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Suspecting Lupus by Analyzing Rashes using Artificial Neural Networks (ANN)

Payel Saha[1 *], Rakesh Kumar Mandal[2]

[1]Dept. of Computer Science, North Bengal St. Xavier's College, West Bengal, India
[2]Dept. of Computer Science & Application, University of North Bengal, West Bengal, India

[*]*Corresponding Author: payel17.10@gmail.com*

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Abstract— In this research paper lupus disease is suspected using Artificial Neural Networks (ANN). Lupus is a chronic disease which is not curable. But it can be controlled by early diagnosis. By analyzing various symptoms it is very difficult to diagnose lupus manually. This paper is an approach to diagnose lupus in an efficient way with the help of ANN. An ANN has been designed here to suspect lupus. The ANN consists of many neurons associated with weights. Each neuron represents each symptom. Here patients are classified into two categories: infected and non-infected. Classification is an important tool in medical diagnosis. The data was collected from North Bengal Medical College for training the net.

Keywords—Disease Suspection, Artificial Neural Networks (ANN), SLR

I. INTRODUCTION

Lupus is a chronic disease which affects blood vessels and connected tissues [6]. There are mainly two variants of Lupus Erythematosus, one is the cutaneous, that was earlier called discoid lupus, that causes disfigurement of skin, darkening, itchiness, redness on skin or scalp, thinning and wrinkling of skin. The other, Systemic Lupus Erythematosus or SLE, the most common form, like the name suggests, involves the systems of heart, lungs, kidneys, and brain. Lupus is about nine times as common in women as in men [7]. It is more common in younger women. In this research paper lupus is suspected using Artificial Neural Networks (ANN). The ANN consists of many neurons associated with weights. Each neuron represents a symptom.

During the time of this research work it was observed that research work had already been done to suspect various diseases like cancer, dengue etc using ANN. Payel Saha et al have used ANN to detect dengue disease. Farhad Soleimanian Gharehchopogh et al have used ANN to diagnose thyroid disease. Dey et al [3] has used ANN techniques to diagnose Diabetes disease. The applied data in this paper have been collected from Sikkim Manipal Institution of Medial Science Hospital which includes 530 patients. The output includes 2 classes of 0 or 1. They suggested two feed forward ANN architectures where the first one includes the number of neurons in three layers (6-10-1) and the second one involves two hidden layers and the number of neurons in (6-14-14-1) layers. In [5], F.S.Gharehchopogh et al. have used ANN to diagnose heart disease. They used MLP ANN with 60 nodes in input layer, 4 nodes in hidden layer and 2 nodes in output layer which is back propagation learning algorithm.

This paper is divided into four sections. Rashes are discussed in Section I. Architecture of the ANN is discussed in Section II. Methodology is discussed in Section III and Analysis of the system is discussed in Section IV.

II. SUSPECTION OF LUPUS BY ANALYSING RASHES:-

Doctors suspect lupus on the basis of some symptoms. Rashes are one of them [6, 7].

A. Rashes:-

1) Number of effected body areas (face, neck, upper limb, chest, nail, scalp, ear, mouth, shoulder)
2) Size of the affected area (normal, abnormal)
3) Number of different shapes (oval, ring, no particular shape)
4) Distribution (wide spread, localized)
5) Margin (clear-cut or not)
6) Surface (Scaling present or not, atrophied or not)
7) Colour (Red, pink, black, white, violate)
8) Duration(<4 weeks or >4 weeks)

9) Symptom (pain, etching, burning, photosensitivity).
10) Progression (slow, rapid).

