A Medical Image Fusion using a Deep Learning Approach

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ABSTRACT: Image Processing is one of the tedious and risky tasks for any developers while we are using this concept for Brain Tumour detection. MRI (Magnetic Resonance Imaging) is now the most recommended and adaptable practice all over the corner and it is a medicinal procedure, and generally, it is practiced by the radiologist for the representation of the internal part of the human body without surgery. The machine learning technology we are using for its coding and for giving its functionality at very best. We are using Machine learning technology for better coding and functionality and it is now the best ever technology for complex type coding like this. Its experience for image processing tasks is a very easy and very appropriate one too. We conclude by discussing research obstacles, emerging trends, and possible future directions.

KEYWORDS*:* CNN (Convolution neural networks), medical image analysis, machine learning, deep learning.

I. INTRODUCTION

ML (Machine learning) and its algorithms have the potential to be invested deeply in all fields of medicine, from drug discovery to clinical decision making, significantly altering the way medicine is practiced. At the introduction of ML in the field of medical utility which gets great success with the implementation of machine learning algorithms at computer vision tasks in recent years and it results at an opportune time when medical records are increasingly digitalized.

Magnetic resonance imaging is a medical imaging technique used in radiology to form pictures of the anatomy and the physiological processes of the body. MRI scanners use strong magnetic fields, magnetic field gradients, and radio waves to generate images of the organs in the body.

In it, we are having the use of electronic health records (EHR) quadrupled from 11.8% to 39.6% amongst office-based physicians in the US from 2007 to 2012. We find in recent trends more than enough things including Medical images are an integral part of a patient's EHR and are currently analysed by human radiologists, who are limited by speed, fatigue, and experience. In that process, it may take years and may result in great financial cost to train a qualified radiologist, and some health-care systems outsource radiology reporting to lower-cost countries such as India via tele radiology. A delayed or erroneous diagnosis cause's harm to the patient. However, it is ideal for medical image analysis to be carried out by an automated, accurate and efficient machine learning algorithm.

Medical image analysis is an active field of research for machine learning, partly because the data is relatively structured and labelled, and it is likely that this will be the area where patient's first interact with functioning, practical artificial intelligence systems. This is significant for two reasons.

Firstly, in terms of actual patient metrics, medical image analysis is a litmus test as to whether artificial intelligence systems will actually improve patient outcomes and survival. In the end, it may provide a testbed for human-AI interaction, of how receptive patients will be towards health- altering choices being made or assisted by a non-human actor.

II. EXISTING SYSTEM AND PROPOSED MYTHOLOGY

EXISTING SYSTEM:

There is a myriad of imaging modalities, and the frequency of their use is increasing. Smith-Bindman et al. getting view almost every image from the year 1996 to 2010 in all different aspects and get some pointers from it and take sample for examining. As the 2010 census is running the demand for electronic machines for CT-scan, MRI-scan, and all increases suddenly.

So technology evolution reaches to AI concept to build some important machine based on machine learning using AI concept on the broader goal but fails to give potential output at that time. In the early experiment and implementation in medicine filed was the MYCIN system by Short life, which suggested different regimes of antibiotic therapies for patients. Parallel to these developments, AI algorithms moved from heuristics-based techniques to manual, handcrafted feature extraction techniques and then to supervised learning techniques. Unsupervised machine learning methods are also being researched, but the majority of the algorithms from 2015-2017 in the published literature have employed supervised learning methods,

DISADVANTAGES

- Use complex image processing algorithm and filters
- Due to complex algorithm cost of implementation is high
- Cannot give appropriate output after diagnosis

PURPOSE OF THE PROJECT

As world louds for the use Ai and machine learning in the application like MRI and CT-scan with very much successful result at image recognition tasks in recent years but the use of electronic machines get the result faster and accurate one. This review introduces the machine learning algorithms as applied to medical image analysis, focusing on convolutional neural networks, and emphasizing clinical aspects of the field.

SOLUTION FOR THE PROBLEM STATEMENT:

Whatever the detection we have found, sometimes known as Computer-Aided Detection is a keen area of study as missing a lesion on a scan can have drastic consequences for both the patient and the clinician. The task for the Kaggle Data Science Bowl of 2017 involved the detection of cancerous lung nodules on CT lung scans. In around of total 2000 CT scans were released for the competition and the winner Fangzhou achieved a logarithmic loss score of 0.399. As a result, it is used a 3-D CNN inspired by U-Net architecture to isolate local patches first for nodule detection and hence we get this output was fed into a second stage consisting of 2 fully connected layers for classification of cancer probability. Shin et al.evaluated five is very much known for their CNN architectures in detecting thoracoabdominal lymph nodes and Interstitial lung disease on CT scans and after a lot of processes it gets Detecting lymph

nodes is important as they can be a marker of infection or cancer at the end it achieved a mediastinal lymph node detection AUC score of 0.95 with a sensitivity of 85% using GoogLeNet, which was state of the art. They also documented the benefits of transfer learning, and the use of deep learning architectures of up to 22 layers, as opposed to fewer layers which were the norm in medical image analysis. Overfeat was a CNN pre-trained on natural images that won the ILSVRC 2013 localization task. They combined this approach with simple SVM and RF binary classifiers, as well as a Bag of Frequencies, a novel 3-dimensional descriptor of their own invention.

