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A Review and Survey of Artificial Neural Network in Medical Science

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Abstract – The c*urrent era of computer science and medical science functioning together to solve complex challenges such as diseases and medical instruments which are highly effective to use for the solution of algorithms and mathematical problems, while some challenges still need to improve in their techniques and algorithms, for instance, facial recognition, voice recognition, and processing of a language are current issues. This paper is twofold, first provides the classification of Artificial Neural Networks (ANNs) and second present the techniques of medical science which comprehensively enables the ANNs techniques to the prediction of medical diseases. ANNs techniques are extensively used in medical science. Computing based models are really effective to fine vector born disease and artificial neural network provided good efficiency in diagnosis. Also neural network is useful to check cancer, cardio vascular and diabetic patient.* It is perceived through previous literature that b*y employing ANNs techniques in medical science can improve to diagnose in an intelligent way such as to develop the drugs prescription, recordkeeping of patients by maintaining the patient's history so it can be easy to analyze the prediction of diseases.*

Keywords: Artificial Neural Network, Prediction of diseases, Medical Science

1.0 INTRODUCTION

An ANNs [1] are significantly enabled in plenty applications of sciences and technologies in different areas for instance in the area of computing, chemistry, physics, and biology. Such as ANNs has been used in chemical kinetics [2], recognition of the performance of industrial devices [3], developing kinetics of drug issue [4], the taxonomy of agriculture's goods, for instance, onions variety [5], as well as species resoluteness [6-8].

It is verified in the previous study that, huge varied data, for instance, taxonomy of biological's object, chemicals kinetic data, as well as the clinical parameter easily handle in fundamentally the similar approaches. Enhanced computing approaches, involving ANNs, use varied varieties of input/output data which are handled in the context of prior training study on a described samples database to manufacture a clinically significant output, for instance, the probability of a specific pathology or taxonomy of biomedical's object. ANNs are given the witnesses beneficial in the investigation of blood and urine samples of a diabetic patient. [9, 10], identification of tuberculosis [11, 12], leukemia taxonomy [13], investigation of complex effusion samples [14], and image examination of radiographs or even living tissue [15, 16]. It is scrutinization that the many publications have been done in the field of medical science with ANNs, Figure 1; shown the numbers of publications are published by each year, the papers are

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browsed on well-known publishers like IEEE, ACM, Springer, Wiley and Elsevier and keywords for browsing used "Artificial Neural Network medical applications", "Artificial Neural Network prediction of diseases (cancer, malaria, heart, memory, skin)", "Artificial Neural Network survey in medical science".

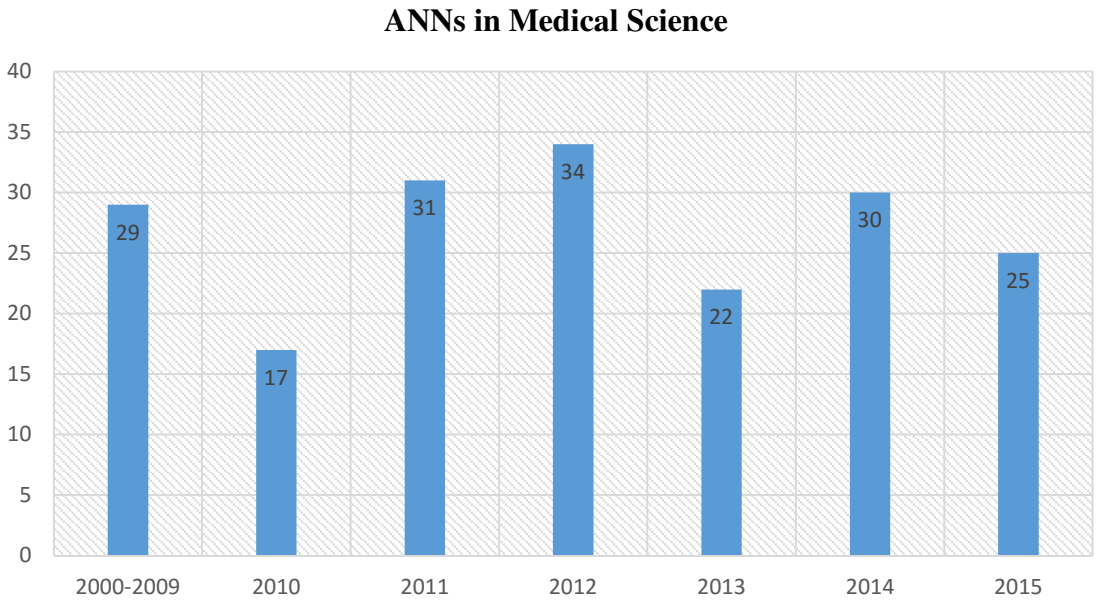

Figure 1: Publication in Artificial Neural Network in Medical Science

The objective of this paper is to provide the overview to use of ANNs in analytical methods over certain approaches, this paper is systemized into sections such as section two present the classification of ANNs, applications of artificial neural network in medical science are discussed in third section and finally gives overall conclusion of use of ANNs in medical science.

