A Neuro-Fuzzy Approach to Noise Studies and Its Effects on Performance of Human Being

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Abstract— A neuro-fuzzy method provides interpretation of fuzzy and learning of neural systems in a single structure. Also neuro-fuzzy can solve many real time problems in that Adaptive neuro-fuzzy inference system (ANFIS) is a careful and matched method for model building and best possible results. The effects of noise on human work efficiency are done by neuro-fuzzy model. The main factors of model are level of noise, type of work, and exposure time. The ANFIS is executed on Fuzzy Logic Toolbox in MATLAB. The data given is from noise monitoring in different sites.
Key words: ANFIS, MATLAB, REL

I. INTRODUCTION

Present industrial setting is sort of completely different than past. Economic process and market driven forces has created the operating setting quite competitive. it's quite obvious that these factors once combined with environmental factors, cause poor operators/workers performance. Therefore, ergonomists has new challenges in terms of predicting staff potency still as staff health protection and well being. High background level exposure results in psychological still physiological issues. It leads to deteriorated psychological feature task potency, though the precise nature of labor performance remains unknown. To anticipate subjective undertaking effectiveness weakening, neuro-fuzzy apparatuses were utilized. It has been set up that a neuro-fuzzy registering framework helps in ID and examination of fluffy models. The most recent decade has seen significant development being developed of different neuro-fuzzy frameworks. Among them, adaptive neuro-fuzzy inference system provides a systematic and directed approach for model building and gives the best possible design parameters in minimum possible time. Input variables were amplitude, psychological feature task kind, and age of staff. Out-put variable was foretold in terms of reduction in psychological feature task potency. The cause-effect relationships of those parameters square measure advanced, uncertain, and non-linear in nature so, it's quite troublesome to properly examine it by typical strategies. Hence, a shot is created in gift study to develop a neuro-fuzzy model to predict the consequences of sound pollution on human work potency as a operate of amplitude, psychological feature task kind, and age of the staff active psychological feature style of task at (I.T.O powerhouse station, pump trade WPIL Asian nation restricted, and Shriram Piston & Rings limited) industries. Categorization of noise and its levels (high, medium, and low) was supported a survey conducted for this purpose.

II. LITERATURE SURVEY

1) Zaheeruddin, and V. K. Jain (March 2, 2004) "A Fuzzy Approach for Modeling the Effects of Noise Pollution on Human Performance" The main thrust of the present work has been to develop a fuzzy model for the prediction of human performance as a function of noise levels, type of task, and exposure time. The number of fuzzy sets for each of these variables has been chosen on the basis of their general classification used in day-to-day routine language. Further, these fuzzy sets have been represented by the triangular membership function because of its linear nature and computational efficiency. The model has been implemented on Fuzzy Logic Toolbox of MATLAB using both Mamdani and TSK inference mechanisms. The results obtained in both the cases are almost similar. From the present fuzzy model, it can be inferred that the human performance depends to a large extent on the nature of the task in addition to exposure time and noise level. Simple tasks are not affected even at very high noise level while complex tasks get significantly affected at much lower noise level. Despite our best efforts, we have not been able to find any published data in numerical form from field survey pertaining to industrial settings to validate our model results. This has necessitated us to assume a hypothesized relationship between the human work efficiency and acoustic dose based on Recommended Exposure Limit (REL) for workers engaged in industrial environment. For moderate tasks, the results of the present model are in fairly good agreement (within 10%deviation range) with those deduced from a criterion based on Recommended Exposure Limit for industrial
2) Zaheeruddin ,Garima (14 February 2005) "A neuro-fuzzy approach for prediction of human work efficiency in noisy environment"The main thrust of the present work has been to develop a neuro-fuzzy model for the prediction of work efficiency as a function of noise level, type of tasks and exposure times. It is evident from the graph that the work efficiency, for the same exposure time, depends to a large extent upon the noise level and type of task. It has also been verified that simple tasks are not affected even at very high noise level while complex tasks get significantly affected at much lower noise level. It is to be appreciated that the training done using ANFIS is computationally very efficient as the desired RMSE value is obtained in very less number of epochs. Moreover, minor changes are observed in the shape of the membership functions after training the model. This is because of close agreement between the knowledge provided by expert and input/output data pairs.
3) Hany HOSSAM ELDIEN (April 2009) "Noise Mapping In Urban Environments: Application at Suez City Center"This study constructed noise maps for

Suez City in Egypt to demonstrate the efficacy of noise mapping to investigate environmental noise. The analytical results revealed that Suez City suffers serious noise pollution. More than 80% of the Suez City population is exposed to unacceptable noise environments, indicating that Strategies for improving noise control are urgently needed. Noise maps are very powerful tools for communicating results of assessment of environmental noise to the general public and also for technicians to devise noise correction measures and to study alternative urban scenarios. Results of this study demonstrate that noise maps are an effective means of understanding noise level distributions in investigated areas. Additionally, when compared with the current regulation standards, noise maps can also be used to identify the areas seriously violated the standards. By using this evaluation method, decision makers can quickly and easily identify the area's most urgently requiring noise improvement as well as reexamine the adequacy of current regulatory standards.

