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A Comparative Study of Deep learning Methods Applied to Image Segmentation

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ABSTRACT

Medical image processing is a technique and process of creating visual representation of the interior of a body for clinical analysis and medical intervention .The development of appropriate technology to extract clinically useful information usually in the form of an image from the observed. Library routines can be used to store data and retrieve it from the cloud whenever required. This research would provide quantitative and clinical analysis of digital medical images. It requires the special models to transform the signals that are being recorded or captured at surface of human. Imaging techniques allow doctors and researchers to view activity or problem within the human body exactly. In this work , an attempt is made to develop a simple framework to detect the particular disease. The highlight of this research is user friendliness and keen observation of medial image at minute levels. List of segmentation algorithms used in data mining such as K-means algorithm, fuzzy logic, Neuro fuzzy, Neural network based segmentation, snake algorithm , thresholding based segmentation have been surveyed .

Keywords Image Processing, Segmentation , data mining, abnormalities , data analytics .

1. INTRODUCTION

Deep Learning is a growing trend in Data Analysis and it a subset of machine learning or a family of machine learning. The machine learning methods are based on Artificial Neural Networks. Deep Learning methods are most effective when applied to large training data sets .It is especially suitable for medical data sets. Deep Learning improvements consistent across a large variety of domains. Deep Learning has three different categories Supervised, Unsupervised, Semi supervised learning. Deep learning architecture has deep neural network, deep belief network , recurrent neural network and Convolution neural network. These architecture has applied to various fields like audio recognition, speech recognition, Video recognition , computer vision, machine vision, medical analysis, social network, bio informatics etc.

The main objective of this research is to store the medial data in cloud and retrieving and analyzing using data analytics or data mining technique. The resultant values would create a platform to understand the use and medical practitioner. The motivation of research is to help society and needy people.

The word "deep" in "deep learning" refers to the number of layers through which the data is transformed. Manually designed features are often

over-specified, incomplete and take a long time to design and validate. Learned Features are easy to adapt, fast to learn.

2. NETWORKS TODAY

a) Machine Learning is a study of computer algorithms that improves automatically through experience. It is the subset of Artificial Intelligence.

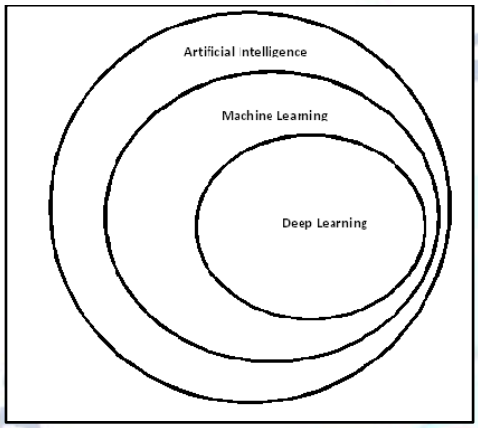

Fig .1 Deep learning Representation

b) Artificial Neural Network is also called neural networks. ANN is based on collection of connected units or notes called Artificial Neurons. It is mainly designed to simulate the way of human brain analysis and processes information. It is the foundation of Artificial Intelligence. The three major learning paradigms are supervised learning. Unsupervised Learning, Reinforcement learning. ANN are multi-layer-fully connected neural network. It consists of an input layer, multiple hidden layer and output layer. Every node in one layer is connected to every other node in the next layered. Networks are improved Back propagation algorithm. And other classifies are developed including Decision Tree, Boosting, and Support Vector Machine (SVM) each of these classifiers are applied to Medical Image analysis., especially for detection of abnormalities.

c) Convolution Neural Network (CNN) is a part of deep neural network. CNN commonly applied to analyzing visual imagery representation. Also called as shift invariant or space invariant ANN. Applications are video and image recognition , image classification , medial image analysis, natural language processing(NLP). CNN are version of multilayer perceptron's. Multi- layer perceptron's means fully connected networks. Each neurons in one layer is connected to all the neurons in the next layer.

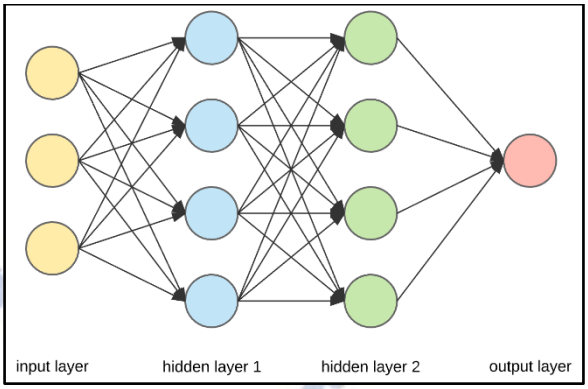

Fig :2 Artificial Neural Network(ANN)

Imaging techniques allow doctors and researchers to view activity or problem within the human body exactly.

