted pixel can often be restored as an average value of neighboring pixels.

If the gray scale has 256 brightness the ideal image has constant brightness value 128.

4.5 GRAY SCALE TRANSFORMATION

Gray scale transformations do not depend on the position of the pixel in the image.

$$Q=T\ (p)$$

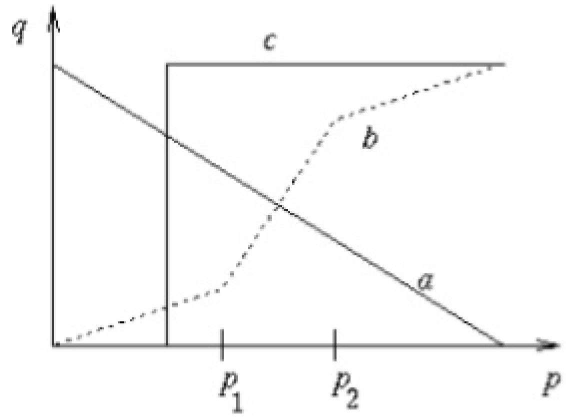


Fig 2: Gray scale transformations

a - Negative transformation

b - Contrast enhancement between P1 and P2

c - Brightness thresholding

Gray scale transformations can be performed using Look-Up tables. Mostly used if the result is viewed by a human. Histogram equalization is usually found automatically. The aim of image with equally distributed brightness levels over the whole brightness scale.

