World Journal of Research and Review (WJRR)
ISSN:2455-3956, Volume-6, Issue-5, May 2018 Pages 01-03

Modelling and Diagnosis of Cervical Cancer Using Adaptive Neuro Fuzzy Inference System

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Abstract— **Artificial intelligence and expert systems have gone a long away in proffering solutions to decision making problem in various sectors. One of the major challenges faced today in under developed country is access to quality and fast health facilities, which poses a big threat to the health a condition of patients. Accurate medical diagnosis is one of the major ways to sustain good health and live long. In this paper, a neuro-expert system was developed using advanced neuro-fuzzy inference system, taking into consideration the combination of eight attributes or factors and one output for the prediction and diagnosis of cervical cancer. Cervical cancer dataset obtained from cancer medical experts, was used to build the system. An evaluation performance was so as to carried out to determine the level of predictive and explanatory power of the developed system. The resulting test carried on the systems shows a very good predictive model with an accuracy of 93.54%.**

Index Terms— **Cervical Cancer, Confusion Matrix, Diagnosis, Neuro Fuzzy, Performance Evaluation.**

I. INTRODUCTION

Cervical cancer is a cancer that is known to be the second most deadly cancer affecting women worldwide which emerges from the cervix of a woman. It is because of the unusual development of cells that can attack or spread to different parts of the body. Cancer cervix is malignancy of the passage of the uterus. Cervical cancer happens normally in ladies beyond 30 years of age [1]. This cancer is the second form of cancer after breast cancer influencing ladies worldwide yet it is preventable and treatable if detected early. This cancer begins with pre-malignant changes and grows gradually, results shows that up to 90% of cervical growths might be forestalled if cell changes are distinguished and treated early [2].

This cancer very well has a connection with human papillomavirus (HPV) infection, and is a preventable human cancer due to its moderate progression, cytological identifiable forerunners, and treatments if recognized early. Early finding of cervical malignancy cells plays an imperative part in the curing process. A common symptoms associated cervical cancer is severe bleeding from the vagina, yet now and again there might be no seen manifestations until the growth has advanced to a high stage. [3]

As indicated by research, one lady passes on every four hundred and twenty seconds of cervical cancer and by the year 2025. However in most times, cervical cancer takes numerous years to grow from normal stage to high or advanced stage. Hence, the mortality identified with this cancer can be altogether lessened through early recognition and appropriate treatment [4] .There are wide varieties of screening techniques for cervical cancer. Pap smear test is a notable screening technique yet because of rare number of talented and experienced cytologists the screening strategies gets to be tedious and highly inclined to human mistakes that could lead to mistakes in results or loss in results. These days, diagnostic systems in light of artificial intelligence could be a promising system to create a more precise and quicker diagnosis result for cancer patients.

Cervical cancer diagnosis and treatment regularly can decrease the rate at which people die from the disease. In view of that reason, a diagnosis system turns out to be important. One of the issues that described the conventional strategy for medical analysis or diagnosis is error and imprecision which has cause numerous lives. The development of Computer has prompted the improvement of many algorithms and models to guarantee exactness and accuracy and this has significantly diminished the number of patients that die day by day in the clinics and hospitals and one of such model is Adaptive Neuro-Fuzzy Inference System (ANFIS).[5]

Adaptive Neuro-Fuzzy Inference System (ANFIS), a kind of artificial intelligence which incorporates both neural network systems and fuzzy logic standards and principles.ANFIS uses either back propagation or hybrid algorithm to adjust the membership functions of a Sugeno-type fuzzy inference system (FIS).The hybrid optimization method is a combination of both the back propagation and leas-square gradient descent scale which trains the membership function of the fuzzy system to emulate the training data set. The pros of the fuzzy inference system is that it can bring justice to semantic expressions and the benefit of a neural system is that it can be trained to learn thus can self-learn and self-move forward. A wise man named Jang took both focal points, joining the two techniques, and proposed the Adaptive Neuro-Fuzzy Inference System (ANFIS).

Therefore, this research describes a methodology for the diagnosis of cervical cancer by utilizing the Adaptive Neuro-Fuzzy Inference System (ANFIS) which is an intelligent system which joins the fuzzy logic methodology and neural network capacities to create or improve better performance.