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.

Image processing basically includes the following three steps: Importing the image via

image acquisition tools; Analyzing and manipulating the image; Output in which result can be altered image or report that is based on image analysis.

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

In this lecture we will talk about a few fundamental definitions such as image, digital image, and digital image processing. Different sources of digital images

will be discussed and examples for each source will be provided. The continuum from image processing to computer vision will be covered in this lecture. Finally we will talk about image acquisition and different types of image sensors.

3. RECENT TRENDS IN IMAGE PROCESSING

With a rapid advancement in Digital camera technologies and availability in portable form, that gain attention of large number of researchers in the field of digital image processing. The digital image processing is name referred to the techniques and methods which applied on input image to extract meaningful information from it or transformed input image into desired manipulated image. In the last decade, there are number of applications come into existence such as face recognition, object recognition, text extraction from image, hand written text recognition, motion recognition, etc.

The present study explores commonly used digital image processing techniques along with their implications. The current study is aimed to identify emerging trends in digital image processing; particularly we have included future trends in the field of OCR for Indian regional languages and

Text extraction from images. The general procedure for Image processing techniques [1-2] can be defined as number of operations performed in a sequence to attain the desired output. There is no standardized set of procedures which may be imposed on every problem. The generalized procedure can be defined which provides flexibility to cater solution for large number of problems. The generalized procedure is demonstrated in the figure 1 diagram In general, digital image process is started with acquisition of input image. It may be a colored, gray or black and white image. The input image may acquire by Mobile Camera, Digital professional camera, CCTV or Scanned copy of an image. After acquiring input image, image need to be pre-processed by using pre-processing techniques.

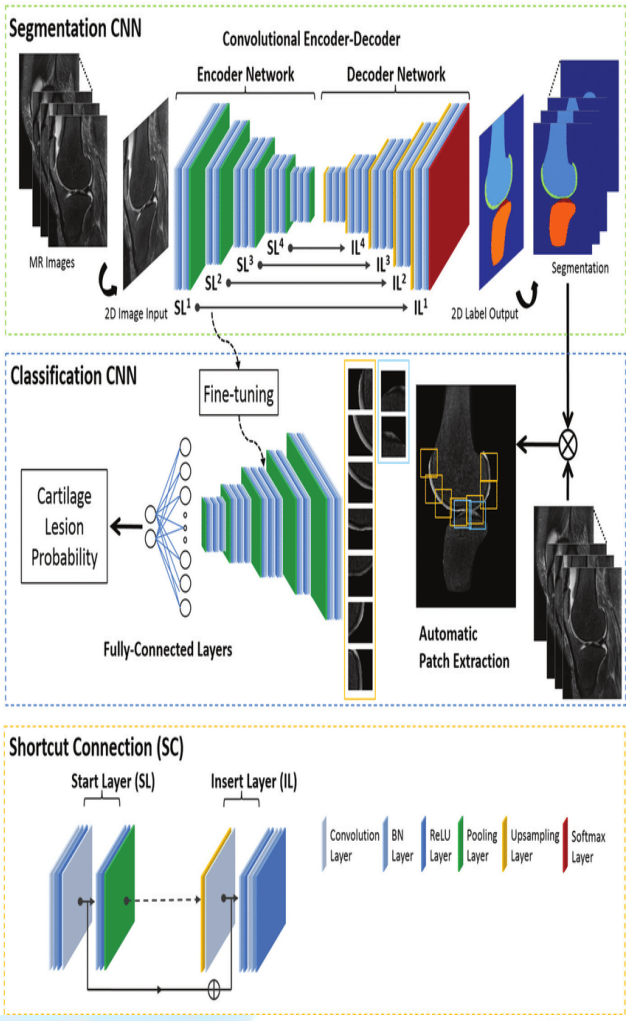

Fig 3 : Convolution Neural Network in Deep Learning

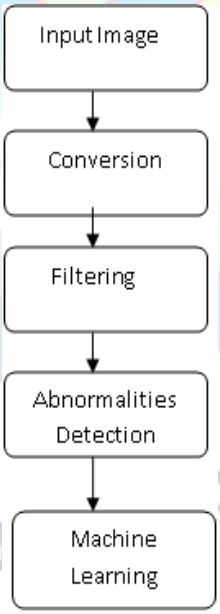

Fig 4 : Image Processing Flow Chart

Detecting Abnormal Structures in Image Processing

Magnetic Resonance Imaging

MRI is a test that uses powerful magnets, radio waves, and a computer to make detailed pictures of the inside of your body. An MRI helps a doctor diagnose a disease

or injury, and it can monitor how well you're doing with a treatment. MRIs can be done on different parts of your body. It's especially useful for looking at soft tissues and the nervous system