III. ARCHITECTURE OF THE SLR-NET

A SLR net consists of two layers of neurons. Layer1 consists of input neurons consisting of input vectors {R1f, R1ne, R1ul, R1c, R1na, R1sc, R1e, R1m, R1sh},{ R2n, R2ab},{ R3o, R3r, R3nos},{R4w, R4lo},{R5cl, R5no},{R6sca, R6atro},{R7r,R7p ,R7b ,R7w, R7v},{R8lt, R8 gt},{R9pa,R9etch,R9bur,R9pho},{R10sl,R10ra}. R1f represents effected area face, R1ne represents effected area neck, R1ul represents effected area upper limb, R1c represents effected area chest, R1na represents effected area nail, R1sc represents effected area scalp, R1e represents effected area ear, R1m represents effected area mouth and R1sh represents effected area shoulder. R2n represents normal size of area affected by rash. R2ab represents abnormal size of area affected by rash. Oval shaped rash is represented by R3o, ring shaped rash is represented by R3r, no particular shape is represented by R3nos. R4w represents wide spread of rash, R4lo represents localized rash. R5cl represents clear cut margin of rash, R5no represents opposite situation of R5cl. R6sca represents presence or absence of scaling surface of rash, R6atro represents atrophied surface of rash. Red coloured rash is represented by R7r, Pink coloured rash is represented by R7p, Black coloured rash is represented by R7b, White coloured rash is represented by R7w, Violet coloured rash is represented by R7v. R8lt defines duration of rash existence which is less than 4 weeks, R8gt defines duration of rash existence which is greater than 4 weeks. R9pa represents the absence or presence of paining for rashes, R9etch represents the absence or presence of etching for rashes, R9bur represents the absence or presence of burning for rashes, R9pho represents the absence or presence of photosensitivity symptom of rash. Slow progression of rash (if rash progressing time is more than 4 weeks) is represented by R10sl, Rapid progression of rash(if rash progressing time is 2-4 weeks) is represented by R10ra.

Layer2 consists of 10 neurons {R1_O, R2_O, R3_O, R4_O, R5_O,R6_O,R7_O,R8_O,R9_O,R10_O}. Layer3 consists of 1 neuron Y_out. There are two weight layers of SLR –net. Weight Layer-1 represented by vector V1 is present between the Neuron layer-1 and Neuron Layer-2. Weight Layer-2 represented by vector V2 is present between the Neuron layer-2 and Neuron Layer-3.

IV. METHODOLOGY

Number of all possible effected body areas by rashes in lupus are 9 (face, neck, upper limb, chest, nail, scalp, ear, mouth, shoulder). For each effected area 0.1 weights is taken. For each unaffected area 0.0 is taken. The R1_O vector is represented by the combination of 0 and 1. If any area is affected 1 is taken as an input, otherwise 0 is taken. Size of effected areas by rashes in lupus are 2(normal, abnormal). The R2_O vector is represented by the combination of 0 and 1. If size of effected area by lupus is greater than normal size, then 1 is taken as an input, otherwise 0 is taken. Shape of rashes is of 3 types (oval, ring, no particular shape). The R3_O vector is represented by the combination of 0 and 1. For the presence of any shape 1 is taken as an input, otherwise 0 is taken. Spreading of rashes is classified into 2 categories (wide spread, localized). The R4_O vector is represented by the combination of 0 and 1. For the presence of each category 1 is taken as an input, otherwise 0 is taken. Margin of lupus rashes are clustered into 2 sections (clear-cut or not). The R5_O vector is represented by the combination of 0 and 1. For presence of each category 1 is taken as an input, otherwise 0 is taken. Surface of lupus rashes is clustered into 4 categories (scaling present or not, atrophied or not). The R6_O vector is represented by the combination of 0 and 1. For the presence of each category 1 is taken as an input, otherwise 0 is taken. Colour of lupus rashes is clustered into 5 categories (Red, Pink, Black, White, and Violet). The R7_O vector is represented by the combination of 0 and 1. For the presence of each category 1 is taken as an input, otherwise 0 is taken. Duration of lupus rash is clustered into 2 categories (< 4 weeks or>= 4 weeks). The R8_O vector is represented by the combination of 0 and 1. For the presence of any of these categories 1 is taken as an input, otherwise 0 is taken. Symptom of lupus rash is classified into 4 sections (pain, etching, burning, and photosensitivity) The R9_O vector is represented by the combination of 0 and 1. For the presence of any of these categories 1 is taken as an input, otherwise 0 is taken. Progression of lupus rash is classified into 2 sections (slow, rapid) The R10_O vector is represented by the combination of 0 and 1. For the presence of any of these categories 1 is taken as an input, otherwise 0 is taken.