1.1 Classification of Artificial Neural Network

ANNs, normally known as a neural network, which is fundamentally a mathematical model inspired by biological nervous. Plain and multifaceted relations straightforwardly enables the modeling by neural networks. As well as enabled to figure out pattern and clustering in data, Fig. 2 shown the fundamental working principle of artificial neurons is shows the fundamental building block of each ANNs are an artificial neuron, that includes three functions namely; multiplication, summation, and activation.

The classification of ANNs based on network structures, types of learning, supervised learning, unsupervised learning is classified in figure 3. Which shown the principle techniques of overall ANN. The brief explanation of these techniques can be found in [11-16] that has been used in medical science, as well in [1] Bio-medical application are discussed.

Based on Fig. 1, it can notify the strength of ANNs, has the capability to train the data that by what method to perform the tasks through the data presented for training or primary task. Once getting the information in learning time the ANN produce its own pattern. Various neural networks estimations taken out parallel. Particular hardware's devices presence proposed to take use of this capability of neural networks.

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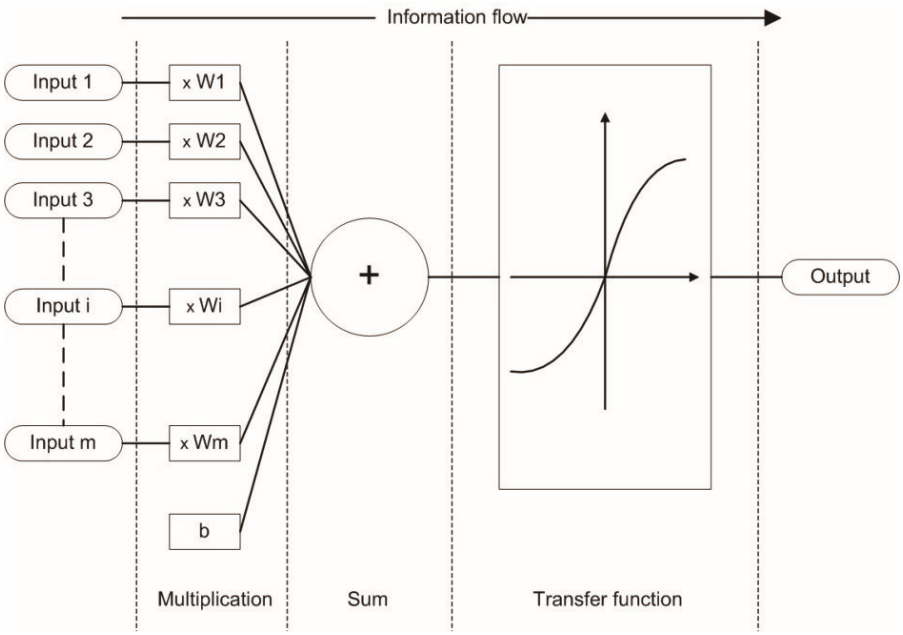