ADVANTAGES

- Introduce the use of CNN
- Some Python mathematical tools like Keras and pandas helps to detect and detailed the diagnosis
- ML (Machine Learning) is part of AI which is very much used for the problem like us
- Filtering works well to eliminate noise and malfunction from the scan.

III. LITERATURE SURVEY

December 29, 2017- Deep Learning Applications in Medical Image Analysis JUSTIN KER1, LIPO WANG 2, JAI RAO1, AND TCHOYOSON LIM3: - This review paper introduces the machine learning algorithms as applied to medical image analysis, and it is completely focused on CNN (convolutional neural networks), and emphasizing clinical aspects of the field. At last, this paper shows some advantage over machine learning in an era of medical big data is that significant hierarchal relationships within the data can be discovered algorithmically without laborious hand-crafting of features. In this paper, we cover almost every key research areas and applications of medical image classification, localization, detection, segmentation, and registration. We conclude by discussing research obstacles, emerging trends, and possible future directions.

Volume 29, Issue 2, May 2019- The paper on gentle use of ML in the medical research paper: - Through this paper, we get some ideas about how to use machine learning in the medical research domain after reading the paper we get a broad idea over intense use of Machine learning algorithm in diagnosis field. This paper is having a very much detailed architectural explanation over how to use this algorithm in an MRI scan and Ct-scan. This kind of paper gives us a breakthrough over some kind of utility-based development in the medical field.

March 14, 2018- Topological Measurements of DWI Tractography for Alzheimer's disease Detection: - According to this paper we are fully dived into deep learning over the concept of neurological treatment in biological domain. As we know that very well Neurodegenerative diseases affect brain morphology and connectivity, making complex networks a suitable tool to investigate and model their effects and because of that kind of problem and pattern, Alzheimer's disease (AD) is a natural benchmark for the study of novel methodologies. Behind that scene, we see several studies have been investigated the different network centrality and segregation changes induced by AD, especially with a single subject approach. In this work, a holistic perspective based on the application of multiplex network concepts is introduced.

2 March 2017- Exploring Deep Learning and Transfer Learning for Colonic Polyp Classification: - Deep Learning and Machine Learning is a domain of Artificial Intelligence and currently this is the vastest and intense technology adopted by different kinds of professions for making their application simple and quite function-able. In it, we use language and tools given by Python-like Keras, Pandas, and CNN, etc. Through this paper, we get how the CNN works and progress with data most fluently while Keras and Pandas working with mathematical approaches like how to convert numerical data into compile code easily without writing any extra patch code for it.

4 October 2016- An Active Learning Classifier for Further Reducing Diabetic Retinopathy Screening System Cost: - Its full form is Diabetic retinopathy (DR) which is a kind of screening system that raises a financial problem. Through this paper, we are going to learn how the approaches work with screening the collected data and we can input data from the source and after getting whole calculations and analysis decide to provide an accurate output to the clients. Our approach identifies retinal images based on features extracted by anatomical part recognition and lesion detection algorithms. Although another function called Kernel extreme learning machine (KELM) which is a rapid classifier for solving classification problems in high dimensional space and both are active learning and ensemble technique elevate the performance of KELM when using the small training dataset. Finally, it results on more than 80% accuracy in the output.

IV. SYSTEM ARCHITECTURE AND MATHEMATICAL CALCULATIONS

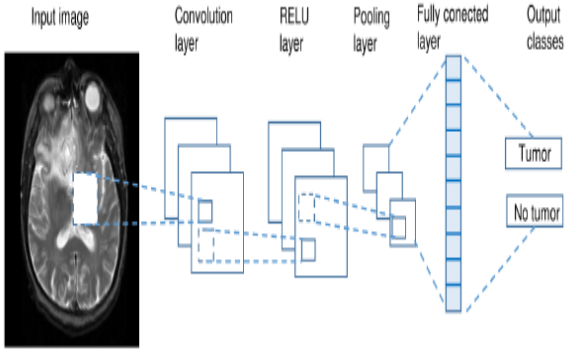

Fig-1: Architectural diagram

Medical Image Segmentation:

- In our architecture we use Segmentation and separation of structures which is nothing but the area of interest from the background and from each other, is an essential analysis function for which numerous algorithms have been develop in the field of image processing.
- The main achievement and its Principal goal of the segmentation process is to partition an image into regions

that are homogeneous with respect to one or more characteristics or features.