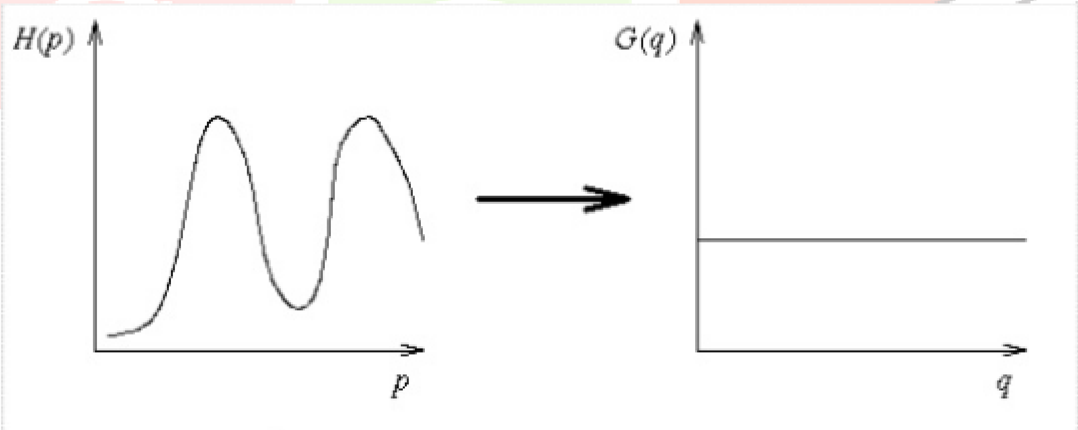


Fig 3: Histogram equalization

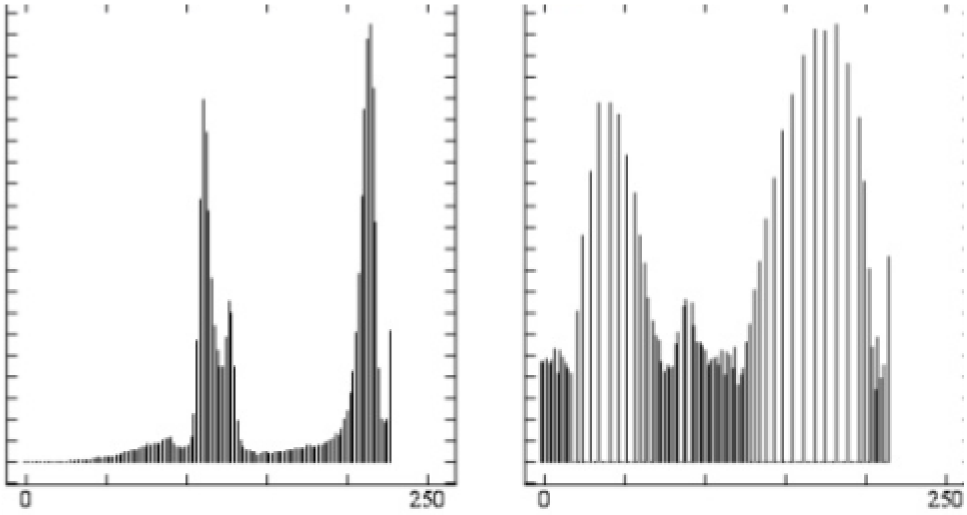


Fig 4: Histogram equalization: Original and Equalized histograms

This step includes converting the RGB acquired skin image to gray image, Contrast enhancement, Noise filtering and Histogram modification. Contrast enhancement and histogram modification are proposed since some of the acquired images are not homogenous due to incorrect illumination during the image acquisition. While the histogram modification techniques such histogram equalization is used to enhance the contrast of the image and, therefore, making the segmentation more accurate.

Noise filtering using median filter is implemented to reduce the impact of hair cover on the skin in the final image used for classification. Often used to remove noise from an image or signal. Such noise reduction is a typical pre-processing step to improve the results of later processing for example, edge detection on an image.

4.6 SEGMENTATION

Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as image objects). It is typically used to locate objects and boundaries (lines, curves, etc.) in images. It is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image (see edge detection). Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture.

4.7 THRESHOLDING

The simplest method of image segmentation is called the thresholding method. This method is based on a clip-level (or a threshold value) to turn a gray-scale image into a binary image. The key of this method is to select the threshold value (or values when multiple-levels are selected). Recently, methods have been developed for thresholding computed tomography (CT) images. The key idea is that, unlike Otsu's method, the thresholds are derived from the radiographs instead of the (reconstructed) image.

HISTOGRAM BASED METHODS

It is very efficient compared to other image segmentation methods because they typically require only one pass through the pixels. In the techniques, a histogram is computed from all of the pixels in the image, and the peaks and valleys in the histogram are used to locate the clusters in the image.

Histogram based approaches can also be quickly adapted to apply to multiple frames, while maintaining their single pass efficiency. The histogram can be done in multiple fashions when multiple frames are considered. The same approach that is taken with one frame can be applied to multiple, and after the results are merged, peaks and valleys that were previously difficult to identify are more likely to be distinguishable. The histogram can also be applied on a per-pixel basis where the resulting information is used to determine the most frequent color for the pixel location.

The second stage after pre processing is detecting and segmenting the region of interest which represents the lesion region. The segmentation stage includes steps: image thresholding, image filling, image opening, converting extracted region to gray level, and the image filling is applied to remove background pixels from inside the detected object and, therefore, make the ROI clear. Image opening is used to remove the extra background pixels which represent a part of non-ROI. Finally, the extracted region is cropped then converted to a gray level image and the histogram image is calculated.

.4.8 FEATURE EXTRACTION

Feature extraction is a part of the dimensionality reduction process, in which, an initial set of the raw data is divided and reduces to more manageable groups. The most important characteristics of these large data sets is that they have a large number of variables. So feature extraction helps to get the best feature from those big data sets by select and combine variables into features, thus, effectively reducing the amount of data. These features are easy to process.

The technique of extracting the features is useful when have a large data set and need to reduce the number of resources without losing any important or relevant data from the data set. In the end, the reduction of the data helps to build the model with less machine's efforts and also increase the speed of learning and generalization steps in the machine learning process.

After extracting the lesion in the segmentation stage, the predefined features will be extracted from the ROI for classification. The selected features are shape, color and various texture features. Use one of the common algorithms to extract such features which are Gray Level Co-occurrence Matrix (GLCM).

4.9 CLASSIFICATION

SVM is one of the most common machines learning algorithm that can be used in data classification. It's based on the concept of decision planes that define decision boundaries; a decision plane separates the objects to distinguish classes. The simplest SVM plane is linear whenever the data can be linearly separated.