Figure 2: Fundamental working principle of an artificial neurons

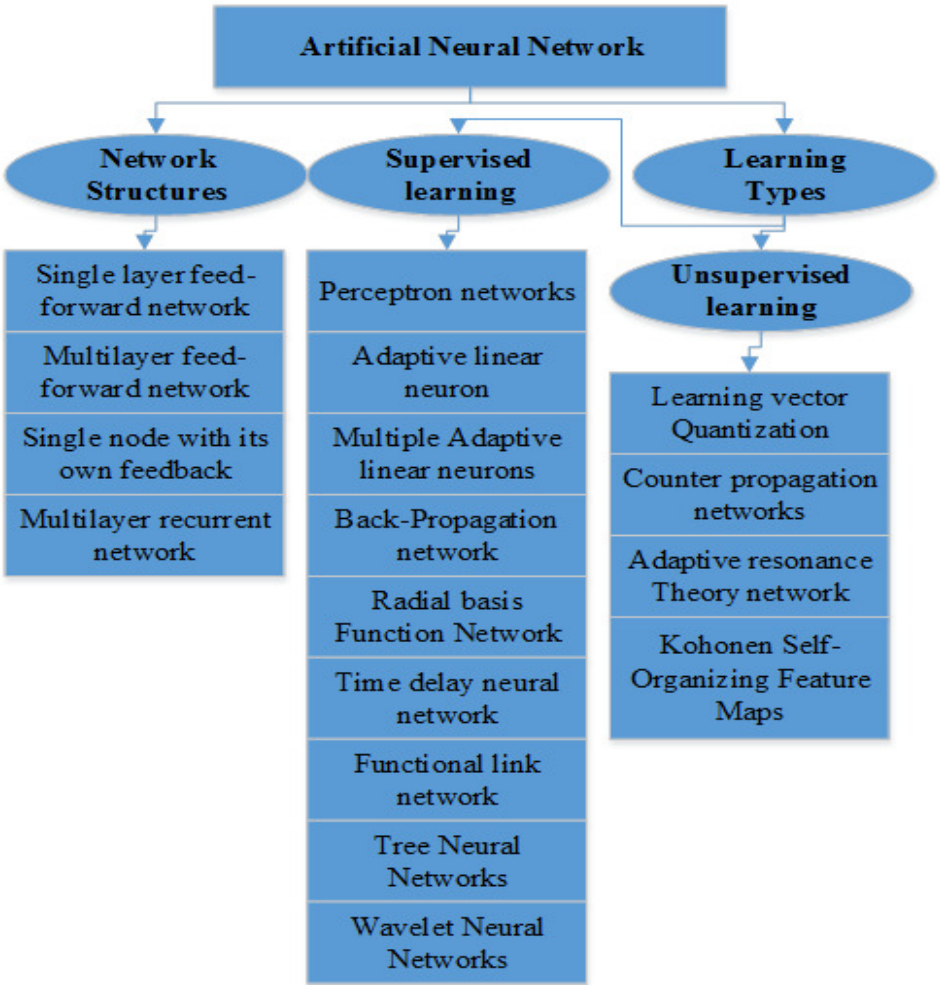

Figure 3: Classification of ANNs which includes Network structure, and learning type

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Limited loss of a neural network structures models to the degrading of performance. Although, a few network abilities can be recalled even after main network loss. Furthermore, look forward on its limitation, such as Neural networks size and complication of the neural network considered high, and Training process time also considered larger than normal.

2.0 APPLICATIONS OF ARTIFICIAL NEURAL NETWORK IN MEDICAL SCIENCE

Many researchers presented the overview and proposed solutions based on the classification of Plasmodium which is shown in figure 4 [17], that used a neural network such as Jayavanth and Singh has also used ANN to analyze the severity of malaria by using different processes, for example, aggregation and deformability parameters of erythrocytes. Dangerous malaria at a high level also can be classified by using this method up to 100% accuracy. While result shows 60% accuracy for non-severe and 80% for mid-severe malaria [18].

