JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1921 - 1928
https://publishoa.com
ISSN: 1309-3452

Sushrut- Diagnosis Made Easy

Ms..Srividhya Ganesan
Senior Assistant Professor
New Horizon College of Engineering, Bangalore
v.vidhya8@gmail.com

Pallavi Yadav
New Horizon College of Engineering, Bangalore
1nh18cs134.pallavi@gmail.com

Pooja Sunil Jadhav
New Horizon College of Engineering, Bangalore
1nh18cs140.pooja @gmail.com

Prapti
New Horizon College of Engineering, Bangalore
prapti1803@gmail.com

ABSTRACT

Given the state of healthcare in our nation, the unavoidable reality is that, although being a fundamental right, it is not always accessible and, even when it is, it is not always of high quality.

According to a poll done by Thomson Reuters in 2011, a large percentage of misdiagnosis occurs in many healthcare institutions, resulting in lasting repercussions and affecting the person's livelihood. Thyroid and Arthritis are two such disorders. While it is believed that 42 million people in India alone suffer from Arthritis, 210 million people worldwide suffer from it in some form or another.

In order to determine whether or not a person has Arthritis and Thyroid, our model use the CNN algorithm. It takes image data from users, feeds it into an algorithm, and decides whether the user has Arthritis. When it comes to thyroid detection, the model analyses thyroid scans to see whether there are any nodules present. And correctly infers whether the individual has an abnormal growth around the thyroid gland.

Keywords- CNN, Arthritis, Thyroid

I. INTRODUCTION

In healthcare, machine learning assists people in processing large and complicated medical information and then analysing them for clinical insights. As an example, using patient treatment history and health data, the k-mean method is used to forecast illnesses.

We can use machine learning to create models that quickly clean and analyse data and give results. Doctors will make good judgments on patient diagnoses using this system, and the patient will receive good treatment as a result, resulting in an improvement in patient healthcare services. Machine Learning Technology may be used to efficiently handle healthcare challenges.

Cardiovascular problems, high blood pressure, high cholesterol levels, depression, and infertility are all signs of an advanced thyroid

stage. T4 and T3, are active thyroid hormones produced by the thyroid gland, and these hormones govern the body's metabolism. Its significance is not limited to cells, but also includes tissues, organs, and overall energy yield and control.

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1921 - 1928
https://publishoa.com
ISSN: 1309-3452

Arthritis affects 4,444 joints, causing inflammation, discomfort, and swelling. It is frequently persistent and can result in long-term joint damage or deformity. Arthritis affects one out of every 100 persons at some point in their life. Arthritis has yet to be identified. Arthritis can be readily treated if detected early. It's usually diagnosed when the suspected patient begins to exhibit medium to severe, or more painful, symptoms, and the ailment need more rigorous therapy.

TSH may be measured in a number of ways at the moment. The earlier technologies, which date back to the 1970s, use radio immunoassays (RIA) with a sensitivity of roughly 2 mUI L1. These approaches, on the other hand, provide false negative results at high TSH concentrations, restricting the analytical range to only the medium and low TSH levels [13, 14]. The enzyme-linked immunosorbent assays (ELISA) technique, an immunoenzymometric test with a sensitivity of 0.01 mUI L1 [15, 16]. Although all of the aforementioned procedures are effective and sensitive, they are inconvenient, time-consuming, and reliant on chemical reagents. As a result, finding a process that is simpler, quicker, and reagent-free has been a major research focus.

Currently, the diagnosis of Arthritis is dependent on clinical experience rather than formal illness categorization criteria. An effective and correct diagnosis of Arthritis symptoms can help to prevent chronic damage to the patient's joints and bones, which can have a negative impact on the quality of life of those who suffer from the condition. The development of such a technique is described in this paper.

II. EXISTING SYSTEMS

A. THYROID

Thyroid disease is centered around the thyroid gland. This gland plays a crucial in ensuring an overall functioning of the body and it also checks for the level of metabolism in our body.

So if anything goes wrong with this thyroid gland then the consequences can be adverse and can drastically affect the quality of life of the patient.

If the dysfunctionality is detected in its early stage, its consequences can be minimized and can be treated in an efficient manner.