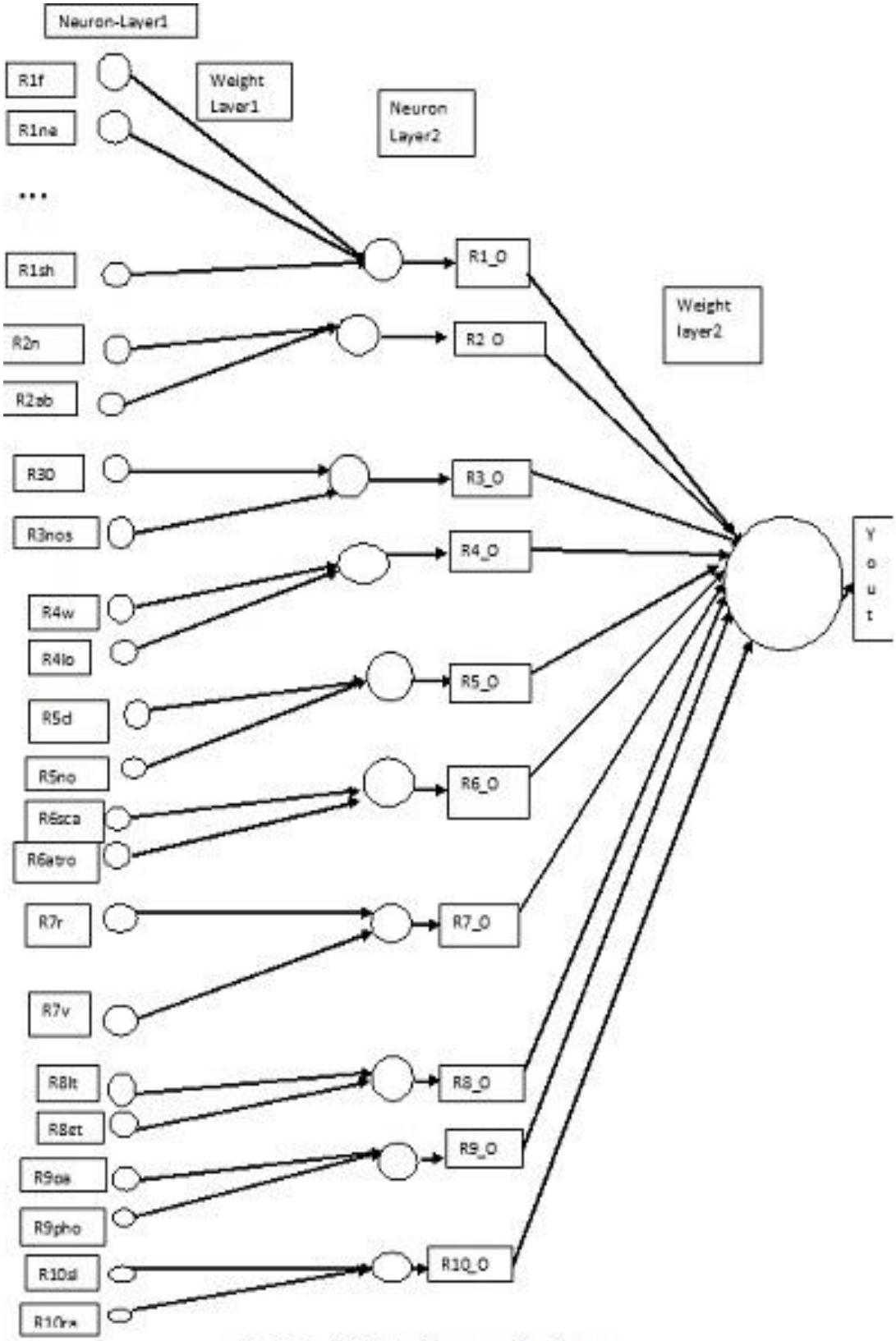

Fig: Neural Network suspecting Lupus

V. ANALYSIS

MATLAB software has been used to design the ANN. Here input vector and weight vectors are used.

$y\_out=\sum x_i w_i$ (where i = 1 to n) for n=9

Case1: x= [1 1 1 1 1 1 1 1 1];
w= [0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1]

y_out=0.1+0.1+0.1+0.1+0.1+0.1+0.1+0.1+0.1=0.9
a=y_out

Here nine ones represent that the number of effected areas of any patient is 9. For rashes each symptom is associated with 0.1weight.

Case2: x= [0 1]; w= [0.0 0.1]
y_out=0+ 0.1=0.1
s=y_out

Here one represent that the size of rash effected areas greater than normal effected area. If it is greater consider its weight as 0.1 otherwise consider weight as 0.0.

