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Prostate Cancer Detection using Deep Learning

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Abstract: *According to WHO (World Health Organization), the estimated cancer cases in the year 2020 is 1.4 Million. Prostate cancer is one of the reason for death in men. Prostate cancer is cancer occurred in prostate gland. Prostate cancer begins when cells in the prostate gland start to grow out of control. It is detected using Ultrasound Image or Magnetic Resonance Image (MRI). Now a day after consulting with doctor there are other secondary tools which can help to detect prostate cancer. The system used for detecting prostate cancer are developed using different technology like Artificial Intelligence, Machine Learning and Deep Learning. In this paper we have trying to develop a system which can detect prostate cancer using input like ultrasound image and Magnetic Resonance Image.*

Keywords: Prostate Cancer, Prostate Cancer Detection, Deep Learning, CNN

I. INTRODUCTION

In this paper we have trying to select best algorithm and for detecting prostate cancer or trying to select efficient technologies which can gives us high accuracy and work efficiently. We have tried different algorithm on different input like CNN (Convolutional Neural Network) with input as MIR (Magnetic Resonance Image) and other is Ultrasound Image of prostate gland. After that we compared all the out comes of all the algorith and then we have selected CNN as our Final Algorithm with Ultrasound Image as a input because of its accuracy and efficiency.

On the basis of probability of out put we have classified result into three classes as Normal, Bengin Prostatic Hyperplasia, Adenocarcinoma. For developing different models we have used python libraries such as tensorflow, keras, matplotlib, numpy, pandas and some other libraries.

The data which is we have used for traing the model and testing the model is of Bharti Hospital Pune which contain total 400 images of prstate gland ultrasound image. The images are classified into three type Normal, Adenocarcinoma, Bengin Prostatic Hyperplacia.The size of image given to the model is 224X224 as input after pre-processing. The Accuracy of CNN algorithm range from 8.5 to 9 as shown in below chart.

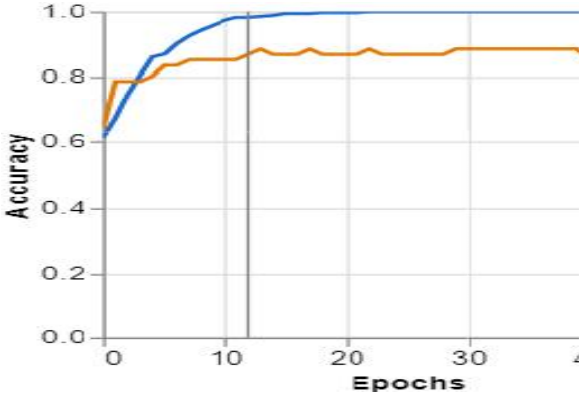

Fig1. Accuracy of CNN Model

We have studied different research papers for collecting more information related to prostate cancer and detection of prostate cancer and some other papers related to Deep Learning algorithms.

II. LITERATURE REVIEW

Pulmonary nodule detection in CT images: false positive reduction using multi-view convolutioal networks[1]. Explained about the proposed architecture which comprises multiple streams of 2-D ConvNets, for which the outputs

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are combined using a dedicated fusion method to get the final classification but the morphological variation of nodules is often greater than what a single candidate detection algorithm.[1]. Unsupervised Deep Embedding for Clustering Analysis[2]. It explains about clustering. Clustering is central to many data-driven application domains and has been studied extensively in terms of distance functions and grouping algorithms. Relatively little work has focused learning representations for clustering. However misclassification of any images doesn't gives the approximate result[2]. Classification and Stage Prediction of prostate Cancer using Convolution Neural Networks[3]. In this paper the author has proposed a novel framework to classify both small cell and large cell prostate cancer and predict its type and treatment using CNN. The paper also concentrates on the preprocessing and segmentation processes to accomplish the accuracy in prediction. The experiment results in Python - TensorFlow with Kaggle image dataset show that compared to state of the art of classification and prediction methods[3]. Deep Supervision for Pancreatic Cyst Segmentation in Abdominal CT Scans[4]. It explains if it is done under a reasonable transformation function, so approach can be factorized into two stages, and each stage can be efficiently optimized via gradient back-propagation throughout the deep networks. We collect a new dataset with 131 pathological samples, which, to the best of our knowledge, is the largest set for pancreatic cyst segmentation. Without human assistance, our approach reports a 63:44% average accuracy measured by the Dice-Sorensen Coefficient (DSC), which is higher than the number (60:46%) without deep supervision. But in this process it gives less accuracy[4]. Computer Assisted Decision Support System in Stage Classification on CT images[5]. Classification of nodules into different stages is done in Hierarchical manner. This provides range of diameter of stage wise tumor. It also provides the average diameter for the tumor which is to be classified into one of four stages. One the basis of this results, nodule is classified in respective stage[5].