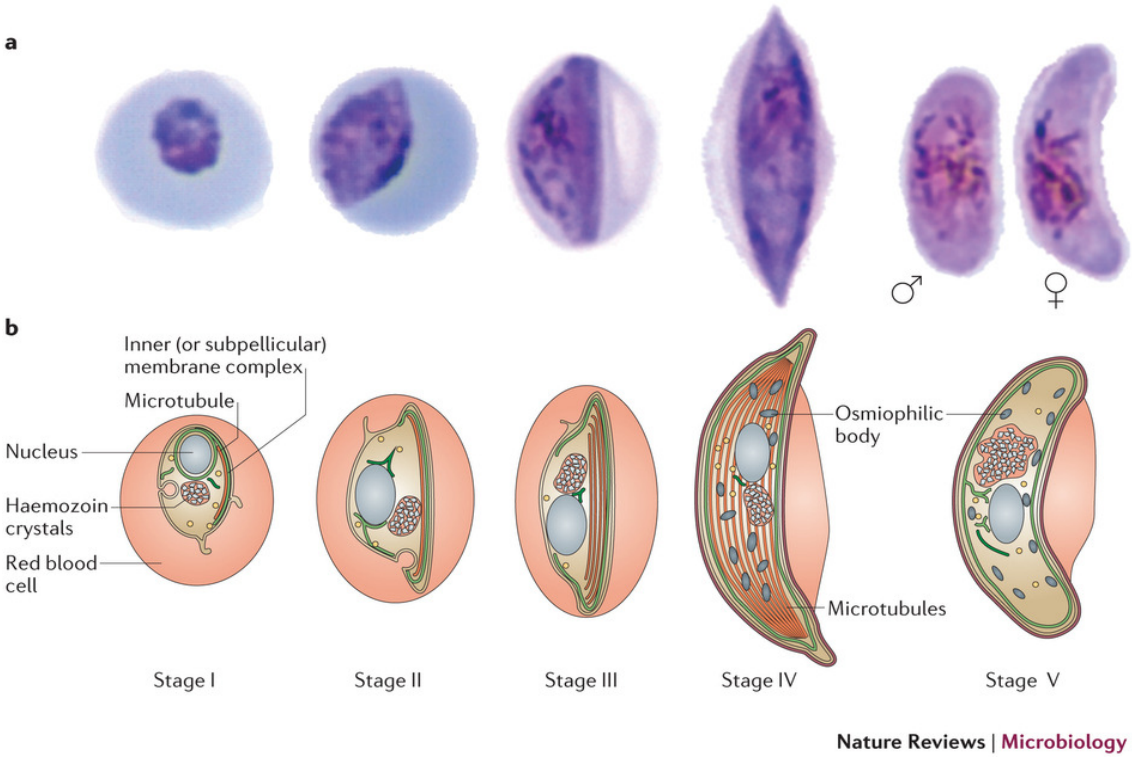

Figure 4: Plasmodium Falciparum

In many of applications for medical diagnosis, it has been observed that neural network has used for its ability by which it can learn the human expertise very well, as well effective use of knowledge for the isolation. Classification for the heart disease also done by neural network application in which sensor inputs given to system for stroke classification by using MPL feed forward network along with back propagation rule is shown in figure 5 [19]. Simulation system has given the effect result for whole input data given which is given for testing to the network [20].

Neural network effectively used for some of the severe disease like cancer, diabetics. These diseases have a very complex relationship to each other. By Epidemiological research, it has

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been proved that if a patient is suffered from diabetes than several types of cancer are may found in the patient. ANFIS used for enhancement of classification accuracy also for better efficiency for diabetes patients, where is diabetic patient's data has been given as an input to neuro-fuzzy network for the classification which is shown in figure 6 [21].

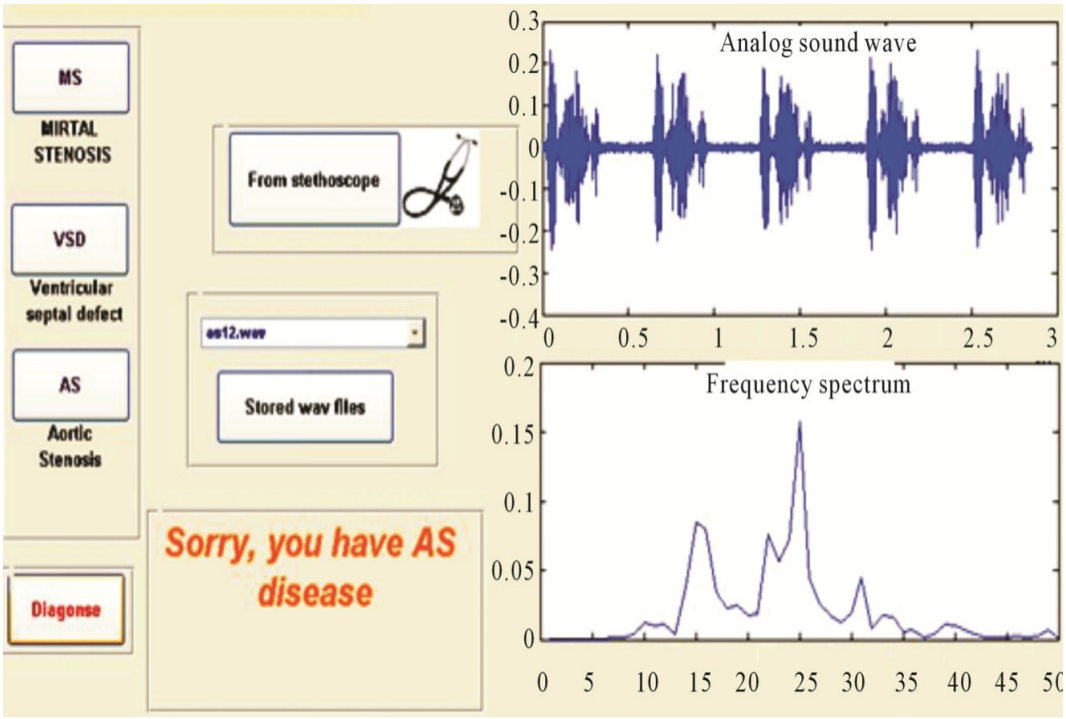

Figure 5: Classification of heart disease using MPL

There is another effective technique to diagnose disease based on artificial intelligence. They have used a hybrid algorithm which is GSO and ABC to enhance the training procedure of neutral network to effectively diagnose heart disease and to identify a perfect member to train in the neural network. [22].