5. INPUT TEXT IMAGES

Fig 5: Text Image1

Fig 6: Text Image2

6. OUTPUT DESIGN

Implementation of output is text the coding in to tool and it process step by step, after output window is shown click the input image automatically tool fetch the image and after steps are processed. Pre processing is converting RGB image into CT image and then segmenting the image and extract the image by feature extraction and it is classified by Multiclass Support Vector Machines. Finally it achieved 93.1% accuracy.

7. SYSTEM IMPLEMENTATION

Implementation is process of converting a new or revised system design into an operational one. The first task is implementation planning that is deciding on the methods and time scale to be adopted. The proper implementation involves conversion of existing clerical files to computer media and hence these files as they are get converted. Then the actual changeover from the existing system to the new system takes place. The changeover plays a vital role, which checks the developed tool for the following requirements and then only the developed tool will be accepted by the users. The software has been checked with sample data. The changes being made are as per the user requirements and will run in parallel with the manual system to find out any discrepancies. The users also have been apprised of the ways of handling the software, as a part of training the user personnel. The implementation is the final stage and it is an important phase. It involves the individual programming system testing, user training and the operational running of developed proposed system that constitutes the application subsystems. On major task of preparing for implementation is education of users, which would really have taken place much earlier in the project when we're being involved in the investigation and design work. The implementation phase of software development is concerned with translating design specifications into source code. Its potential has been recognized globally, with a variety of international organizations and technology companies highlighting the benefits of its application in reducing costs of operation and compliance, as well as in improving efficiencies. First collect the set of CT data sets and it is pass through the pre processing for converting color code.

SOFTWARE REQUIRED

- MATLAB R2015b

HARDWARE REQUIRED

- System : Windows XP Professional Service Pack 2
- Processor : Up to 1.5 GHz
- Memory : Up to 512 MB RAM

8. IMAGE FILE FORMATS

Image file formats are standardized means of organizing and storing digital images. Image files are composed of either pixel or vector (geometric) data that are rasterized to pixels when displayed in a vector graphic display. The pixels that constitute an image are ordered as a grid (columns and rows); each pixel consists of numbers representing magnitudes of brightness and color.

8.1 IMAGE FILE SIZES

Image file size expressed as the number of bytes increases with the number of pixels composing an image, and the color depth of the pixels. The greater number of rows and columns, the greater image resolution, and the larger the file. Also, each pixel of an image increases in size when its color depth increases an 8-bit pixel (1 byte) stores 256 colors, a 24-bit pixel (3 bytes) stores 16 million colors, the latter known as color. Image compression uses algorithms to decrease the size of a file. High resolution cameras produce large image files, ranging from hundreds of kilobytes to megabytes, per the camera's resolution and the image-storage format capacity. High resolution digital cameras record 12 megapixel images, or more, in true color. For example, an image recorded by a 12 MP camera; since each pixel uses 3 bytes to record true color, the uncompressed image would occupy 36,000,000 bytes of memory a great amount of digital storage for one image, given that cameras must record and store many images to be practical. Faced with large file sizes, both within the camera and a storage disc, image file formats were developed to store such large images.

8.2 IMAGE FILES COMPRESSION

There are two types of image file compression algorithms: lossless and lossy.

Lossless compression algorithms reduce file size without losing image quality, though they are not compressed into as small a file as a lossy compression file. When image quality is valued above file size, lossless algorithms are typically chosen.

Lossy compression algorithms take advantage of the inherent limitations of the human eye and discard invisible information. Most lossy compression algorithms allow for variable quality levels (compression) and as these levels are increased, file size is reduced. At the highest compression levels, image deterioration becomes noticeable as "compression artifacting". The images below demonstrate the noticeable artifacting of lossy compression algorithms; select the thumbnail image to view the full size version.

JPEG/JFIF

JPEG (Joint Photographic Experts Group) is a compression method; JPEG-compressed images are usually stored in the JFIF (JPEG File Interchange Format) file format. JPEG compression is (in most cases) lossy compression. The JPEG/JFIF filename extension in DOS is JPG (other operating systems may use JPEG). Nearly every digital camera can save images in the JPEG/JFIF format, which supports 8 bits per color (red, green, blue) for a 24-bit total, producing relatively small files. When not too great, the compression does not noticeably detract from the image's quality, but JPEG files suffer generational degradation when repeatedly edited and saved. The JPEG/JFIF format also is used as the image compression algorithm in many Adobe PDF files.

