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Detection of Dengue Disease Using Artificial Neural Networks

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***Abstract*— This research paper is aimed at the detection of dengue disease using Artificial Neural Network (ANN). Necessary data was collected from Jalpaiguri Sadar Hospital for training the net. An ANN was designed which detects dengue disease. North Bengal region was aimed for the analysis.**

Keywords- Disease Detection, Artificial Neural Network

I. INTRODUCTION

Dengue is a viral disease transmitted by mosquito. It is a vector borne disease [7]. It has been recently seen in North Bengal region. It is a break bone disease [2]. In this research paper, Artificial Neural Network is used to detect dengue. Artificial Neural Network is modelled on human brain that consists of many neurons. A neural network is trained to perform a particular function by adjusting the values of the connections (weights) between elements [6]. The approach of this paper is to design an Artificial Neural Network model to diagnose dengue. Here patients are classified into two categories: infected and non-infected. Classification is an important tool in medical diagnosis [2].

II. RELATED WORK

While preparing this research paper it has been observed that most researchers used ANN techniques to diagnose many diseases like thyroid, cancer, diabetes etc. In [3], Farhad Soleimanian Gharehchopogh et al have used ANN to diagnose thyroid disease. Dey et al [4] has used ANN techniques to diagnose Diabetes disease, wherein the applied data have been collected from Sikkim Manipal Institution of Medial Science Hospital which includes 530 patients. The output includes 2 classes of 0 and 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 four (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 a back propagation learning algorithm.

III. CHARACTERIZATION OF DENGUE

Jalpaiguri Sadar Hospital was approached to collect information about dengue. According to them, doctors diagnose dengue on the basis of the following methodology:

a) **Suspected Dengue:** Doctors advise patients for further dengue test on receiving the following complaints from patient. Doctors suspect patients suffering from dengue on the basis of the following symptoms:
- High rise of temperature
- Joint Pain
- Anorexia
- Nausea
- Bleeding (nose or eyes)

b) **Probable Dengue (Clinical Test):** After suspected dengue patients go for clinical test, the positive result of dengue probability is based on the following symptoms:
- High Temperature
- Retro Orbital Pain
- Pulse weak
- Pressure down

b) **Confirm Dengue (Laboratory Test):** Dengue is confirmed after the following test.
- NS1 test(positive)
- Mac Elisa Test(positive)
- Rapid Diagnostic Kit test

IV. ARTIFICIAL NEURAL NETWORK MODEL FOR THE DETECTION OF DENGUE CONFIRMED CASES

ANN has been used in past for solving many problems in many domains through the collected data [6]. Neural network consists of a large number of interconnected inputs, outputs and hidden nodes [6].The Information processing in ANN is performed by transforming inputs into outputs. The ANNs are controlled by manipulating the synaptic weights [2]. The training in ANN is done by specifying some threshold value. In this research work, the ANN model is trained by 187 confirmed dengue cases of Jalpaiguri District.

V. METHODOLOGY

In the proposed method following three different artificial neural networks are used.

1. **For the suspecting dengue:**

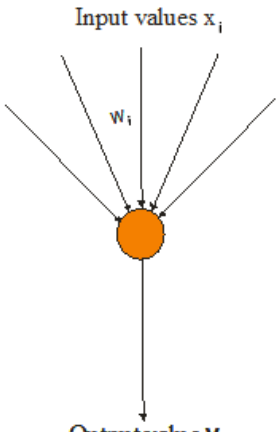

Fig 1: An ANN for dengue suspection

Algorithm for suspecting dengue:

i) Collect five complaints from patient that are fever, joint pain, anorexia, nausea, bleeding(nose or eye). Store the binary answers in X_i.

ii) If particular two symptoms nausea and bleeding are common problems of any patient the algorithm will suspect dengue. Since these two symptoms are necessary for dengue detection, the weights (W_i) of these two symptoms are fixed at 2 and remaining weights are set to 1.

iii) Consider theta or threshold value as 4.

iv) If the value of Y_out >= theta, then suspect dengue, else not.

$Y\_out=X_1W_1+X_2W_2+X_3W_3+X_4W_4+X_5W_5$

2. **For the dengue probability:**

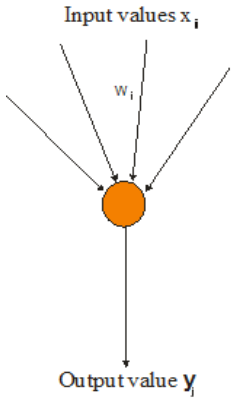

Fig 2 : An ANN for dengue probability

Algorithm for probability of dengue:

i) Collect four clinical features from patient viz. temperature, Retro orbital pain, weak pulse, low blood pressure. Store the binary answers in X_i.

ii) If the particular symptom Retro orbital pain is common in any patient then sign dengue. Since this symptom is necessary for dengue detection, the weight (W_i) of this symptom is fixed at 4 and remaining weights are set to 1.

iii) Take theta or threshold value as 0.

iv) If the value of Y_out >= theta, then sign dengue probability, otherwise not.

