# Application of Artificial Neural Network And Pattern Recognition Algorithm For Detection of Malaria

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***Abstract-*** *Malaria is one of the common viral disease that infects a large number of people. Normally, it's a bit late before people take a blood test in case of viral infections, and as a result, it worsens their situation. In our paper, we propose a solution that will identify malarial diseases and their types. Weintend to accomplish this using the unique temperature pattern that every disease portrays. The method we have adopted is that we have used a highly sensitive temperature sensor to record the temperature fluctuations. With this data in hand, we will use artificial neural networks and pattern recognition algorithms to detect the disease. Using this method its possible to determine the type of malarial disease in a matter of, at the most, three days. For this paper we have considered the three types of malarial viruses to demonstrate our idea.*

***Keywords***- Malaria,public health, temperature pattern, artificial neural networks

## I. INTRODUCTION

Any human being is always infected by diseases from time to time. Also, the diseases are myriad in number and in form. Among them Malaria is one of the most life-threatening viral disease. It is responsible for taking the lives of thousands of people every year. In 2016, according to WHO, there were an estimated 216 million cases of malaria in 91 countries and among them 445000 people died due to it. The main reason for the death toll going up as high as it does is because there is no way for any person to know what infection he has been affected with, unless he takes a blood test. But, normally a person doesn't take a blood test every time he gets a high fever. Only if the fever keeps rising high, in spite of taking medicines, does he become alert about his condition and decides to take the test. But in that period of 3-4 days the virus causes a lot of damage as it isn't acted upon to be supressed. Therefore, its necessary that the disease be detected as soon as possible so that proper medical treatment can be provided immediately. Our main intention through this project is to develop a diagnostic kit which will detect the infected patient by analysing his body temperature and the environmental factors. Another intention of this project is to reach rural areas where a doctor can't reach patients to give them proper medical care and attention. The temperature sensor that we have used is very thin and flexible and can be worn around the wrist like a band. Hence, we want our kit to be engineered like a wristband, which would enable any person to carry it with him all the time. This way he will be always updated about his condition.

## II. COMPONENTS USED

### 1.Raspberry Pi

In our project, we have made use of Raspberry Pi 3 model B. It's a small single-board computer that is compatible with the high amount of data processing. For our project, we intend to use the Raspberry Pi 3 Model B as it has features such as quad-core 64-bit ARM Cortex A53 clocked at 1.2 GHz. The RAM – 1GB of LPDDR2- 900 SDRAM. The Pi 3 includes on-board 802.11n Wi-Fi and Bluetooth 4.0. Wi-Fi, wireless keyboards, and wireless mice now work out of the box. That's the reason Raspberry Pi 3 stands out good for processing high amount of data and for seamless connectivity to the data servers.

### 2. Denso-Energy Eye - Heat Flow Sensor

Denso heatflow sensor is advanced heat-flux sensor, which gives us, both heat-flux and temperature details of the region in contact. This sensor contains accuracy of 0.001degree-celsius. It is made from a semiconductor and a thermocouple. It is flexible and specially designed for human body application.

## III. APPROACH TO SOLUTION

In this project we are trying to implement artificial neural network to predict disease outbreak by estimating the environmental factors and also using pattern recognition algorithms to recognize the fever pattern. Both of these elements will collaborate to improve the prediction accuracy of our kit.

By taking environmental factors first, we will analyse if there is a chance of disease outbreak. Since malaria is being spread through insects, their reproductivity completely depends upon environmental factors like temperature, humidity and rainfall. Using artificial neural networks first we will train, from pre-recorded statistical data and that data will be compared to present data which will give us the estimate about the probability of a particular disease outbreak. If there is a chance of outbreak a public notification will be sent to the people to make them aware.

Every disease has its own temperature pattern, for example three different disease pathogen of malaria are having different fever readings. We can apply this for any disease which has a fever pattern like dengue, typhoid etc. However, for experiment purpose we have restricted ourselves only to malaria. In our kit we use a temperature sensor which is highly accurate, and we will compare patients' body temperature with standard temperature readings for P. Falciparum, P. Vivax, P. Malariae. If the patient is showing similar traits then he and his doctor will be warned by our application.

## IV. ARTIFICIAL NEURAL NETWORK AND PREDICTION

### 1. Data-collection

Data was collected from different sources like malaria data from National Vector Borne Disease Control Program, Pune and Meteorological data from Indian Meteorological Department, Pune. Duration of data was from 2011 to 2014.

### 2.Building model

We have applied backward elimination method to increase the efficiency of the data set. Backward elimination is a method of eliminating unwanted data in dataset. By eliminating those, accuracy of the prediction increases.

**Algorithm**

1. Calculate the significance level of the variable

$$Z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$$

2. Compare the present significance level with chi square table, if significance is less than chi square, keep the variable, otherwise eliminate it.