JPEG 2000

JPEG 2000 is a compression standard enabling both lossless and lossy storage. The compression methods used are different from the ones in standard JFIF/JPEG; they improve quality and compression ratios, but also require more computational power to process. JPEG 2000 also adds features that are missing in JPEG. It is not nearly as common as JPEG, but it is used currently in professional movie editing and distribution (e.g., some digital cinemas use JPEG 2000 for individual movie frames).

9. SYSTEM TESTING

System testing is the stage of implementation, which is aimed at ensuring that the system works accurately and efficiently before live operation commences. Testing is vital to the success of the system. System testing makes a logical assumption that if all the parts of the system are correct, the goal will be successfully achieved. System Testing is a type of software testing that is performed on a complete integrated system to evaluate the compliance of the system with the corresponding requirements. System testing detects defects within both the integrated units and the whole system. The result of system testing is the observed behavior of a component or a system when it is tested. System Testing is basically performed by a testing team that is independent of the development team that helps to test the quality of the system impartial. The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, subassemblies, assemblies and/or a finished product. It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

9.1 OBJECTIVES OF TESTING

Testing is the process of executing a program with the intent of finding an error.
A successful test is one that uncovers a discovered the error.

9.2 VALIDATION TESTING

Verification testing runs the system in a simulated environment using simulated data. This simulated test is sometimes called alpha testing. This simulated test is primarily looking for errors and monitions regarding end user and decisions design specifications hat where specified in the earlier phases but not fulfilled during construction. Validation refers to the process of using software in a live environment in order to find errors. The feedback from the validation phase generally produces changes in the software to deal with errors and failures that are uncovered. Than a set of user sites is selected that puts the system in to use on a live basis. They are called beta tests.

The beta test suits use the system in day to day activities. They process live transactions and produce normal system output. The system is live in every sense of the word; except that the users are aware they are using a system that can fail. But the transactions that are entered and persons using the system are real. Validation may continue for several months. During the course of validating the system, failure may occur and the software will be changed. Continued use may produce additional failures and need for still more changes.

9.3 OUTPUT TESTING

After performing the validation, the next step is output testing of the proposed system, since no system could be useful if it does not produce the required output in the specified format. Asking the users about the format required by them tests the output generated or displayed by the system under consideration. Hence the output format is considered in two ways-one is on screen and another in printed format.

10. CONCLUSION

In this project, proposed approach that uses an ensemble of support vector machines (SVM), for medical object segmentation and also presented a new data augmentation method called boundary emphasization that can be easily applied in most of the segmentation approaches in the medical field; it can strongly help the network to focus on the object contour.

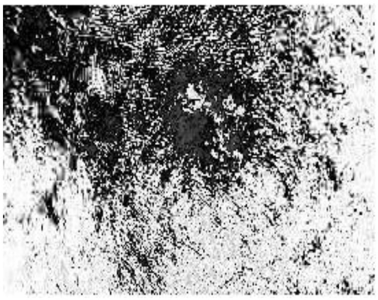
The main motive of this project is to give valuable insights to apply deep learning techniques in dermocscopy modal based area. Deep learning techniques have been implemented in dermocscopy based image analysis and processing. The deep learning helps to classify disease pattern enumeration and categorize from the processing of image. It permits to enhance analytical goals also generates prediction prototypes for the betterment of treatment. The researchers from medical image consider these tasks as challenges for continuing to flourish. This deep learning grows rapidly in health care based applications and it will conquer significant accomplishments in the medical field.

The proposed method, using the SVM based on the selected features was successful in classifying the extracted lesion ROI. The result of the SVM classifier shows accuracy of 92.1% with the full set of features.