Artificial Neural Network is used highly in medical science due to successes of its decision making for all problems as well it proved it effective capacities in the field of medical science. It is also very useful for solving the problem of any disease which having many of confusing symptoms [23].

In this research, a decision support system (DSS) is proposed to diagnose nodules into benign and malignant by analyzing data via ANNs. In this work, a dataset of 63 samples are utilized to train and test the neural network based algorithm. As a result, %95 accuracy is reached. As well, the proposed method which is based on ANNs is compared against some well-known classification algorithms [24].

The health state for patients can be automatically evaluated by using four different methods of ANN including, Bayesian networks, decision trees and simple classification models which are also helpful for decisions in medical treatment. By using these methods uncertain conditions can be evaluated cardiac arrest [25], which is shown in figure 7 [26].

Malaria affects millions of people approximately more than 100 all around the world out of 2,414 died in a day in every year. Although Indonesia is notable on one-third position in the

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quantity of intestinal sickness occurrence in South East Asia, with 229,819 confirmed cases while in 2010 approximately by 432 effected and resultant passed away.

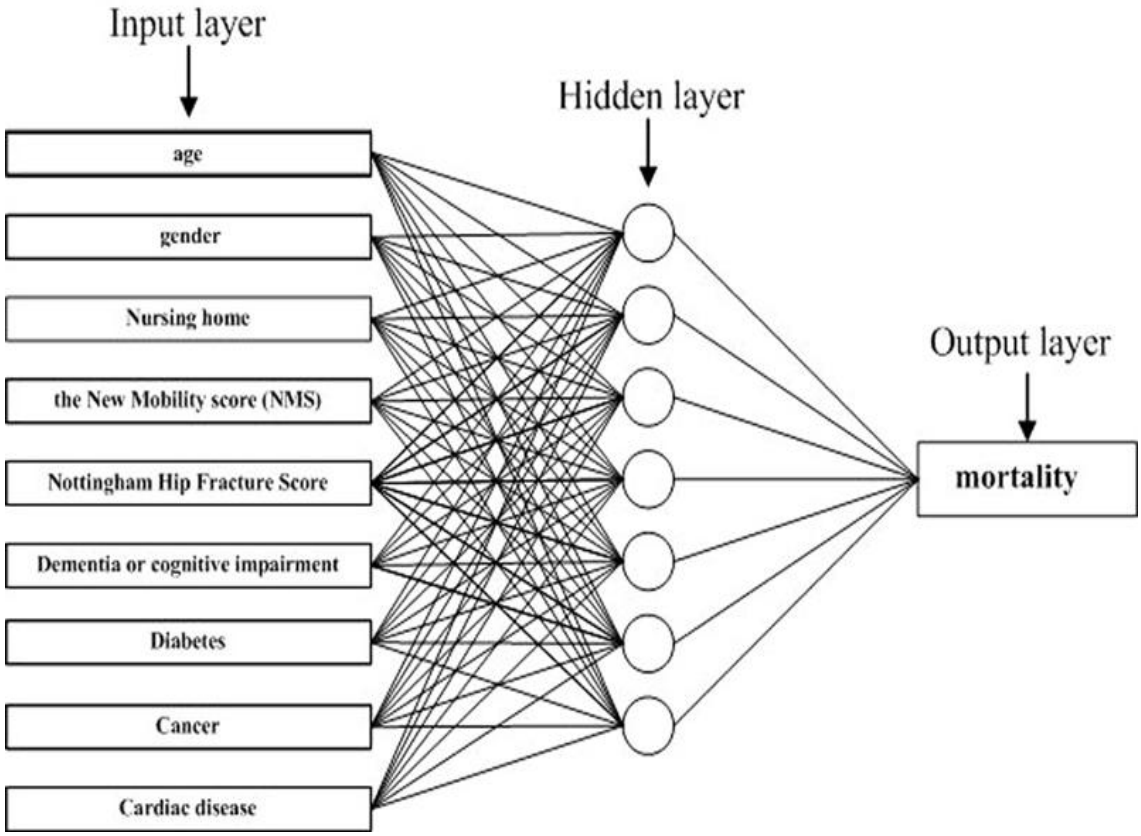

Figure 6: Diagnosis of Cancer and Diabetics using MPL

GMDH Polynomial Neural Network was connected in an awesome assortment of territories for information mining and learning disclosure, determining, frameworks demonstrating, improvement, and example acknowledgment. Results analysis shows that Learning time can be decreased by changing GMDH PNN up to 72% while 88.02% enhance precision with first GMDH PNN [27]. In figure 8 [28] is shown the Neural Network with Multi layer perceptron which technique has been applied.