- After all the Segmentation is an important tool in medical image processing, and it has been useful in many applications.This application results in some kind of detection of tumours and different kind of diagnosis and some time it may detect the concentration of blood clotting and issues related to this and so on.
- In medical imaging, the facility of segmentation is important for feature extraction, image measurements, and image display. As per requirement we can use some time the classification of image pixels into anatomical regions, such as bones, muscles, and blood vessels, while in others into pathological regions, let us see some examples related to this as such as cancer, tissue deformities, and multiple sclerosis lesions.
    a) Segmentation can be treat as the pre-processor for further analysis.
- A wide variety of segmentation techniques have been proposed and it can be divided into classes in different ways. e.g., based on the classification scheme:
    a) Manual, semiautomatic, and automatic
    b) Pixel-based (local methods) and region-based (global methods).
    c) Low-level segmentation (thresholding, region growing, etc.), and Model-based segmentation (multispectral or feature map techniques, Marcov random field, deformable models, etc.).
- Model-based techniques are suitable for segmentation of images that have artifacts, noise, and weak boundaries between structures.
- Deformable models:
    a) Snake model and Level Sets
    b) Classical (thresholding, edge-based, and region-based techniques), Statistical, Fuzzy, and Neural network techniques.
- Histogram analysis

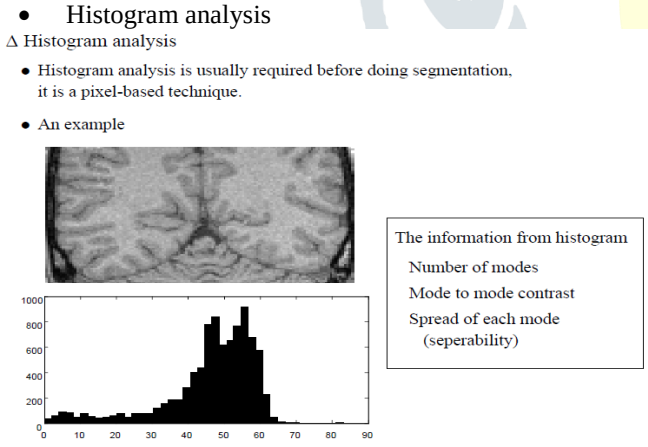

Fig-2: Histogram Analysis

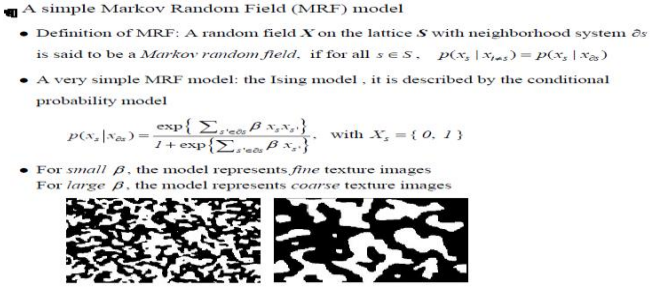

Fig-3: Calculation based Heuristic

- A three level MRI model is used.**Modules:**

1. **Numpy: -** NumPy enriches the programming language Python with powerful data structures, implementing multi-dimensional arrays and matrices where data structures guarantee efficient calculations with matrices and arrays. This is an approach which is more versatile in the implementation of even aiming at huge matrices and arrays, better known under the heading of "big data". As we know it provides internal library to access all the important facility of the algorithm which can utilize the concept like arrays and statistics.
2. **Pandas:** - Pandas is a high-level data manipulation tool developed by Wes McKinney. It is completely develop to built on the Numpy package and its key data structure is called the DataFrame. One of its factor called DataFrames which allow you to store and manipulate tabular data in rows of observations and columns of variables.
3. **Sklearn:** - Scikit-learn provides a range of supervised and unsupervised learning algorithms via a consistent interface in Python. This kind of thing is licensed under a permissive simplified BSD license and is distributed under many Linux distributions, encouraging academic and commercial use
4. **Matplotlib:** - It is a plotting library used for 2D graphics in python programming language. Which may be used in python scripts, shell, web application servers and other graphical user interface toolkits.In the current market lots of ML toolkits which are available that extend python matplotlib functionality.
5. **Seaborn:** -Seaborn is a Python data visualization library based on matplotlib and it is used to provide a high-level interface for drawing attractive and informative statistical graphics.

V. SOFTWARE AND HARDWARE REQUIREMENT

SOFTWARE REQUIREMENT

OS : Windows
Python IDE : python 2.7.x and above, Pycharm IDE, Anaconda 3.5

HARDWARE REQUIREMENT

RAM	:	4GB and Higher
Processor	:	Intel i3 and above
Hard Disk	:	500GB: Minimum

VI. CONCLUSION AND FUTURE WORK

CONCLUSION

- Hence, we are getting a very fine tuned application that is very much capable of getting very efficient output of brain related case in medical field.
- MRI scan is best in the market and now its future is bright now a day everything is depends on digital data conversion and gathering of it from the different part of the research lb for better result and hence our project gets all these advantages because of machine learning technology.

FUTURE WORK

- And in it we can see splitting screen over the multiple available sources and at a time multiple dr. view multiple parts and can give their results as soon as possible which is quite commendable in current trends.

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