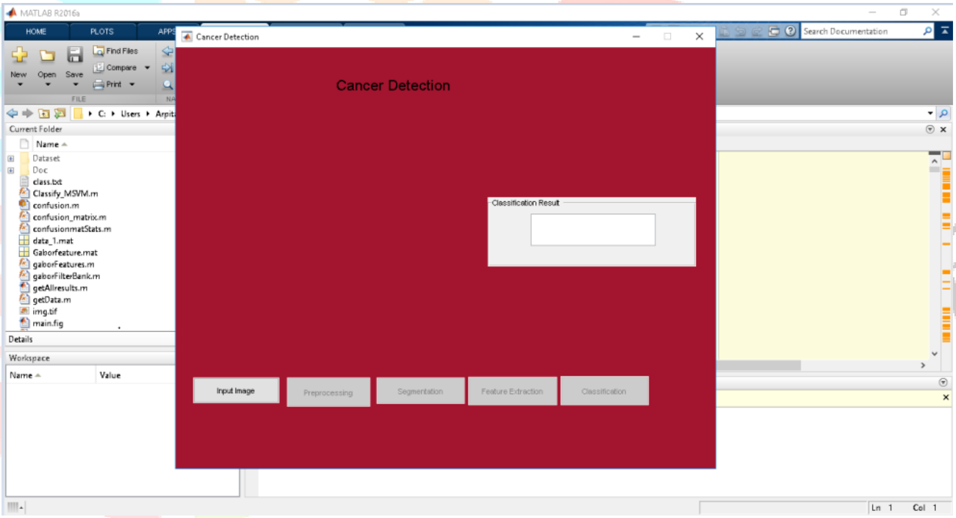
FUTURE WORK

The future work on the skin cancer detection system can be more accurate and efficient where the system can be implemented in the stand-alone mobile application, and, therefore, make the system more reliable and practical.