Malaria is affected by environmental and weather factors [29], like rainfall and temperature, these factors actually increased the ratio of Anopheles mosquito which the main cause of malaria, because of these factors it found abundant in those where more rainfall occur due which malaria risk increased. To solve the particular issue it was necessary to predict the weather factors, through which at initial stage malaria risk can be predicted. This problem is solving by Evolving Neural Network (ENN) and Genetic Algorithm (GA) [30].

Neural Network is also working effectively for prediction system of malaria which actually based on different factors of weather. In 2008, network gave the best result with 21.3%MAPE with an accuracy of 75% as well 84.21%F-value. While in 2009 prediction of malaria had given the result of 15.29%MAPE, accuracy of 75% while 40% F-value. It was observed by findings that there is a correspondence between malaria incidence and weather. ANN performance also improved by ENN up to 14.84% in MAPE with an accuracy of 25% while 40% in F-value [31].

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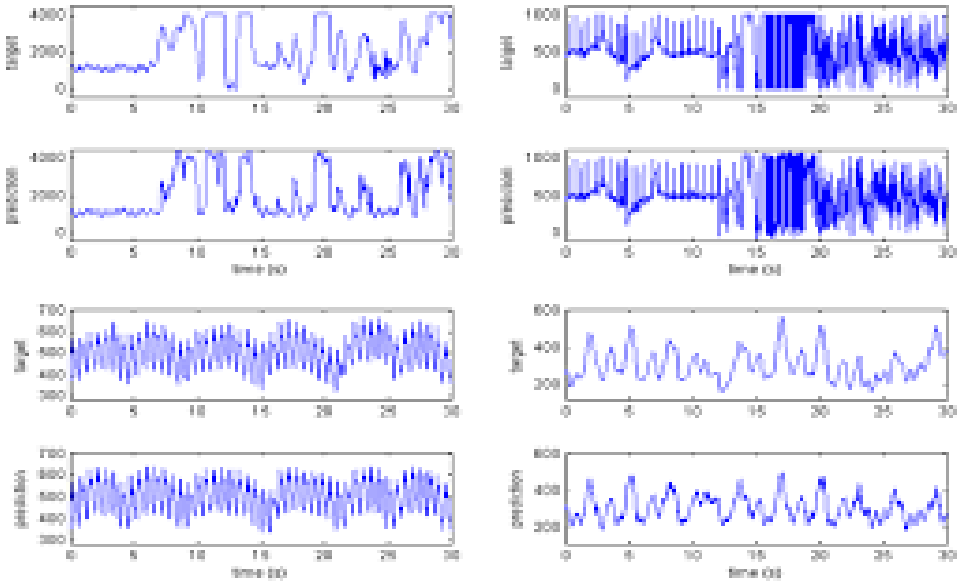

Figure 7: Recognition of cardiac arrest disease

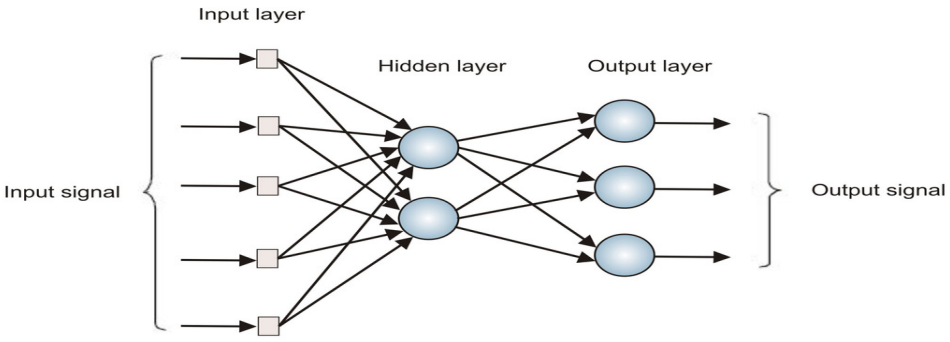

Figure 8: Neural Network with Multi layer perceptron

Application of MPL network is used to classify malarial parasite into three different species which are Plasmodium falciparum, Plasmodium vivax, and plasmodium malaria by observing six features of these including RBC size, parasite's shape, and the number of chromatin, the number of parasite per RBC, RBC's texture and chromatin location of the parasite. MPL network is used with three different algorithms named back propagation, Levenberg-Marquardt, and Bayesian Rule algorithms although back propagation has given 89.80% accuracy than rest of other two[32].