II. LITERATURE REVIEW

Cervical cancer is a cancer which affects a woman's vagina and it emerges from the cervix of a woman. It is caused by the irregular development of cells that can attack or spread to different parts of the body. Cervical cancer begins in the cells coating of the cervix in the lower part of the uterus. The

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cervix joins the body of the uterus to the vagina. The part of the cervix closest to the body of the uterus is known as the endocervix. The part by the vagina is the exocervix. The two essential sorts of cells covering the cervix are squamous cells and glandular cells. These two sorts meet at a spot called the change zone. The zone of the change zone changes as you get more seasoned and if you conceive an offspring. Most cervical cancers start in the cells of the transformation zone. These cells don't all of a sudden change into cancer. Rather, the typical cells of the cervix first progressively create pre-harmful changes that transform into cancer. Medical Specialists or practitioners utilize a few terms to describe these precancerous changes, including cervical intraepithelial neoplasia (CIN), squamous intraepithelial sore (SIL), and dysplasia. These progressions can be identified and treated to keep cancer from developing. [6]

Mutgi, Murthy, & V, (2015) [7] an automated system was created for analysis of cervical cancer utilizing image processing procedures and neural systems. MATLAB an image processing tool was utilized to extract features from cytology images that are utilized for separating different phases of cervical cancer. The features extracted served as data used to train the neural network. The result was to classify the images as non-cancerous, low- grade and high-grade cancer cells.

Odeh (2011) [8] developed a diagnosis system, for diagnosis of skin cancer. Hybrid gradient descent optimization method was used to train the ANFIS algorithm. The diagnosis system comprised of three different types of skin lesions. The performance evaluation of the ANFIS model was based accuracy of the classification and the performance of the training. The outcomes affirmed that the proposed ANFIS model has potential in classifying the skin cancer diagnosis.

Hernandez et al. [9] developed an expert system with image interpretation and fuzzy. The data given by specialists for decision in diagnosis is modeled by the expert system. In a second stage, at that point, the system plays out an examination by fragmenting the prepared images to demonstrate the interest parameters in the image recommended by the system for its conclusion. In the initial two stages, the system is incorporated by a graphic interface and fuzzy where image is transferred. At long last, a finding is proposed for antecedent wounds of CN. In cases managing doctor's ability, an expert system that can analyze good or bad cases does not cause for any enthusiasm; consequently, the commitment of this work concentrates on the atypical, where the data is insufficient to diagnose.

Al-daoud(2016) [10], a model to analyze the malignancy infections by utilizing fuzzy rules with moderately little number of linguistic labels was developed. The model is actualized and contrasted with ANFIS. The both models are connected on "Wisconsin Breast Cancer" data set. Three rules are expected to acquire the grouping rate 97% by utilizing the changed model. In actuality, more standards are expected to get the same exactness by utilizing ANFIS. In addition, the outcomes demonstrate that the new model is more precise than the former. The proposed Neuro-fuzzy inference system can be re-connected to numerous applications, for example, data estimate, human conduct representation, and many more.

III. PROPOSED SYSTEM

A. Technique Procedure

The technique to be employed to achieve the stated objectives of this project is stated below:

B. Dataset collection

The set of data collected is within one health center which is Leah Foundation. A total of 250 patient's data was collected. The data contains eight input risk factors of cervical cancer used to develop the cervical cancer diagnosis system which is capable of predicting the possibility of a patient having cervical cancer using the given factors.

C. Grouping of Data Set

The whole data was divided into 75% that is 188 data samples for training and 30% that is a total of 62 data samples for testing. 25% of the data were also used for checking. The checking or validation set is used to check how generalized the trained set can be while the testing set is to evaluate how efficient the ANFIS can be in predicting cervical cancer.

D. Input variable

The input variables are the risk elements or factors which put a lady at a higher risk of getting cervical cancer. The inputs are:

I. Risk of human papilloma virus (HPV)
II. Multiple sex partner
III. Young age at first sexual act
IV. Husbands extra marital affair (if married)
V. Low socio economic status
VI. Parity(minimum of four pregnancies)
VII. Oral contraceptive pill
VIII. Genetic history

Table 1: Data Variable Transformation

S/NO	INPUT VARIABLE	VALUES	
1	Risk of HPV	Yes = 1	No = 0
2	Multiple sex partner	Yes = 1	No = 0
3	Young age at first sexual act	Yes = 1	No = 0
4	Husbands extra marital affair (if married)	Yes = 1	No = 0
5	Low socio economic status	Yes = 1	No = 0
6	Parity(minimum of four pregnancies)	Yes =1	No = 0
7	Oral contraceptive pills	Yes = 1	No = 0
8	Genetic Factor	Yes = 1	No = 0

Table 1 summarizes the data variable transformation. It shows input set and the range of their possible values called membership function.