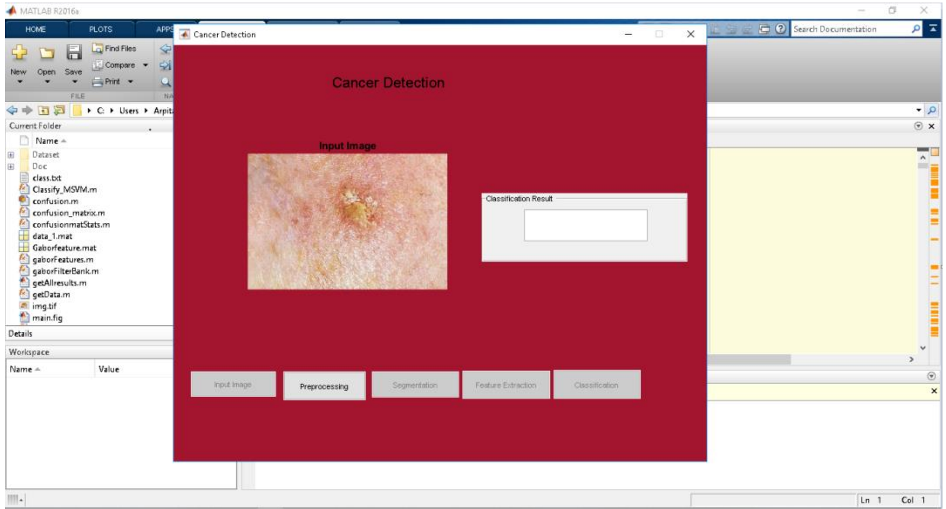
11. SCREENSHOTS



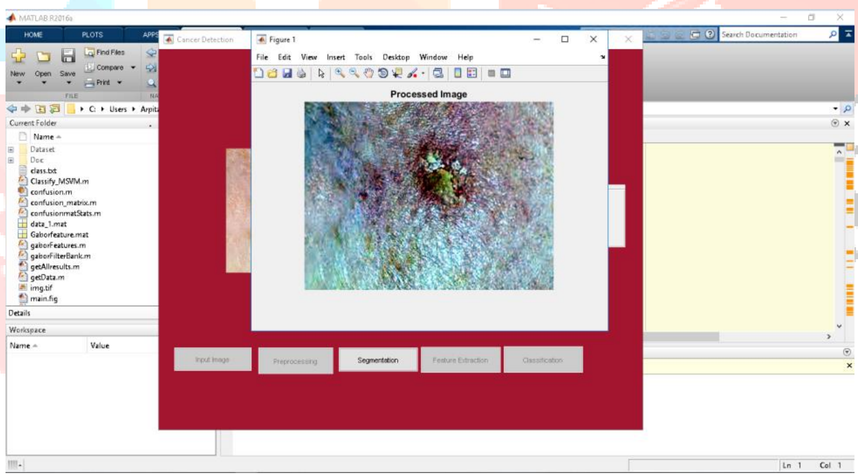
Segmentation



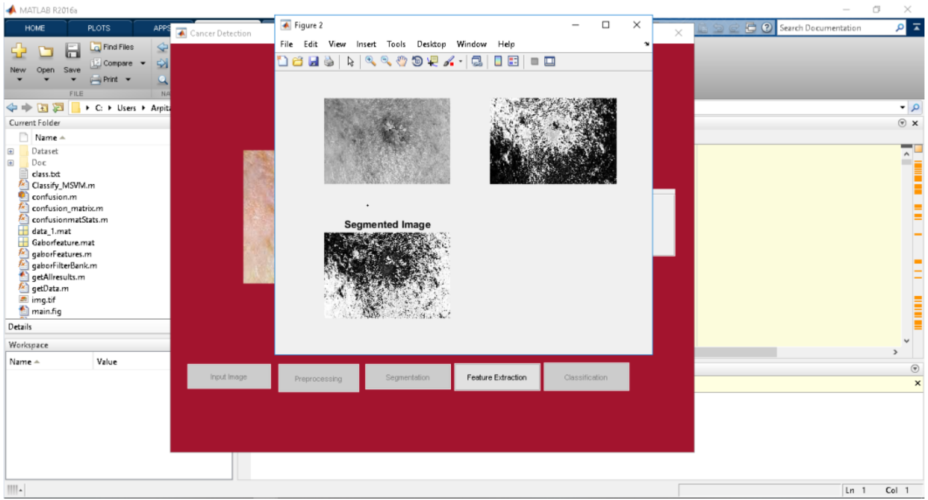
Classification result



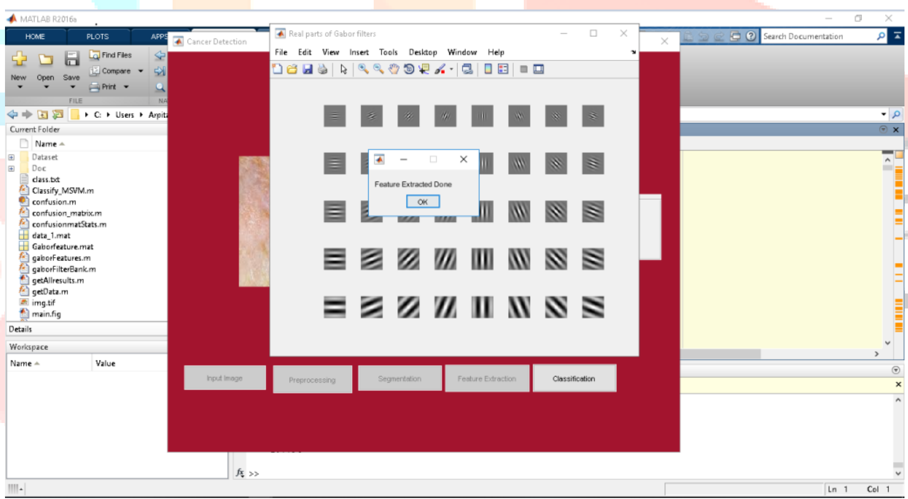
Input Image



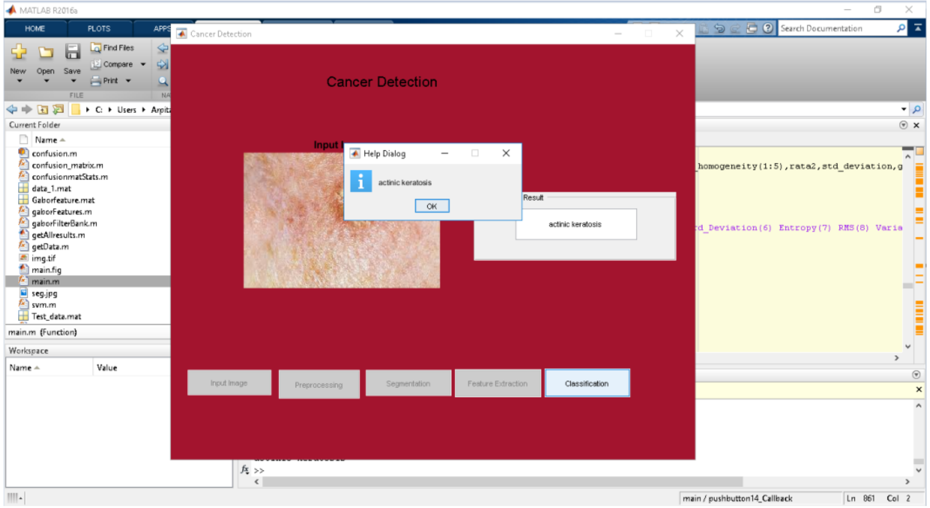
Pre-Processing



Segmentation



Feature Extraction



Classification

12. REFERENCES

[1] Akbari et al. M (2018). "Polyp segmentation in colonoscopy images using fully convolutional network." [Online]. Available: https://arxiv.org/abs/1802.00368.

[2] Bi. L, Kim. J, Ahn.E, Feng.D (2019). "Adversarial Learning for Skin Lesion Segmentation Based on Multi-scale Features and Factorized Channel Attention." [Online]. Available: https://arxiv.org/abs/1703.04197. DOI: 10.1109/ACCESS.2019.2940418

[3] Chen. H, QI. X, Yu.L and Heng. P. A (2016) "DCAN: Deep contour-aware networks for accurate gland segmentation," in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. pp. 2487_2496.

[4] Datchakorn Tancharoen (2019) "Medical Imaging using Automatic Region of Interest Segmentation for Psoriasis Diagnosis" in Proc IEEE Conf, 34th International Technical Conference on Circuits/System, Computers and Communications (ITC-CSCC).

[5] Eneko Osaba (2019) "Hybrid Modified Firefly Algorithm for Border Detection of Skin Lesions in Medical Imaging" in Proc. IEEE Conf, Congress on Evolutionary Computation (CEC), DOI: 10.1109/CEC.2019.8789954.