3.0 CONCLUSION

An ANNs are broadly increasing and enabled in the field of medical science, as well as medical products and its applications are involved from past history. While enhancement of modern software based on the growth of new technologies the applications qualify comparatively friendly using with ANNs, their design, optimization and friendly use in real-life states which is essential to comprehend techniques that stay after them. On the other hand, mathematical law joined through programming's languages which let this era to achieve and implement the predictions of diseases in medical science as approximately by two decades ago was considered

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as a difficult to implement since many researchers are working on these hot issues to design new methods to improve and implement in the field of medical science by proposed and present excremental results and proposed new methods. The prediction of reaction to an exact treatment in specific patient's enables the supervision of ANNs has been reported and certified briefly in the literature. Negligible practice exists in predicting main annoying effects of new drugs after the commercialization. It is perceived through literature that there is need a close collaboration among regulatory agencies Scientific's group and bio mathematician's specialist's in the enabling of the current era artificial adaptive system have to be strongly suggested.

REFERENCE

[1] Wu, Tony Hao, Enid Wai-Yung Kwong, and Grantham Kwok-Hung Pang. "Bio-medical Application on Predicting Systolic Blood Pressure Using Neural Networks." In Big Data Computing Service and Applications (BigDataService), 2015 IEEE First International Conference on, pp. 456-461. IEEE, 2015.

[2] Amato, Filippo, José Luis González-Hernández, and Josef Havel. "Artificial neural networks combined with experimental design: a "soft" approach for chemical kinetics." Talanta 93 (2012): 72-78.

[3] Molga, E. J., B. A. A. Van Woezik, and K. R. Westerterp. "Neural networks for modelling of chemical reaction systems with complex kinetics: oxidation of 2-octanol with nitric acid." Chemical Engineering and Processing: Process Intensification 39, no. 4 (2000): 323-334.

[4] Li, Yongqiang, Andrew M. Rauth, and Xiao Yu Wu. "Prediction of kinetics of doxorubicin release from sulfopropyl dextran ion-exchange microspheres using artificial neural networks." European journal of pharmaceutical sciences 24, no. 5 (2005): 401-410.

[5] Rodríguez Galdón, Beatriz, Eladia Peña-Méndez, Josef Havel, Elena María Rodríguez Rodríguez, and Carlos Díaz Romero. "Cluster analysis and artificial neural networks multivariate classification of onion varieties."Journal of agricultural and food chemistry 58, no. 21 (2010): 11435-11440.

[6] Fedor, Peter, I. Malenovsky@ 4, J. Vanhara, W. Sierka, and Josef Havel. "Thrips (Thysanoptera) identification using artificial neural networks." Bulletin of Entomological Research 98, no. 5 (2008): 437.

[7] Michalková, Veronika, Andrea Valigurová, Maria Luisa Dindo, and Jaromír Vaňhara. "Larval morphology and anatomy of the parasitoid Exorista larvarum (Diptera: Tachinidae), with an emphasis on cephalopharyngeal skeleton and digestive tract." Journal of Parasitology 95, no. 3 (2009): 544-554.

[8] Muráriková, Natália, Jaromír Vaňhara, Andrea Tóthová, and Josef Havel. "Polyphasic approach applying artificial neural networks, molecular analysis and postabdomen morphology to West Palaearctic Tachina spp.(Diptera, Tachinidae)." Bulletin of entomological research 101, no. 02 (2011): 165-175.

[9] Catalogna, Merav, Eyal Cohen, Sigal Fishman, Zamir Halpern, Uri Nevo, and Eshel Ben-Jacob. "Artificial neural networks based controller for glucose monitoring during clamp test." PloS one 7, no. 8 (2012): e44587.

[10] de Canete, J. Fernandez, S. Gonzalez-Perez, and J. C. Ramos-Diaz. "Artificial neural networks for closed loop control of in silico and ad hoc type 1 diabetes." Computer methods and programs in biomedicine 106, no. 1 (2012): 55-66.

[11] Er, Orhan, Feyzullah Temurtas, and A. Çetin Tanrıkulu. "Tuberculosis disease diagnosis using artificial neural networks." Journal of medical systems 34, no. 3 (2010): 299-302.

[12] Elveren, Erhan, and Nejat Yumuşak. "Tuberculosis disease diagnosis using artificial neural network trained with genetic algorithm." Journal of medical systems 35, no. 3 (2011): 329-332.

[13] Dey, Pranab, Amit Lamba, Savita Kumari, and Neelam Marwaha. "Application of an artificial neural network in the prognosis of chronic myeloid leukemia." Analytical and quantitative cytology and histology/the International Academy of Cytology [and] American Society of Cytology 33, no. 6 (2011): 335-339.