Case3: x= [0 1 0]; w= [0.1 0.1 0.1]
y_out = 0+ 0.1+0=0.1
sh = y_out

Here ring shape is present. So for presence of ring shape 1 is taken as an input.

Case4: x= [0 1]; w = [0.1 0.1]
y_out = 0+ 0.1= 0.1
sp = y_out

Here one represent that rash is localized. Its weight is taken as 0.1.

Case5: x= [1 0]; w = [0.1 0.1]
y_out = 0.1+0.1
m = y_out
Here one represent that the rash margin is clear-cut. So its weight is taken as 0.1

Case6: x= [0 1]; w= [0.1 0.1]
y_out = 0+ 0.1=0.1
su = y_out

Here one represent that the surface of rash effected areas is not scaled. Its weight is taken as 0.1.

Case7: x= [1 1 0 0 1]; w= [0.1 0.1 0.1 0.1 0.1]
y_out=0.1+0.1+0.0+0.0+0.1=0.3
c = y_out

Here three ones represent that 3 different rash colour present in lupus affected patient's body. For rashes each symptom is associated with 0.1weight.

Case8: x= [0 1]; w=[0.0 0.1]
y_out = 0+ 0.1=0.1
d = y_out

Here one represent that the duration of rash effected areas is greater than normal time. If it is greater consider its weight as 0.1 otherwise consider weight as 0.0.

Case9: x= [0 1 0 1]; w= [0.1 0.1 0.1 0.1]
y_out = 0+ 0.1+0+0.1= 0.2
sy = y_out

Here one represent that paining and photosensitivity is observed in lupus rash. Its weight is taken as 0.1.

Case10: x= [0 1]; w= [0.1 0.1]
y_out = 0+ 0.1=0.1
p = y_out

Here one represent that the progression of rash effected areas greater than normal progression period. Its weight is taken as 0.1.

w=a +s+ sh + sp+ m+ su+ c+ d+ sy+ p
w will be the weight of rash.

The weight of the rest of the symptoms is computed in the same way.

VII. CONCLUSION

The purpose of this paper is to use Artificial Neural Network to suspect the lupus disease by analyzing rashes on a year recorded data. Emphasis is given on the weight finding algorithm. This will suspect the lupus disease. In future, researchers are advised to explore the detection of lupus disease by using laboratory test report using ANN.

REFERENCES

[1] Farhad Soleimanian Gharehchopogh, Maryam Molany and Freshte DabaghchiMokri, "Using Artificial Neural Network in diagnosis of thyroid disease": a caseStudy, International Journal Computational Sciences & Applications (IJCSA) Vol.3, No.4, August 2013.
[2] R. Dey, V. Bajpai, G. Gandhi, B. Dey, "Application of Artificial Neural Network (ANN) technique for Diagnosing Diabetes Mellitus", the Third international Conference on Industrial and Information Systems(ICIIS), PP.1-4, IEEE, Kharagpur, India,2008..
[3] F.S. Gharehchopogh, Z.A. Khalifelu," Neural Network Application in Diagnosis of Patient: A CaseStudy", International Conference on

Computer Networks and Information Technology (ICCNIT), PP- 245 – 249, Abbottabad, Pakistan, 2011.Study", International Conference on Computer Networks and Information Technology (ICCNIT), PP. 245 – 249, Abbottabad, Pakistan, 2011.

[4] Payel Saha, Rakesh Kumar Mandal "Detection Of Dengue Disease using Artificial neural Network" International Journal of Computer Sciences and Engineering , May 12, 2016.

[5] Laurene Fausett, " Fundamentals of Neural Networks"

[6]http://timesofindia.indiatimes.com/life-style/health-fitness/health-news/Living-with-lupus/articleshow/29909854.cms (Available online)

[7]https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3380630/#R11(Available online)

Profile

Payel Saha pursed Bachelor of Science from University of North Bengal University, India in 2014 and Master of Science from St.xavier's College, Kolkata under Calcutta University in year 2016. She has published 4 research papers in reputed international journals. Her main research work focuses on ANN.

Dr Rakesh Kumar Mandal has completed Bachelor of Science and MCA. He has Completed PhD from North Bengal University. He is currently working as Assistant Professor(Sr) in Department of Computer Science, University of North Bengal, West Bengal, India. He has published more than 20 research papers in reputed international journals. His main research work focuses on ANN.

