

Arthritis Prediction using Thermal Images and Neural Network

Swati Wasnik¹, Vrishali Fulzele², Ishika Vora³, Pankaj Khoabragade⁴, Mrunal Raut⁵, Md Waseem Khanooni⁶

¹Swati Wasnik, Dept. Of Electronics and Telecommunication Engineering, SBJITMR, Maharashtra, India

²Vrishali Fulzele, Dept. Of Electronics and Telecommunication Engineering, SBJITMR, Maharashtra, India

³Ishika Vora, Dept. Of Electronics and Telecommunication Engineering, SBJITMR, Maharashtra, India

⁴Pankaj Khoabragade, Dept. Of Electronics and Telecommunication Engineering, SBJITMR, Maharashtra, India

⁵Mrunal Raut, Dept. Of Electronics and Telecommunication Engineering, SBJITMR, Maharashtra, India

⁶Md Waseem Khanooni, Dept. Of Electronics and Telecommunication Engineering, SBJITMR, Maharashtra, India

Abstract - Arthritis is the swelling and tenderness of one or more of the joints. Joint pain and stiffness are the main symptoms which worsen with age. It targets all ages but it is more common in women. To overcome this problem we need some intelligent device that can help us to give early prediction of arthritis disease. In this paper, artificial neural networks and thermal image processing using MATLAB (Matrix Laboratory) used for early prediction. Some stages are present in this system. First, we will load the thermal image in the GUI created using MATLAB for processing. Then, Select the affected region. The system will read the pixels of selected region and calculate the temperature based on color of pixel in thermal images. When inflammation occurs, chemicals from the body's white blood cells (WBC) are released into the blood. This release of chemicals increases the blood flow to the area of injury or infection with increase in the temperature, and may result in redness and warmth. On the basis of temperature, the early prediction will be done by using Backpropagation algorithm.

Key Words: Arthritis, backpropagation algorithm, inflammation, white blood cells, artificial neural networks

1. INTRODUCTION

Arthritis means inflammation of joints. It can affect children, as well as people in the prime of their lives. Arthritis is a damn serious disease, it cause more death then Melanoma (Skin cancer),Asthma, HIV aids,etc. It is commonly seen in elder population above age 40 mostly in females. Arthritis can be controlled but if it is predicted at early stage then it can be cured as well. Our project is based on the same concept of early prediction to reduce death rate of arthritis patients.

Thermal image processing using MATLAB plays a major role in calculation of temperature of the affected area. The system will detect, display and record thermal patterns and temperature values across a given surface. A thermal image converts the invisible infrared images into a monochrome or

multicolored image. Once captured, thermal images and associated temperatures can be stored for future reference and analysis.

a) Joint appearance (hands)



Fig -1: Stages of arthritis patients

2. LITERATURE REVIEWS

RozinaNaz [1],this research paper developed a new intelligent system for the identification and prediction of rheumatoid arthritis. They used thermal image processing techniques and neural network. It uses backpropagation algorithm.

Swati Bhisikar [2] paper based on concept arthritis disease is detected by radiograph.They focused on image processing techniques using MATLAB to analyze Joint Space Width(JSW).They have used Active Shape Model(ASM) for extracting information through images. Then, Local Linear Mapping is used to detect JSW.

Kento Morita [3] paper says that the estimation of arthritis can be done early by using progression of RA.The modified Total shape(mTS) score was used to predict.But it takes long time.So this paper focused to make automatic mTS score assessments on hand using score vector machine.

Lakshmi TV [4], According to this paper the Rheumatoid arthritis is a genetic disorder. So, researchers predicted the RA by genomic sequence analysis. They have used signal processing algorithm and cross correlation.

3. METHODOLOGY

The purpose of our software is to detect the arthritis of people who are having chances of suffering from arthritis or any bone diseases. By prediction, the person can start taking care of it and the precautions can be taken at the early stage.

3.1 THERMAL IMAGE PROCESSING

X-Ray and MRI are expensive methods to detect arthritis disease whereas thermal image processing allows us to heat as a factor where different colors represent different range of temperatures. It contains red, green, lime, yellow, blue, cyan and magenta. The red or yellow-orange hue represents warmer area. Blue or purple represent cooler area. Thermal image processing has the ability to perform inspection while temperatures are under the load. Thermal inspection quickly locates affected regions and calculates the temperature by calculating the average red color pixels to predict the chances of arthritis which can be treated at early age.

3.2 NEURAL NETWORK

A neural network is composed of connection nodes like brain is composed of nodes. It uses connection of weights.

Input layer: It defines number of input given to the neural network.

Hidden layers: It is having number of layers with arbitrary number of neurons.

Output layers: The number of output values corresponds to the output layer.

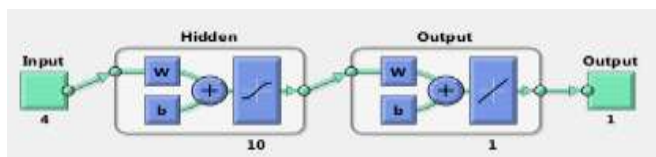


Fig -2: Layers in Neural Network

Here, the project consist 4 inputs, 1 output and the output will be based on 10 best records.

