Prediction of Diseases using Deep Learning: A Review

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Abstract: Deep learning is a prime focus area for medical image analysis in the recent time. With the technical advancements in the last few decades there is a good amount of images in various databases and a number of researchers have focused their researches in medical image analysis. This paper presents the deep learning based approaches for the prediction of Gastrointestinal Diseases, Lung Disease, Breast Cancer Diagnosis and Brain Diseases available in literature. This paper also presents the summary for the prediction of Gastrointestinal Diseases, Lung Disease, Breast Cancer Diagnosis and Brain Diseases available in literature.

1 INTRODUCTION

Medical imaging is a term generally used to represent a set of technologies that produce images of internal body parts. The purpose of medical imaging is to monitor the health and injuries of organs. Magnetic Resonance Imaging (MRI), Ultrasound, Biopsy, Endoscopy, X-Ray, Mammography are among most commonly used medical imaging techniques. With the technical advancements in the last few decades the amount of images generated in the field of medical has increased tremendously. These medical images are stored in various databases along with the images of healthy organs or tissues to compare. The generated medical images differ in imaging technique, resolution, dimensionality and quality. Generally these medical images are analyzed manually by the medical practitioner. Medical image analysis is a complex and time consuming process with which even professional struggle .One of the major problem associated with manual image analysis is the image can be analyzed differently by different experts based on their knowledgeE.Sudheer Kumar and C.Shoba Bindu,2019.This may result in different diagnosis and treatment .Thus there is a need for automated analysis of medical data . Bruijne has discussed major challenges in medical image data as lack of labeled data, variable imaging techniques (Marleen de Bruijne,2016).

In early days of automated classification medical images the images were classified based on the predefined characteristics assigned previously by experts to machine learning models. The drawback of this system was that the machine learning algorithms were not able ho classify the images when they contain structural similarity. Then the focus of image classification shifted from machine learning to deep learning techniques. The automated analysis of medical data can be done by using deep learning techniques. Deep learning is a sub domain of machine learning which uses techniques inspired from the learning ability of the human brain. The architecture of these deep learning techniques is little complex but computationally stronger when compared with other machine learning methods. Along with other applications, deep learning is deployed at the front lines of healthcare and has produced the influential results by analyzing huge electronic data for treatment of various diseases. Deep Learning techniques have shown capacity to analyze the medical data at much faster rate and with more accuracy in comparison to manual methods. Deep learning algorithms attempt to learn high level and complex abstraction as representations of data by utilizing the hierarchical learning process (Ricardo Buettner,2020) .

2 DEEP LEARNING TECHNIQUES

Deep learning is a branch of the machine learning which primarily uses different kind of neural networks for prediction .Some of the deep learning methods used in this paper are as follows:

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2.1 CNN

Convolutional Neural Networks (CNN) is neural networks which contain convolution layers(filter layers) which are used to extract useful information from the input image.

2.2 RNN

Recurrent Neural Network is neural networks characterized by presence of self-loops in the hidden layers of the neural network. Recurrent Neural Networks have the capability to use sequential data and have predicted outputs based on input data along with the information is previous layers.

2.3 LSTM

LSTM is special kind of recurrent neural networks which are created to solve the problem of long term dependencies. LSTM have chain like structure, along with the repeating units. LSTM have three gates called forget gate, input gate and output gate which decide how much information should be erased, updated and provided as output.

3 RELATED WORK

This paper presents the deep learning based approaches for the prediction of Gastrointestinal Diseases, Lung Disease, Breast Cancer Diagnosis and Brain Diseases.

3.1 Gastrointestinal Diseases

Gastrointestinal (GI) diseases are the diseases related with the digestive system. The organs studied within the gastrointestinal domain are liver, pancreas, small intestine large intestine, rectum and anus. Aman Srivastava et al. (2019) proposed a CNN model to predict celiac and environmental enteropathy using biopsy images and obtained accuracy of 97.6%. Samira Lafraxo et al. (2020) used CNN model to abnormalities recognition on endoscopic images obtained from KVASIR dataset and obtained 96.89% accuracy.

Table 1: Summary of deep learning methods in GI disease Prediction

Author/Year	Techniques	Modality	Source	Accuracy
Chen-Ying Hung ,2019	DNN	ElelectronicHealth Record (multimodality)	EHR of Taichung Veterans General Hospital	87.6%
Kuntesh Jani,2019	CNN	Endoscopy	Images from CE videos	95.11%
Pradipta Sasmal,2018	CNN	Endoscopy	CVC clinic database& Hamlyn Centre Laproscopic/Endoscopic dataset	99.85%
Aman Srivastava,2019	CNN	Biopsy	WSI images	93%
Alexy A Shvets, 2018	CNN	Endoscopy	WCE images	75.35%
Franklin Sierra, 2020	CNN	Colonoscopy	Dataset consists of 76 NBI video images	90.79%
Yaxing Cao, 2018	DCNN	Endoscopy	WCE images	98.37%
Qiang Wang ,2019	CNN	Endoscopy	Chinese PLA General Hospital dataset	96.1%
Chathurika Gamage,2019	CNN	Endoscopy	KVASIR dataset	97.38%
Spiros V. Georgakopoulos,2018	CNN	Endoscopy	KID database	90.2%
Tonmoy Ghosh, 2016	CNN	Endoscopy	KID database	94.42%