$Y\_out=X_1W_1+X_2W_2+X_3W_3+X_4W_4+X_5W_5$

3. **For the confirmation of dengue:**

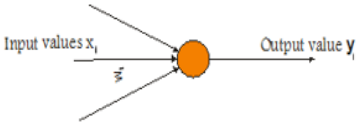

Fig 3: AN ANN for dengue confirmation

Algorithm for confirmation of dengue:

i) Collect three different types of test reports from laboratory that are NS1 test, Mac Elisa test, and Rapid diagnostic test, respectively. Store the binary answers in $X_{i.}$

ii) If the particular tests NS1 test and Mac Elisa test report are positive of any patient the algorithm will confirm dengue. Since these symptoms are necessary for dengue detection, the weight (W_i) of these symptoms is taken to be 2.

iii) So, theta or threshold value is -2 and remaining weights are set as 1.

iv) If the value of Y_out >= theta, then confirm dengue, otherwise not.

$y\_out = X_1W_1 + X_2W_2 + X_3W_3 + X_4W_4 + X_5W_5$

VI. ANALYSIS

Table 1 displays various positive cases of dengue:

IGM ELISA	NS1 ELISA	IGM RAPID TEST	Confirm Dengue
Positive	Negative	Negative	Yes
Negative	Positive	Negative	Yes
Positive	Not Done	Not done	Yes
Not done	Positive	Not done	Yes
Positive	Positive	Not done	Yes

Table1: Five various positive cases of Dengue

To design the ANN, MATLAB software has been used. Here input vectors, weight vectors and threshold value are used.

The formula for whole network becomes

$Y\_out = \sum X_iW_i$ (where i =1 to n)

So, $y\_out = X_1W_1 + X_2W_2 + X_3W_3 + X_4W_4 + X_5W_5$

If Y_out>= 4, then Y=1

else Y=0

Case1: X=[1 1 1 1 1]; W=[1 1 1 2 2]

Here theta=4

Output is y=1(1 indicates positive result of dengue suspicion)

Case2: X=[-1 -1 -1 -1 1]; W=[1 1 1 2 2]

theta=4

Output is y=0(0 indicates negative result of dengue suspicion)

Case3: X=[1 1 1 1]; W=[1 4 1 1]

theta=0

Output is y=1(1 indicates positive result of dengue probability)

Case4: X=[-1 -1 1 1]; W=[1 4 1 1]

theta=0

Output is y=0(0 indicates negative result of dengue probability)

Case5:X=[1 1 1]; W=[2 2 1]

theta=-2

Output is y=1(1 indicates positive result of dengue confirmation)

Case6: X=[-1 -1 1]; W=[2 2 1]

theta=-2

Output is y=0(0 indicates negative result of dengue confirmation)

VII. CONCLUSION

The purpose of this paper is to use Artificial Neural Network to recognize dengue confirmed cases on a year recorded data. This will predict the dengue disease with some degree of certainty. Finally, in future, researchers are advised to explore additional parameters to predict dengue confirmed cases.

VIII. ACKNOWLEDGEMENT

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REFERENCES

[1] B. Cetiner, M. Sari, H. Aburas, "*Recognition of dengue disease patterns using artificial neural networks*", *5th* International Advanced Technologies Symposium (IATS'09), May 13-15, 2009, Karabuk, Turkey.

[2] F. Elijorde, D. Clarite, B. Gerardo, Y. Byun, "*Tracking and prediction of dengue outbreak using cloud-based services and artificial neural network*", International Journal of Multimedia and Ubiquitous Engineering Vol.11, No.5 (2016), pp.355-366 .

[3] F. Gharehchopogh, M. Molany, F. DabaghchiMokri, "*Using artificial neural network in diagnosis of thyroid disease*": a case Study, International Journal Computational Sciences & Applications (IJCSA) Vol.3, No.4, August 2013.

[4] 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..

[5] 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.

[6] L Fausett, "*Fundamentals of Neural Networks*", Pearson Publisher. pp.1-11, 1993.

Authors Profile

Payel Saha passed her Bachelor of Science degree from the University of North Bengal, 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 completed his Bachelor of Science and MCA. He completed his PHD from the University of North Bengal. He is currently working as an Assistant Professor in Department of Computer Science, University of North Bengal, West Bengal, India. He has published more than 20 research papers in reputed international journals and are also available online. His main research work focuses on ANN.