3.Calulate for every variable until its significance level is good enough

Using adjusted R^2 method we can obtain goodness of fit of our predicted output. Adjusted R^2 must be calculated after elimination of each variable, so that we can get to know the effect of the elimination of variable.

**Algorithm**

1. Calculate the value of adjusted R^2

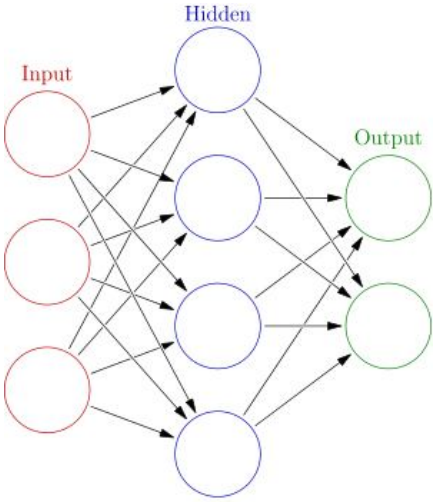
$$R^2_{adj} = 1 - \left[\frac{(1 - R^2)(n-1)}{n-k-1}\right]$$

k is number of variables
p is sample size

2. If value of R^2 decreases then the eliminated variable damages the prediction, which tells us if or not to eliminate that particular variable.

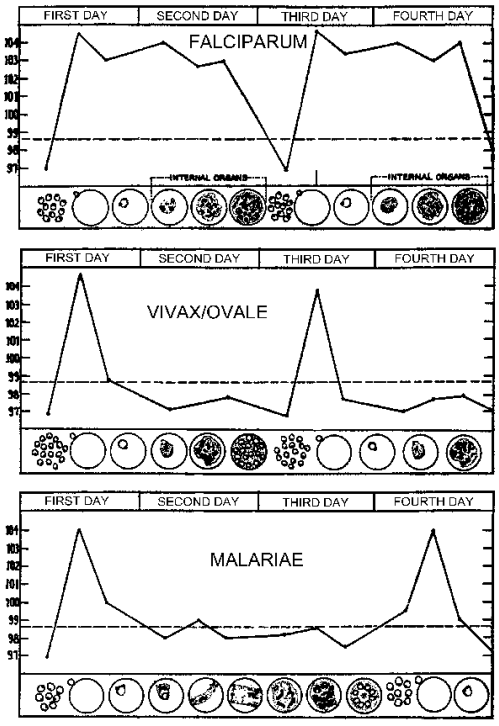
### 3.Training Artificial Neural Network

Artificial Neural Network is one of the best regressor for machine learning, where it is an inspired model of biological neural network system. This model works by taking features as inputs of the model. Different inputs will be given to different neurons. While we train the neuron it checks the value of each neurons. According to the value change it gives weightage to neurons. So after training a few neurons they will be dedicated to one particular output and the other few neurons will be dedicated to the rest. Using this it will predict the result for new inputs.




## V. FEVER PATTERN RECOGNITION

Every pathogen which enters our body will undergo a number of reproductive cycles, which will result in fever cycles thus gives us a pattern. Using this, we tried to analyse and predict which malarial pathogen has entered. Use of Denso heat-flow sensor is optimal because of its high accuracy and heat-flux change is observable faster than temperature change.




As shown in diagram, P. Falciparum, P. Vivax, P. Malariae are having three different fever patterns. We obtained the standard fever readings and compared it with patients' condition. If he shows similar traits its observed that he is infected.

## VII. CONCLUSION

The conclusion of this paper is that the machine learning tools can be exploited very well to uncover the fever pattern of diseases. However, a temperature sensor that has a good accuracy is a pre-requisite to work this out. Apart from Malaria we can add other fever patterns into the database, and thus detect those diseases as well.

## REFERENCE

[1] National Vector Borne Disease Comtrol Programme, Directorate General of Health Science, Ministry of Health & family walefare, India http://nvbdcp.gov.in/malaria3.html

[2] A Profile of National Institute of Malaria Research, "Estimation of True Malaria Burden in India".

[3] Ijeta Sharma, Ajai Kumar, Lakshmi Panat, Dr. Ganesh Karajkhede, Anuradha lele,"Malaria Outbreak Prediction Model Using Machine Learning" International Journal of Advanced Research in Computer Engineering & Technology(IJARCET)Volume 4 Issue 12, December 2015

[4] Tarigoppula V.S Sriram, M. Venkateswara Rao, G V Satya Narayana, DSVGK Kaladhar, T Pandu RangaVital,"Intelligent Parkinson Disease Prediction Using Machine Learning Algorithms", International Journal of Engineering and Innovative Technology (IJEIT) ,Volume 3, Issue 3, September 2013.

[5] http://www.tulane.edu/~wiser/protozoology/notes/malaria.html

[6] http://www.stat.yale.edu/Courses/1997-98/101/sigtest.htm