Generally, the disease is diagnosed with the help of investigation on the tests conducted in the laboratory that revolve around the quantity of the hormones such as thyroxin hormone, triiodothyronine hormone and thyroid stimulating hormone that are secreted in the body.

The measurement of the amount of hormone produced is assisted by the thyroid scan of the patients taken by physicians. An alternative to scan is the measurement of the iodine produced by gland.

All in all, the procedure followed to diagnose thyroid is time consuming. Therefore, it becomes necessary to explore other ways of diagnosing thyroid, especially computer aided methods, to save the precious time of the physicians as well as the patients.

B. OSTEOARTHRITIS

Diagnosis of a particular type of arthritis is very difficult due to recurring and common symptoms shared by multiple kinds of arthritis.

In the conventional kind of diagnosis, a doctor inspects patients' medical history and symptoms. Further multiple laboratory tests are required to diagnose arthritis. Tests like Antinuclear antibody where levels of different kinds of antibodies are measured, Arthrocentesis to examine the joint fluid, complement test to measure the complement levels which is a group of protein found in blood stream etc.

But most of the times doctors go for imaging techniques such as X-rays, Ultrasound, MRI and Arthroscopy. Imaging techniques are more suitable and more accurate compared to lab tests as they give a complete view of what's

happening near and around the joints and any form of abnormality can easily be detected.

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1921 - 1928
https://publishoa.com
ISSN: 1309-3452

Conventionally a patient would take these scans to a doctor as there are hardly any systems that can detect any form of abnormality in use. The doctor then observes the scans and tells the patient about the severity of the case. This is a step that could be eliminated with the help of our model where a patient will be facilitated with a machine where he can feed his scans and get to know of the severity levels and decide on whether to consider going to a doctor in serious cases or not in less severe and benign cases.

III. ALGORITHM

A. CHOICE OF ALGORITHM

When dealing with diagnosis of diseases like Thyroid and Arthritis, generally we deal with image data sets as the diagnosis, from a user's perspective as well as from the medical point of view, is easier with an image dataset.

One of the most effective algorithms that can be used for processing an image dataset is Convolutional Neural Network.

B. METHODOLODY

Convolutional Neural Network is known by its distinctive elements such as an input layer, output layer and the intermediate hidden layer and these elements assist us in processing and classifying the images. When we feed an image, the image with pixels is given to the convolutional layers. If the image is a black and white picture then the image is perceived as a two-dimensional layer and there is a value between 0 and 255 that is given to each layer. The extremes here represent complete back or complete white (0 for complete black and 255 for complete white).

Suppose that we are dealing with images that are coloured and not black and white then unlike the two-dimensional array that we ended up with in the case of a black and white image, we will have three-dimensional array and the layers would be blue, green and red. For each of the three layers, there is a value that lies between 0 and 255 that is assigned.

When the image, after assigning appropriate value between 0 and 255, is processed, a smaller image from the overall image is chosen using a kernel, otherwise known as a filter. The depth of the input is the depth of the kernel.

The image input is made to pass through a sequence of layers such as convolutional layer, pooling layer, and fully connected layer. At the end of this, an activation function, known as Softmax function is applied to ensure that the output of the previous layers fall in a given range, which is, between 0 and 1.

Convolution layer is used to filter the useful features from the image given as input. However, it retains the relation that exists in a pixel's proximity.

There is a movement across the image which is along the right and is of the stride 1. This movement is produced by the kernel.

Strides are the pixels that shifts over the input matrix. There can be instances where when we apply strides, the filter fails to fit in an effective manner. Under such circumstances, we can either add a 0-padding so as to make the filter fit or, we can drop that part of the input wherever the fitting is improper.

The values that were originally assigned to the actual picture is multiplied by this filter and a single numerical value is synthesized by summing up all the values that are produced by applying the product. This procedure is carried out throughout the image and as a result, we end up with a matrix that is comparatively smaller as opposed to the original image.

What we obtain, that is, the final matrix, after performing these steps is what is usually referred to as feature map of an activation map. The benefit of convolution of an image is that by the end of it, we are capable of identifying edges properly, we are able to identify the parts of the images that are sharp and blur easily by applying distinct filters and to do this, we only have to identify the values of aspects like the filter size and architecture of the network and the number of the filters

We introduce non-linearity by applying ReLU (Rectified Linear Unit)

$$f(x)= \max(0,x)$$

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1921 - 1928
https://publishoa.com
ISSN: 1309-3452

We then apply pooling layer to reduce the parameters when the image inputs are huge. It is done ensuring that the important information persists even after the dimensionality reduction process.