4) Andrzej Czyzewski and PiotrDalka(April 2007) "Multimedia Approach for Traffic Noise Monitoring" This paper presented the idea of the advanced system for the metropolitan area environmental monitoring, including traffic noise monitoring. There are numerous advantages resulting from the system implementation which will facilitate everyday life of various emergency, safety and administration agencies, as well as citizens. The possibility of the road and railway traffic monitoring in the real time and dynamic management of the traffic inevitably leads to significant economical profits.
5) The key part of the system is the algorithm for the moving vehicle image detection, which utilizes mixtures of Gaussians. The effectiveness of the algorithm is tested and the results hitherto achieved prove that the model describing the scene background can adapt itself to changes in the scene and the algorithm is able to detect moving vehicles with a good accuracy. The outcome may be directly used by the server to visualize the traffic on numerical maps and to generate statistical rapports.

Sunita Maithani and Richa Tyagi (jan 2008), "Noise Characterization and Classifi'cation for Background Estimation" Characterization and classification of noise in the noisy speech is an important part of noisy speech processing in all related fields of application for speech technology. In this paper, problem of noise characterization and categorization of various environmental noises in the noisy speech of different SNR's (Signal to Noise Ratio) has been handled. This paper purposes a technique for estimation of noise level and classifying the noises in a noisy speech into different categories of noises for background estimation. The technique detects non-speech regions in the noisy speech for SNR estimation and noise classification purpose. Three dimensional representation of noise is obtained using technique, which discriminates visual imprints of different noises in most optimum way in the 2D plane. For classification noise, prominent features from the 2D representation of noise are selected and classified using minimum hamming distance classifier using reference standard noise.

III. PROBLEM STATEMENT

Developing a model using neuro-fuzzy approach, which helps to detect the reduction in work efficiency of the worker and employees working in high noise pollution of the different industries by taking the input factors such as level of noise, task performed by worker and the exposure timings. This is implemented using Fuzzy Logic Toolbox @ MATLAB 2013 in Image Processing.

IV. MATERIALS AND METHODS

From the survey done as mentioned above it was determined that a good majority of people working in industry are unprotected to noise with dissimilar task type. In this study, it has been used to search out the combined effects of background level, exposure time and sort of on industrial worker's performance. Also studied the noisy organization located in Sandoor and around Kolhapur (Maharashtra). The industries are considered based on distinguished sound pressure level. In this framework, calculation of the sound and task done by workers, questionnaire studies have been conducted at mining site, sugar factory and also noise counters has been drained for noisy industries.

Sr.No	Industry	Noise Level(dB(A))	Worker No
1.	MML	45-110	150
2.	SadashivraoMandlik sugar factory LTD.	63-102	88

Table 1: Industries Name & Their Category With Reference To Noise Level

interface system, defuzzification input and output sets, mental object contains information and rule base. the information is taken all from mental object Once the input provides the information to for fuzzification then it converts all real values into fuzzy sets then those ought to be passed from the interface engine and eventually through with the defuzzification methodology during which fuzzy sets area unit born-again to non fuzzy output. Then within the next main block Associate in Nursing adaptive neural network is network contains several variety of networks that connects the nodes. This network provides chiefly six layers like input, input member perform, rule base, output member perform, add of all outputs, and eventually the output. The layer provides the nodes wherever the every node has its own parameters set worth.