IV. System Implementation and Results

A hybrid learning process which is the bringing together of least square gradient descent optimization methods and back propagation is used by ANFIS to adjust the parameters of a sugeno-type fuzzy inference system, so as to emulate the model. The model was tested using a testing data set to validate the performance of the model and to also see how the model performs without the data being used to train it. The model can also be validated using checking data set to test for over fitting of the training data.

The 75% of the data was supplied to the ANFIS so as to create a learning process for the neuro-fuzzy system as it will help the system to keep a good experimental knowledge of brain while the remaining 25% was kept so as to validate system which can be recommend to the use for the diagnosis of cervical cancer. The dataset was loaded into the ANFIS model.

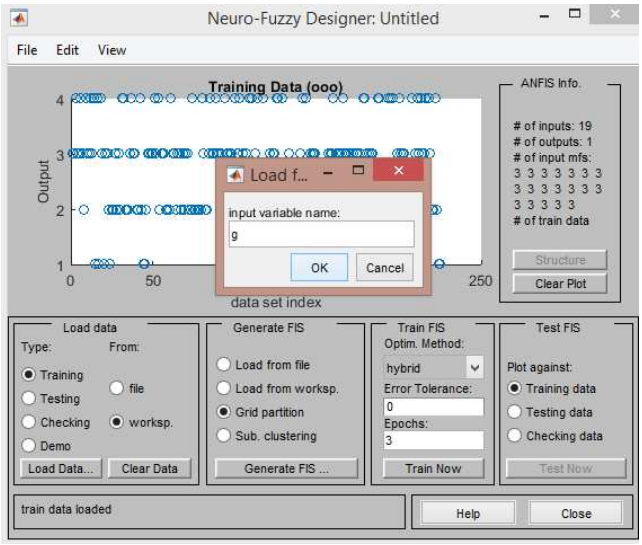

Figure 1: Dataset Loading into ANFIS

Test dataset validation.

Validating the model developed is very essential to accredit how well the model has been able to adapt to learning. The results compared the target which is the expected output to the predicted output of the model. A total number of 62 dataset was used to test and the model was able to classify correctly 58 and classified 4 incorrectly.

The result below shows a true positive rate of 0.935484 and false negative rate of 0.64516 with 93.54% of data classified correctly and 6.451 % of data classified incorrectly by the ANFIS model.

Table 1: Tabular representation of results generated by the ANFIS

TP	FN
58	4
93.5484%	6.4516%

V. CONCLUSION

With the results obtained advanced Neuro Fuzzy inference system can be as well adopted for the diagnosis and staging of cervical cancer as this will in turn helps to reduce mortality rate in cases where limited medical doctors are available, as it provides very rapid method of diagnosis with much accuracy and reduces the hours patients spend in hospitals. This expert system is user-friendly and carries out diagnosis based on patients' complain (symptoms) to medical expert.

REFERENCES

[1] Nordqvist C. (2015,August 25)."Cervical Cancer: Causes, Symptoms and Treatments."*Medical News Today*. Retrieved from http://www.medicalnewstoday.com/articles/15982.php

[2] Sarbortova, H. (2013). Final Project Report Detection of Cervical Cancer in Pap Smear Images, 1–13.

[3] Quteishat, A., Al-batah, M., Al-mofleh, A., & Alnabelsi, S. H. (2013). cervical cancer diagnostic system using adaptive fuzzy moving k-means algorithm and fuzzy min-max neural network, *57*(1).

[4] Al-batah, M. S., Ashidi, N., Isa, M., Klaib, M. F., & Al-betar, M. A. (2014). Multiple Adaptive Neuro-Fuzzy Inference System with Automatic Features Extraction Algorithm for Cervical Cancer Recognition, *2014*.

[5] Awotunde, J. B., Matiluko, O. E., & Fatai, O. W. (2014). Medical Diagnosis System Using Fuzzy Logic, *7*(2), 0–7.

[6] Mutgi, m. A., Murthy, M. R. P., & V, M. T. (2015). neural network based automated system for the diagnosis of cervical cancer project REFERENCE NO .: 38S1497, 3–5.

[7] Odeh, S. M. (2011). Using an Adaptive Neuro-Fuzzy Inference System (AnFis) Algorithm for Automatic Diagnosis of Skin Cancer, *8*, 751–755.

[8] Hernández, K. R. D., Lasserre, A. A. A., Gómez, R. P., Guzmán, J. A. P., & Sánchez, B. E. G. (2013). Development of an Expert System as a Diagnostic Support of Cervical Cancer in Atypical Glandular Cells , Based on Fuzzy Logics and Image Interpretation, *2013*.