3.2.1 BACKPROPAGATION ALGORITHM

It is a supervised learning algorithm. When designing a neural network, we initialize weights with some random values or any variable in the beginning. But our model output will have huge error value. So, to reduce the error, we need to somehow explain the model to change the weights such that error should be minimum. By using a technique called the delta rule or gradient descent the backpropagation algorithm looks for the minimum value of the error function in the weight space.

3.4 IMPLEMENTATION AND RESULT:

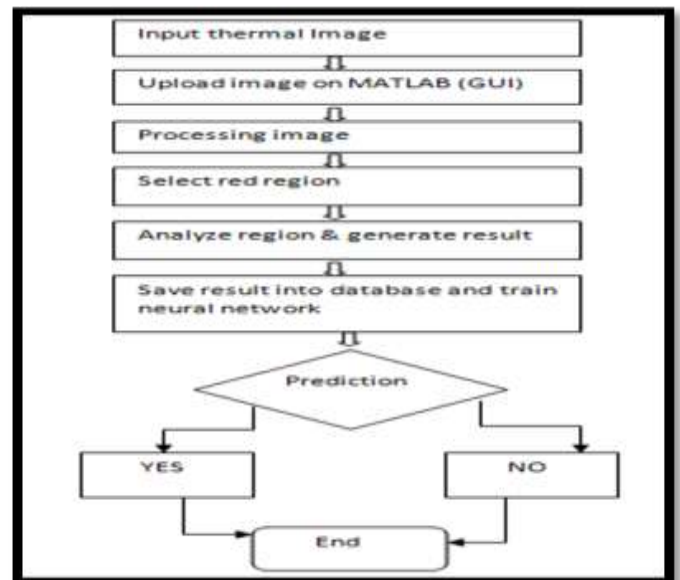


Fig -3: Flowchart of work

In this project, we need thermal image to load and process it. Then, select region of joints. Here, we have taken four joints of hands i.e. Distal interphalangeal joint (DIP), Metacarpophalangeal joint (MCP), Proximal interphalangeal joint (PIP) and wrist. Select the region of the particular joint one by one and click on the button of the respective joint. The arthritis can be happen in any one of the joint or number of joints. So, if any one of the joints having chances of arthritis then the result will be chances of arthritis otherwise it would be normal case. The thermal range is 29°C-32°C for arthritis patients.. The output is shown in fig 2.



Fig -3: Output of work

4. CONCLUSIONS

As there is intense need of medication for the diseases that can't be identified at the early stages and could lead to severe health issues. One of the diseases is arthritis. Our project is based on the same concept to provide a new intelligent system to hospitals. It is a prediction system that helps people to predict the chances of arthritis at early stage. It will help them to protect themselves by taking early steps for prevention.

We used MATLAB R2013a in our project for image processing and backpropagation algorithm for training of the neural network. In future; it can be also used to detect other diseases where temperature of the affected region is different with respect to whole body.

REFERENCES

- [1] Rozina Naz, Moshtashim Ahmad, Mr. Manishkarandikar, "Arthritis prediction by thermal Image processing and neural network", ISQR, August-2015.
- [2] Mrs. Swati Bhisikar and Dr. Sujata Nikale, "Automatic Analysis of Rheumatoid Arthritis based on Statistical features", IEEE, 2016
- [3] Kento Morita, Atsukitashita, Manabunif, syojikobashi, "Computer aided diagnosis system for Rheumatoid arthritis using machine learning", IEEE, 2017
- [4] Lakshmi TV, Dr K.B Ramesh, Dr. VidyaNiranjan, Aishwarya Shetty, Monica N, Aishwarya Rao, "Design of a state-machine based genomic simulator and development of a system for prediction of RA using signal processing", IEEE, 2017
- [5] Sudhir Rathore and Prof. S.V. Bhalerao, "Designing of Neuro-Fuzzy Based Thermal Imaging System on MATLAB for Detection of Rheumatoid Arthritis", International Journal of Engineering Research and General Science, March-April, 2015
- [6] Abhishek Ghosh, Sayanatni Bera, Geetashree Kundu, SudiptaBhadra, AnnindyaJyoti Pal, "A Survey on Thermal Image Processing Using GA, ANN and Fuzzy C-Means Algorithm", International Journal of Innovative Research in Science, Engineering and Technology, June 2016
- [7] Kadir Tok and Ismail Saritas, "The Usage of Artificial Neural Networks Method in the Diagnosis of Rheumatoid Arthritis", International Journal of Intelligent Systems and Applications in Engineering, 2016
- [8] Nizami Mohiyuddin, Pradeepkumar Dhage, Krishna K. Warhade, "Rheumatoid Arthritis Detection Using Thermal Imaging and Fuzzy-C-Means algorithm", International Journal of Computer & Mathematical Sciences, October 2014