[14] Barwad, Adarsh, Pranab Dey, and Shaily Susheilia. "Artificial neural network in diagnosis of metastatic carcinoma in effusion cytology." Cytometry Part B: Clinical Cytometry 82, no. 2 (2012): 107-111.

[15] Barbosa, Daniel C., Dalila B. Roupar, J. Ramos, A. Tavares, and C. Lima. "Automatic small bowel tumor diagnosis by using multi-scale wavelet-based analysis in wireless capsule endoscopy images." Biomed Eng Online 11, no. 3 (2012).

[16] Saghiri, M. A., K. Asgar, K. K. Boukani, M. Lotfi, H. Aghili, A. Delvarani, K. Karamifar, A. M. Saghiri, P. Mehrvarzfar, and F. Garcia-Godoy. "A new approach for locating the minor apical foramen using an artificial neural network." International endodontic journal 45, no. 3 (2012): 257-265.

[17] Available at: http://www.scielo.br/img/revistas/bjmbr/v46n11//1414-431X-bjmbr-46-11-993-gf002.jpg

[18] Jayavanth, Sanjay, and Megha Singh. "Artificial neural network analysis of malaria severity through aggregation and deformability parameters of erythrocytes." Clinical hemorheology and microcirculation 29, no. 3, 4 (2003): 457-468.

[19] Available at: http://file.scirp.org/Html/5-9601148/bc89ee0a-8ae4-4f10-aa6c-1129f9e07deb.jpg

[20] Patel, Ankeeta R., and Mandar M. Joshi. "Heart diseases diagnosis using neural network." In Computing, Communications and Networking Technologies (ICCCNT), 2013 Fourth International Conference on, pp. 1-5. IEEE, 2013.

[21] Available at: http://www.scielo.br/img/revistas/bjmbr/v46n11//1414-431X-bjmbr-46-11-993-gf002.jpg

[22] Rao, B. Srinivasa, K. Nageswara Rao, and S. P. Setty. "An approach for heart disease detection by enhancing training phase of neural network using hybrid algorithm."

In Advance Computing Conference (IACC), 2014 IEEE International, pp. 1211-1220. IEEE, 2014.

[23] Filimon, Delia-Maria, and Adriana Albu. "Skin diseases diagnosis using artificial neural networks." In 2014 IEEE 9th IEEE International Symposium on Applied Computational Intelligence and Informatics (SACI). 2014.

[24] Maltas, Ahmet, Ali Alkan, and Mustafa Karabulut. "Use of artificial neural network algorithm in the immunohistochemical dyeing based diagnosis of thyroid tumor." In Signal Processing and Communications Applications Conference (SIU), 2014 22nd, pp. 1106-1109. IEEE, 2014.

[25] Marciniak, Pawel, Rafal Kotas, Marek Kaminski, and Zygmunt Ciota. "Implementation of artificial intelligence methods on example of cardiovascular diseases risk stratification." In Mixed Design of Integrated Circuits & Systems (MIXDES), 2014 Proceedings of the 21st International Conference, pp. 503-507. IEEE, 2014.

[26] Available at: http://web.utk.edu/~xzhao9/research.htm

[27] Arifianto, Anditya, Ari Moesriami Barmawi, and Agung Toto Wibowo. "Malaria Incidence Forecasting from Incidence Record and Weather Pattern Using Polynomial Neural Network." International Journal of Future Computer and Communication 3, no. 1 (2014): 60.

[28] Available at: http://www.mdpi.com/sensors/sensors-13-15613/article_deploy/html/images/sensors-13-15613f7-1024.png

[29] Hussain, Abir Jaafar, Dhiya Al-Jumeily, and Haya Al-Askar. "The application of dynamic self-organised multilayer network inspired by the Immune Algorithm for weather signals forecast." In Technological Advances in Electrical, Electronics and Computer Engineering (TAEECE), 2015 Third International Conference on, pp. 94-100. IEEE, 2015.

[30] Network, Smears Using Multilayer Perceptron. "Classification Of Malaria Parasite Species Based On Thin Blood." (2008).

[31] Rismala, Rita, The Houw Liong, and Arie Ardiyanti. "Prediction of malaria incidence in Banggai regency using evolving neural network." In Technology, Informatics, Management, Engineering, and Environment (TIME-E), 2013 International Conference on, pp. 89-94. IEEE, 2013.

[32] Lafferty, Kevin D. "The ecology of climate change and infectious diseases."Ecology 90, no. 4 (2009): 888-900.