There are different types of pooling, namely, max pooling, sum and average pooling. Max pooling is used to derive the largest value from a given frame of feature map. When we take the average of the elements in the frame it's called average pooling. On the other hand, when we take the sum of the values in the frame, it's called sum pooling. As a part of our implementation, we have used Max-pooling.

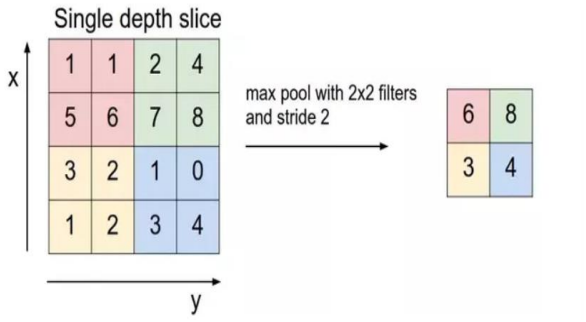

Fig. 1 Max pooling

Before we feed this processed input the fully connected layer, we flatten the input using Keras. For instance, if we have an input of the dimension 2x2 and we feed this input to Keras, then Keras would give us an output that is of the size 4X1. It is an important step when we are dealing with multi-dimensional inputs like images as it makes these multi-dimensional inputs into a single dimension input. The matrix is flattened to a vector.

The flattened output is then fed to the fully connected layer.

The output of the connected layer gives the final output. In our model, we have classified the result into five categories, and those categories are- Healthy, doubtful, minimal, moderate, severe.

C. WORKING DIAGRAM

There are a few steps that have to followed in order to ensure effective diagnosis. Initially, some images are collected from various sources, like UCI machine learning repository, Kaggle or data from certain specific organization.

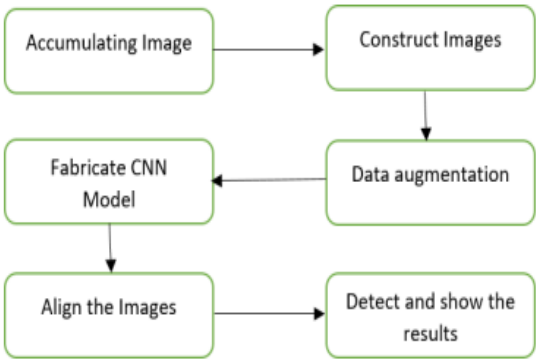

Fig. 2 Block diagram (Generic)

The images that are first collected are then built up for the augmentation of the set of data. Once this augmentation is done, we make a model that use used for testing and training.

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1921 - 1928
https://publishoa.com
ISSN: 1309-3452

Once we are done with testing and training, the model is then capable of diagnosing diseases.

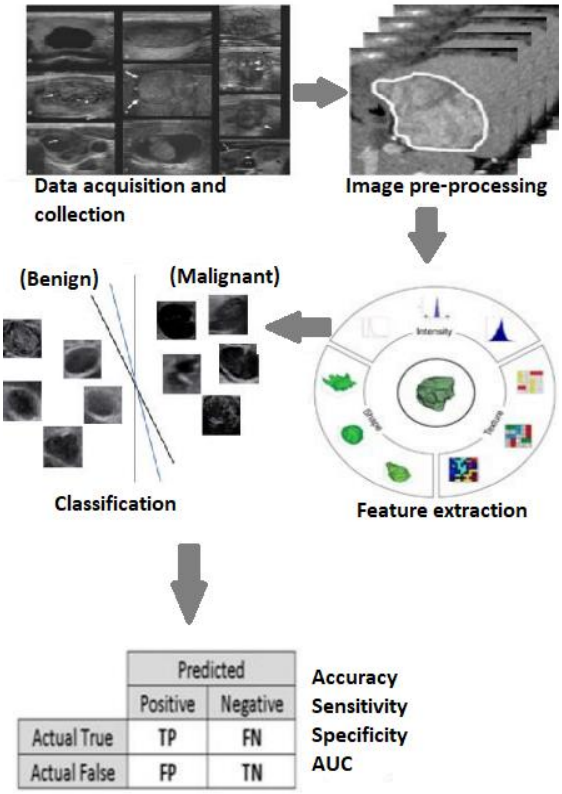

Fig. 3 Overview of thyroid disease diagnosis using CNN

D. DATASET

For each disease, that is, thyroid and osteoarthritis, the number of images that were used for testing and training were approximately 2000.