Computed Tomography

Computed tomography (CT) scan is a useful diagnostic tool for detecting diseases and injuries. It uses a series of X-rays and a computer to produce a 3D image of soft tissues and bones. CT is a painless, noninvasive way for your healthcare provider to diagnose conditions. You may have a CT scan at a hospital or imaging center. Medical professionals use computed tomography, also known as CT scan, to examine structures inside your body. A CT scan uses X-rays and computers to produce images of a cross-section of your body. It takes pictures that show very thin "slices" of your bones, muscles, organs and blood vessels so that healthcare providers can see your body in great detail.

Traditional X-ray machines use a fixed tube to point X-rays at a single spot. As X-rays travel through the body, they are absorbed in different amounts by different tissues. Higher density tissue create a whiter image than other tissues against the black background of the film. X-rays produce 2D images. CT scans have a doughnut-shaped tube that rotates the X-ray 360 degrees around you. The data captured provides a detailed 3D view of the inside of your body.

Doppler ultrasound

A Doppler ultrasound is a noninvasive test that can be used to estimate the blood flow through your blood vessels by bouncing high-frequency sound waves (ultrasound) off circulating red blood cells. A regular ultrasound uses sound waves to produce images, but can't show blood flow.

Positron Emission Tomography

Positron emission tomography is a functional imaging technique that uses radioactive substances known as radiotracers to visualize and measure changes in metabolic processes, and in other physiological activities including blood flow, regional chemical composition, and absorption

Single-Photon Emission Computed Tomography

Single-photon emission computed tomography is a nuclear medicine tomographic imaging technique using gamma rays. It is very similar to conventional nuclear medicine planar imaging using a gamma camera, but is able to provide true 3D information.

4. LITERATURE SURVEY

A Multispectral Analysis of Black Skin Color Images for Linea Nigra Segmentation:

Linea Nigra is refers to a pregnancy line and it is also called as linear hyperpigmentation of skin. Usually Linea Nigra is present in pregnant woman but sometimes it occurs men for certain age. The higher prevalence of in this case of prostate cancer. This paper the problem is addressed by Principal Component Analysis (PCA) technique. This techniques lead to calculate the good results when converting from RGB colors to gray scale. Multispectral Analysis of black skin color images using PCA algorithm. It provides guarantees best color component when passing from RGB color to gray scale color.

PCA Algorithm it works from extracting the data into a table. The table is represented by columns. It has three step are used to calculate the values. We need to calculate the mean for the column, calculate the covariance for the matrix, and determine the Eigen vectors and Eigen values of covariance matrix. The metrics are used Sensitivity, Specificity, and Hausdorff Distance (HD). Finally the PCA methods are compared with the performance evaluation it produces high accuracy, from the clinical point of view it is very important not to miss any part of Linea Nigra. Therefore sensitivity results are the best method to find the Linea Nigra.

Skin Melanoma Segmentation using Recurrent and Convolution Neural Networks.

Skin cancer is a one the major public health problem with over 5 million newly diagnosed cases in the united states of America and Australia from the every year. The deadliest form of Skin Cancer responsible for over 9000 to 10000 deaths per year. Skin Melanoma is a major problem in many countries.

Deep learning is the recent Machine Learning techniques or method to solve various computer tasks. In this paper they proposed two hybrid deep learning methods are used, Convolution Neural Network and Recurrent Neural Network. The training datasets has 900 images and tested on 375 images. The images are derived from Skin Lesion Analysis Towards Melanoma Detection (ISBI 2016) conference. The results would be greater output performance for the practitioner. One of the best methods in deep learning is object detection, image classification and semantic segmentation.

In this paper proposed architecture is used to solve saturation problem. The new method were introduced i.e Conditional Random Fields (CRF) module. The extracted images are fed into CRF and CRF produce smooth noisy segmentation with image pixels. The extraction is done through the Recurrent Neural Network. It has four layers with four decoupled directions. And also have two dependencies , local and global. To handle two dependencies they introduce Long Short Term Memory (LSTM). The LSTM has divided into four categories they are, up to down, down to up, left to right, right to left.

CNN has seven layers with two max pooling layers. In this method they achieved accuracy of 0.98 and jaccard index for 0.93, these values are compared with previous methods. The proposed method provides the higher accuracy, security and robust performance. The output of the proposed method is smooth with no holes. Finally it works with deep CNN and RNN of skin lesion segmentation.