III. FINDINGS FROM LITERATURE

We have systematically studied approx 10 research papers inclusion year from 2015 to 2022, and some meaning full findings are highlighted in table 1. We have observed that ultrasound image and Magnetic Resonance Image are used for diagnosis of prostate cancer. We have seen different methods to classify prostate cancer. In those method different Machine learning and deep learning algorithms are used and everyone has used there one data set.

Table 1: Summary Table of Literature Review

No.	Year	Title	Authors	Methodology
1	2019	Pulmonary nodule detection in CT images: false positive reduction using multi-view convolutioal networks	Arnaud A. A. Setio, Francesco Ciompi, Geert Litjens, Paul Gerke, Colin Jacobs, Sarah J. van Riel, Mathi	The proposed architecture which comprises multiple streams of 2-D ConvNets, for which the outputs are combined using a dedicated fusion method to get the final classification but the morphological variation of nodules is often greater than what a single candidate detection algorithm.
2	2019	Classification and Stage Prediction of prostate Cancer using Convolution Neural Networks	K. Narmada, G. Prabakaran, S. Mohan	In this paper the author has proposed a novel framework to classify both small cell and large cell prostate cancer and predict its type and treatment using CNN. The paper also concentrates on the pre-processing and segmentation processes to accomplish the accuracy in prediction
3	2018	Deep Supervision for Pancreatic Cyst Segmentation in Abdominal CT Scans	Alan L. Yuille	The approach can be factorized into two stages, and each stage can be efficiently optimized via gradient back-propagation throughout the deep networks. We collect a new dataset with 131

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4	2018	Computer Assisted Decision Support System in Stage Classification on CT images	Anum Masood, Bin Sheng	Classification of nodules into different stages is done in Hierarchical manner. This provides range of diameter of stage wise tumor. It also provides the average diameter for the tumor which is to be classified into one of four stages. One the basis of this results, nodule is classified in respective stage.
5	2016	Unsupervised Deep Embedding for Clustering Analysis	Junyuan Xie, Ross Girshick	It explains about clustering. Clustering is central to many data-driven application domains and has been studied extensively in terms of distance functions and grouping algorithms. Relatively little work has focused learning representations for clustering. However misclassification of any images doesn't gives the approximate result.

IV. METHODOLOGY

4.1 Dataset and Results

We have used dataset of Bharati Hospital Pune, it contain ultrasound images classified as Normal, Benign Prostatic Hyperplasia and Adenocarcinoma. In Adenocarcinoma there is 140 ultrasound images, in normal there is 10 ultrasound images and in Benign Prostatic Hyperplasia 250 ultrasound images are there. And the accuracy of our CNN model is ranging from 8.5 to 9.5. The accuracy of model is increased by increasing the dataset size.

4.2 Proposed architecture of CNN (Convolutional Neural Network)

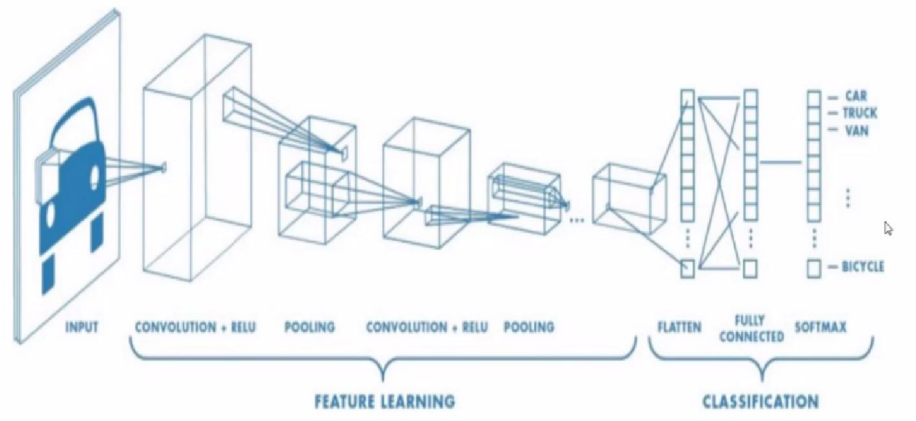

Fig 2. Architecture of CNN

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V. CONCLUSION AND FUTURE WORK

Detection of prostate cancer in a clinical systematic method. The ultrasound image plays an important role because it is an input to the classification model to detect prostate cancer. We have seen different algorithms and gone through some research paper to find out which algorithm and method is best, accurate and efficient for detecting the prostate cancer from ultrasound image of prostate gland. At the end we have selected CNN algorithm for detecting the prostate cancer. We have used dataset of Bharti Hospital Pune it contains 400 ultrasound images of prostate gland. And the overall accuracy of this model ranges from 8.5 to 9.5 which is higher than other algorithms or models. So finally we have selected CNN as our algorithm for detecting the prostate cancer and we are trying to build easy and simple user interface for user to access this model to detect prostate cancer but it is an secondary verification tool for normal users and doctors. We have gone through different algorithm other than CNN some of them such as RNN (Recurrent Neural Network), SVM (Support Vector Machine), and some other.

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