[6] Fulham. M, Kim. J (2019) "Improving Skin Lession Segmentation vios Stacked Adversarial Learning" in Proc IEEE Conf, pp. 1100-1103. doi: 10.1109/ISBI.2019.8759479.

[7] Heimann. T, MEinzer. H. P "Statistical shape models for 3D medical image segmentation: A review," Med. Image Anal., vol. 13, no. 4, pp. 543_563, 2009.

[8] Iraji. M. S and Yavari. A (2011)"Skin color segmentation in fuzzy YCBCR color space with the mamdani inference," Amer. J. Sci. Res., vol. 7, pp. 131_137, Jul.

[9] Long. J, Shelhamer. E and Darrell. T (2015)"Fully convolutional networks for semantic segmentation," in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. pp. 3431_3440.

[10] Nidhi pandey etal (2019) "Adversarial Learning for Skin Lesion Segmentation Based on Multi- scale Features and Factorized Channel Attention" in Proc. IEEE Conf at Sept.

[11] Ronneberger. O, Fischer. P and Brox. T (2015) "U-net: Convolutional networks for biomedical image segmentation," in Proc. Int. Conf. Med. Image Comput. Comput.-Assist. Intervent, pp. 234_241.

[12] Wickstrom. K, KampFFmeyer. M and Jenssen. R (2018)"Uncertainty Modeling and Interpretability in Convolutional Neural Networks for Polyp Segmentation," in Proc. IEEE 28th Int. Workshop Mach. Learn. Signal Process. (MLSP), Sep, pp. 1_6.

[13] Xu. H, Berendt. R, Jha. N and Mandal. M (2017)"Automatic measurement of melanoma depth of invasion in skin histopathological images," Micron, vol. 97, pp. 56_67, Jun.