Skin Lesion Segmentation In Clinical Images Using Deep Learning

Melanoma is one of the most rapidly increasing cancers all over the world. In 2016 estimated 80000 new cases and an estimated dead list are 10200. Melanoma occurs when the pigment producing cell that give color to the skin become cancerous. Melanoma is also called Malignant. It occurs anywhere on the body. Typically occurs in skin but rare cases in eye and mouth. Melanomas look like moles on the skin. If permitted to progress, melanomas that are less than on half inch across on the surface of the skin can spread and lead to death. Melanoma is a big and growing problem. Early detection of melanoma is ABCDEs criterion (Asymmetry, Border, Color, Diameter, Evolution). Dermoscopic is a digital technique that improves melanoma diagnosis.

In this paper they proposed the extraction of accuracy lesion region by using deep leaning approaches. The input image fed into CNN and CNN combines both dependencies local and global, and it shows the output label. Output label producing the segmentation mask. The Proposed method has four steps, Preprocessing, Patch Extraction, CNN, Post Processing.

Preprocessing usually has noisy artifacts such as hair, light reflection from skin etc. For this the guided filters is applied on the input image. It performs edge preserving and smoothing operator. Patch Extraction: skin identification either normal skin or lesion region. These patched are fed into CNN and the CNN divided the texture by local or general analysis. Convolution Neural Networks the image size is 600 * 400, It is resized by using local patch it would be a 31 X 31 is defined. The larger size also be resized to the same size. It has four layers. Convention layer, maxpool, conv2layer & Maxpool2.Post procuring: In these images are labeled by the class using values if the value is it is labeled as lesion (or) 0 means normal skin region. At the end the op mask is redefined by largest conducted component. Dataset it consists of 126 digital images 66 melanoma and 60 non-melanoma. Proposed s / m is implemented in matlab & caffe. Evaluation Our method, there commonly used metrics for classification problem are used sensitivity specific city, accuracy. The proposed system is compared with different methods like L-SRM, OtsuR, Otsu RGB, TDLS etc. but proposed method reach the best performance compared to other methods. It provides 95 % sensitivity & 98.5 for accuracy.

Automated lesion segmentation and dermoscopic feature segmentation for skin cancer analysis.

In this paper the two main segmentation tasks were performed, lesion segmentation and dermoscopic feature segmentation. This method is evaluated on the database ISBI challenge 2016. The three major methods are used in this paper data argumentation, lesion segmentation and lesion dermoscopic feature segmentation.

Data argumentation: The datasets are randomly partitioned into both training and test sets, with 900 jpeg colored images .the pixel size is too large so they resized the images by cropping, cropping by both vertically and horizontally, now and the training images are increased to 7200.

Lesion segmentation: The aim is to predict lesion segmentation boundaries from dermoscopic images for test data. Lesion segmentation s a quite challenging task of low contrast between lesion, liver and other organs. Lesions are variable in terms of shape, size and texture, noise in CT scan.

Dermoscopic feature segmentation: There is a growing body of literature focused on the analysis of dermoscopic images Improve diagnostic accuracy by 30% in the hands of trained physicians. May require as much as 5 year experience to have the necessary

training. Motivation for Computer-aided diagnosis (CAD) in this area. Dermoscopic is an imaging technique that eliminates the surface reflection of skin. By removing surface reflection, visualization of deeper levels of skin is enhanced. Prior research has shown that when used by expert dermatologists, dermoscopic provides improved diagnostic accuracy, in comparison to standard photography. As inexpensive consumer dermoscopic attachments for smart phones are beginning to reach the market, the opportunity for automated dermoscopic assessment algorithms to positively influence patient care increases.

The result of two different deep learning networks was utilized. They are convolution network for lesion segmentation and convolution network for dermoscopic feature segmentation. Both network have been tested and trained with stochastic gradient descent (SGD) method. At the conclusion they applied deep network architecture for both tasks; data augmentation and merging high layer information with improved accuracy have been demonstrated.

5. CONCLUSION

This paper compares the deep learning methods used for image segmentation to perform the clinical analysis for skin diseases. The analysis process includes the isolation of infected area from the other skin region and then examining the image in that region. In this paper designs a framework for skin disease analysis using various segmentation algorithm such K-means, Fuzzy algorithm and neural networks. This process which continues the survey on usage of different segmentation algorithms like, Principal Component Analysis, Conditional random fields, Long Short term memory, Asymmetry border color diameter, evolution. In future the best of the above list of algorithm can be arrived by implementing on specific dataset

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Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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