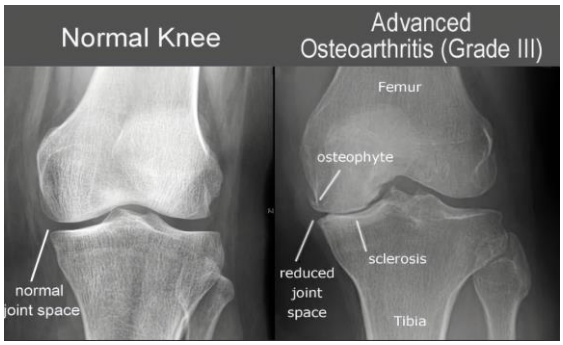

Fig. 4 Comparison of a healthy joint and arthritis prone joint

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1921 - 1928
https://publishoa.com
ISSN: 1309-3452

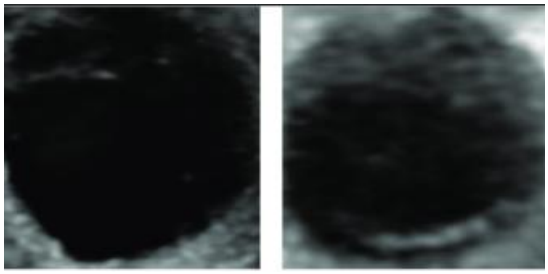

Fig. 5 a) Benign Thyroid Nodules

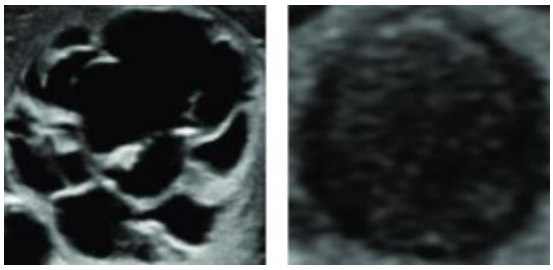

Fig. 5 b) Malignant Thyroid Nodules

IV. RESULT

This model uses CNN algorithm to detect diseases pertaining to thyroid and joints(i.e. arthritis). This model takes ultrasound images and X-ray scans as inputs to detect any form of abnormality in thyroid gland and joints respectively. Our model successfully detects abnormality and their severity with 95% accuracy.

VI. CONCLUSION AND FUTURE WORK

This model is an attempt to make a digital system where the x-rays and ultrasound scans of various diseases could be taken as an input and the severity and abnormality would be reported back to the user without any doctor's intervention for benign and mild cases. Our project is a primitive model where we focus on 2 diseases i.e., thyroid and arthritis. We feed ultrasound images and X-ray scans to the model in order to detect thyroid related and joints related diseases. In this particular project we have used CNN algorithm for both the diseases due to its high accuracy with image data.

The main agenda of the model is to make healthcare more accessible and affordable as doctor's appointment can cost a lot and we can cut down on the cost for mild and benign symptoms.

In future we expect to be able to incorporate more diseases and improve the algorithms accuracy.

REFERENCES

1. Ankita Tyagi, Ritika Mehra, Aditya Saxena **"**Interactive Thyroid Disease Prediction System Using Machine Learning Technique" 5th IEEE International Conference on Parallel, Distributed and Grid Computing(PDGC-2018), 20-22 Dec, 2018, Solan, India.

2. W.K.D. Jayamini, K.G.H.D. Weerasinghe "Decision Support for Diagnosing Thyroid Diseases using Machine Learning", International Journal of Scientific and Research Publications, Volume 11, Issue 6, June 2021 1 ISSN 2250-3153

3. Navya, V., Patil, K.A. . "Identification of Anomalies in Images Using CNN and Autoencoders Techniques",

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1921 - 1928
https://publishoa.com
ISSN: 1309-3452

Lecture Notes in Networks and Systems

4. Gyanendra Chaubey , Dhananjay Bisen, Siddharth Arjaria1,Vibhash Yadav," Thyroid Disease Prediction Using Machine Learning Approaches" The National Academy of Sciences, India 2020

5. Shaik Razia and M. R. Narasinga Rao "Machine Learning Techniques for Thyroid Disease Diagnosis - A Review", In Indian Journal of Science and Technology · July 2016.