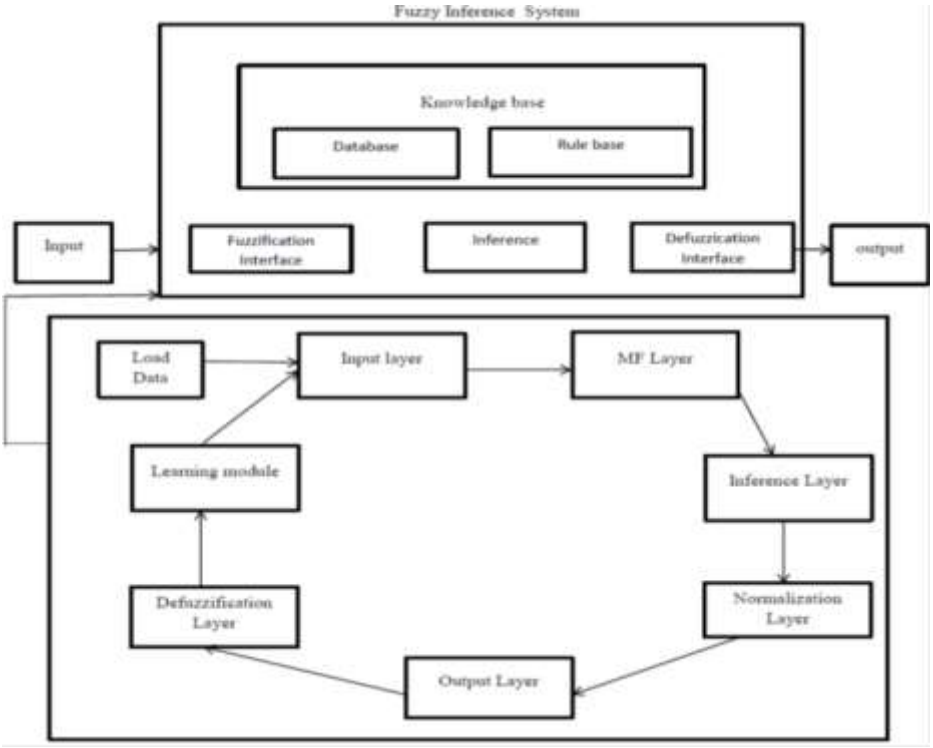

Fig. 1: Conceptual Diagram of ANFIS

V. STUDY DESIGN

A. *Step 1: system identification*

The first step in system modelling is that the identification of input and output variables referred to as the system's variables. Then fuzzy IF–THEN rules supported Takagi–Sugeno–Kang (TSK) model ar fashioned, wherever antecedents ar outlined by a group of non-linear parameters and consequents ar either linear combination of input variables and constant terms or could also be constants, usually referred to as, singletons.

B. *Step 2: Determining the Network Structure*

neuro-fuzzy system is realized using a six-layered network as shown in Fig.

1) Layer 1 (input layer)
2) Layer 2 (fuzzification layer)
3) Layer 3 (inference layer)
4) Layer 4 (normalization layer)
5) Layer 5 (output layer)
6) Layer 6 (defuzzification layer)

C. *Step 3: Learning Algorithm and Parameter Tuning*

The first step in system modelling is that the identification of input and output variables referred to as the system's variables. Then fuzzy IF–THEN rules supported Takagi–Sugeno–Kang (TSK) model ar fashioned, wherever antecedents ar outlined by a group of non-linear parameters and consequents ar either linear combination of input variables and constant terms or could also be constants, usually referred to as, singletons.

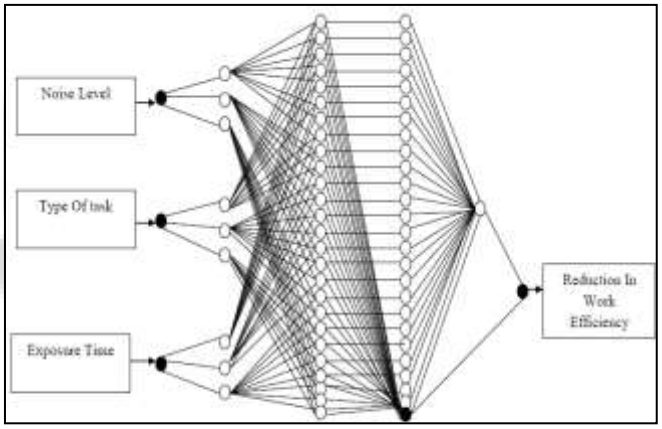

Fig. 2: Structure of ANFIS Model

VI. IMPLEMENTATION

In this paper implementation of the most model is finished by victimisation ANFIS (Fuzzy Logic Tool box) of MATLAB. The system enforced first of all victimisation Sugeno Fuzzy reasoning. Sugeno is that the system that contains 3 no. of inputs and provides single output. during this input parameters area unit amplitude, exposure time and kind of task and eventually provide the output parameter as reduction in work potency. victimisation fuzzy sets the input parameters area unit planning to be shown, to characterize these input values chosen the gbell formed membership functions. during this used 3 factorial rules i.e. total of twenty seven rules fashioned since our input variables area unit 3 so taken 3 factorial. The membership functions for input variables and for output variables area unit shown in below:

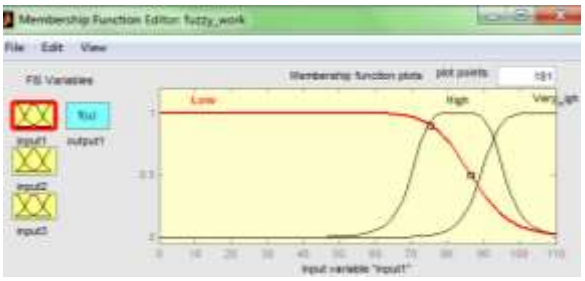

Fig. 3: Membership Functions of Noise Level

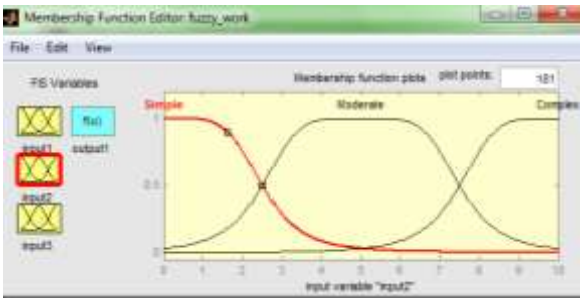

Fig. 4: Membership Functions of Type of Task

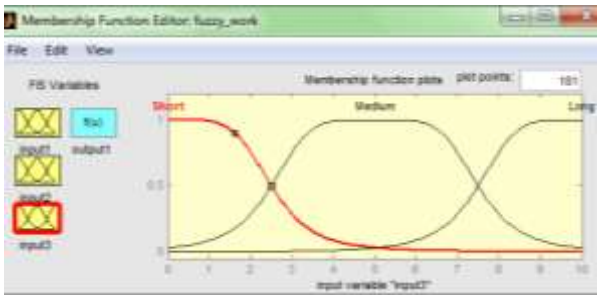

Fig. 5: Membership Functions of Exposure Time

Fig. 6: Output Parameter

VII. RESULTS

In this section the output is going to given in two case studies case 1 once the type of task is going to be kept constant and in case 2 exposure time is constant.

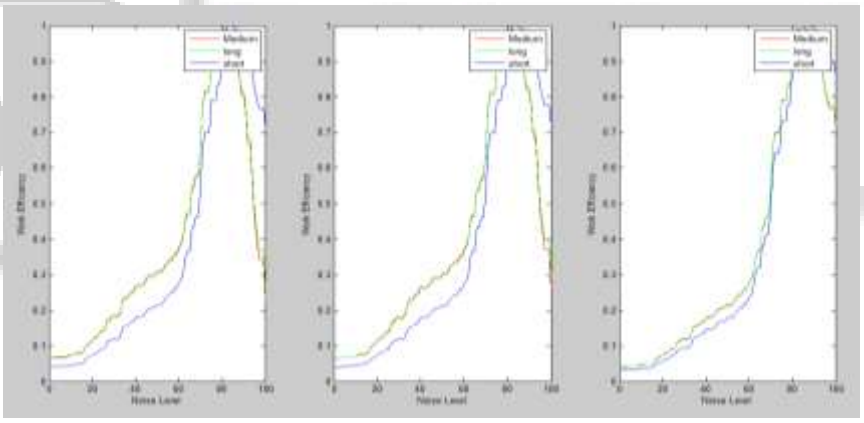

Fig. 7: Case 1

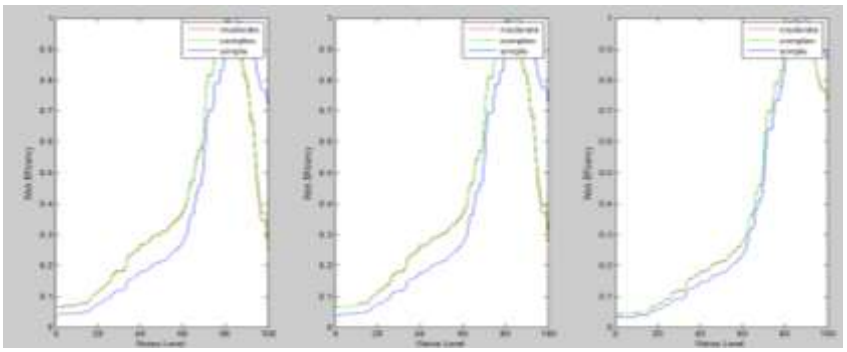

Fig. 8: Case 2

VIII. CONCLUSION

The main thrust of this work has been to develop a neuro-fuzzy model for the prediction of work potency as noise levels, type of tasks and exposure times. it's evident from the graph that the work efficiency, for an equivalent exposure time, depends to an outsized extent upon the amplitude and sort of task. It has additionally been verified that straightforward tasks are not affected even at terribly high noise whereas complex tasks get considerably affected at a lot of lower noise level. it's to be appreciated that the training done in ANFIS is computationally. Moreover, minor changes are observed within the form of the membership functions after training the model. This can be

owing to close agreement between the information provided by knowledgeable and input/output knowledge pairs.

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