3.2 Lung Disease

Lung diseases are related with the respiratory function of the lungs. Lungs contract and expand with the help of diaphragm. This contraction and expansion helps the lungs to inhale fresh air

containing oxygen and exhale air containing carbon dioxide. Amrit Sreekumar et al.(2020) used a 3DCNN model to detect presence of lung cancer using CT scan images obtained from LIDC-IDRI dataset.They obtained the accuracy of 86% . Rahul Hooda et al (2017) proposed a Tuberculosis prediction method using CXR images with CNN.Used images are from two datasets Montgomery and Shenzhen.

Table 2. Summary of deep learning methods in lung disease Prediction

Author/Year	Techniques	Modality	Source	Accuracy
Sheikh Rafiul Islam, 2019	CNN	CXR	Kaggle	97.34%
Karan Jakhar, 2018	DCNN	CXR	Chest XRay data	84%
Diksha Mhaske,2019	CNN-LSTM	CT scan	LIDC-IDRI	97%
S. Rajaraman, 2019	Ensemble	CXR	Kaggle pneumonia detection challenge dataset	98.7%
Ahmad P.Tafti, 2018	3DCNN	CT scan	DSB 2017, MLCIA datasets	83.75%
Ruchika Tekade,2018	3DCNN	CT scan	LIDC-IDRI, LUNA 2016, Kaggle data science Bowl 2017 datasets	95.66%
Matko Saric, 2019	CNN	Histopathology	WSI	75.41%

3.3 Breast Cancer Diagnosis

Breast cancer is one of the most frequent occurring cancer in females. Breast cancer is second largest cause of deaths in females after skin cancer. Ankit Titoriya et al.(2019) used CNN to predict the breast cancer using the histopathology images. The data set used is BreakHis dataset and they obtained accuracy of 93.8% in classifying.

Table 3. Summary of deep learning methods in Breast Cancer Diagnosis

Author/Year	Techniques	Modality	Source	Accuracy
Hari Krishna Tiammana, 2020	CNN	Mammography	WBCD	97.94%
Pritam Sarkar, 2019	DNN	Mammography, CT scans,MRI	WBC DIAGNOSTIC, WBC Original datasets	99.52%
Naresh Khuriwal,2018	CNN	Histopathology	MIAS dataset	98%
Jasmir, 2018	MLP	Oncology	Medical Center university institute of Oncology dataset	96.5%
Ahmed Hijab, 2019	CNN	Ultrasound images	Data was collected at Baheya Foundation for Treatment of Breast Cancer	97.39%
Benzheng Wei, 2017	BiCNN	Histopathology	BreaKHis dataset	97%
Sidharth S Prakash,2020	DNN	Mammography	WBCD	99%
Nur Syahmi Ismail, 2019	CNN	Mammography	IRMA dataset	94%
Mahboubeh Jannesari, 2018	CNN	Histopathology	Tissue Micro Array(TMA),BreaKHis dataset	98.7%
PhuT. Nguyen, 2019	CNN	Histopathology	BreaKHis dataset	73.68%

3.4 Brain Diseases

Brain is the most important part of the human body which controls the functionality of all other organs. Brain provides the living organisms the ability to learn, think and make decisions. Marek Wodkinski et al.(2019) proposed RNN-CNN based method to convert voice recordings into spectrogram and then use it to identify the presence of Parkinson's disease.The observed accuracy is 90%.

Table 4 . Summary of deep learning methods in classification of brain diseases

Author/Year	Techniques	Modality	Source	Accuracy
Amin Ul Haq, 2018	DNN	Voice sample	PD dataset	98%
Gaurav Shalin, 2020	CNN	F scan	Data recorded at University of Ottawa	95.1%
Pir Mohammad Shah, 2018	CNN	MRI scans	PPMI	96%
Mohammad Shaban, 2020	DCNN	Handwriting drawings	Kaggle handwriting dataset	94%
Pedram Khatamino, 2018	DCNN	Handwriting drawings	HW dataset	79.64%
Gunawardena, 2017	CNN	MRI	ADNI	84.4%
Ahmad Waleed Salehi, 2020	CNN	MRI	ADNI	99%
Ibtissam Bakkouri, 2019	3DCNN	MRI	ADNI	93%

4 CONCLUSION

This paper provides an overview of various deep learning technologies used by various researchers in the medical field. The deep learning techniques have shown unique capabilities in analyzing different kinds images in medical field .Deep learning techniques have the potential to reduce the efforts medical personals by accurate and faster analysis of medical images , this may help the proper treatment of the patients. This paper presented the deep learning based approaches for the prediction of Gastrointestinal Diseases, Lung Disease, Breast Cancer Diagnosis and Brain Diseases available in literature. This paper also presented the summary for the prediction of Gastrointestinal Diseases, Lung Disease, Breast Cancer Diagnosis and Brain Diseases.

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