6. Bin Zhang, Jie Tian, Shufang Pei, Yubing Chen, Xin He,Yuhao Dong, Lu Zhang,Xiaokai Mo, Wenhui Huang, Shuzhen Cong, and Shuixing Zhang, " Machine Learning–Assisted System for Thyroid Nodule Diagnosis", Thyroid: official journal of the American Thyroid Association · March 2019

7. K. Dharmarajan, K. Balasree, A.S. Arunachalam, K. Abirmai," Thyroid Disease Classification Using Decision Tree and SVM", Indian Journal of Public Health Research and Development · March 2020

8. Hajer Khachnaoui, Ramzi Guetari, Nawres Khlifa ," A review on Deep Learning in thyroid ultrasound Computer-Assisted Diagnosis systems", 2018 IEEE International Conference on Image Processing, Applications and Systems (IPAS).

9. Zahra Shiezadeh , Hedieh Sajedi and Elham Aflakie ," DIAGNOSIS OF RHEUMATOID ARTHRITIS USING AN ENSEMBLE LEARNING APPROACH", CS & IT-CSCP 2015

10. Kento Morita, Atsuki Tashita, Manabu Nii, Syoji Kobashi," COMPUTER-AIDED DIAGNOSIS SYSTEM FOR RHEUMATOID ARTHRITIS USING MACHINE LEARNING"

11. J ¨orn L ¨otsch, Lars Alfredsson , Jon Lampa," Machine-learning–based knowledge discovery in rheumatoid arthritis–related registry data to identify predictors of persistent pain", 2019 International Association for the Study of Pain.

12. Jose L. Salmeron, Samira Abbasgholizadeh Rahimi, Amir Mohammad Navali, Alireza Sadeghpour," Medical Diagnosis of Rheumatoid Arthritis using Data driven PSO-FCM with scarce datasets", Neurocomputing 2016

13. Janick Rohrbach, Tobias Reinhard , Beate Sicka , Oliver Dürr, "Bone erosion scoring for rheumatoid arthritis with deep convolutional neural networks", Computers and Electrical Engineering 78 (2019) 472–481

14. S. A. Bhisikar and S. N. Kale," Classification of Rheumatoid Arthritis Based on Image Processing Technique", Springer Nature Singapore Pte Ltd. 2019.

15. B.Jayanthy, C.Senthamarai," Feature Selection using K-Means Genetic Clustering To Predict Rheumatoid Arthritis Disease", International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-3, September 2019.

16. S. Shanmugam and J. Preethi," Design of Rheumatoid Arthritis Predictor Model Using Machine Learning Algorithms", Cognitive Science and Artificial Intelligence, SpringerBriefs in Forensic and Medical Bioinformatics 2018.

17. Vandana, C.P., Chikkamannur, A.A.," Feature selection: An empirical study" International Journal of Engineering Trends and Technology, Volume 68, Issue -2

18. Maria Hügle, Patrick Omoumi, Jacob M van Laar, Joschka Boedecker,and Thomas Hügler," Applied machine learning and artificial intelligence in rheumatology", Published online 2020 Feb 19.

19. Jihyung Yoo , Mi Kyoung Lim , Chunhwa Ihm , Eun Soo Choi, Min Soo Kang," A Study on Prediction of Rheumatoid Arthritis Using Machine Learning", International Journal of Applied Engineering Research ISSN 0973-4562 Volume 12, Number 20 (2017) pp. 9858-9862 © Research India Publications.

JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 2, 2022, p. 1921 - 1928
https://publishoa.com
ISSN: 1309-3452

20. Srividhya Ganesan, Sustainable Development of Green Healthcare Communities for Prediction of Autism Spectrum Disorder using Machine learning approach, Journal of Green Engineering, Scopus Indexed Journal, Volume-10, Issue -9, September 2020