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ARTIFICIAL NEURAL NETWORK USING TO MINIMIZE ACTIVE NOISE CANCELLATION BY IMPLEMENT IN MAT LAB

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Abstract— Active noise cancellation (ANC) has wide application in next generation human machine interaction to automobile and HVAC devices. We are using decision tree technique to non-functional neuron's (algorithm) from ANC network, whih ma kesonly best neurons responsible for noise cancellation. Neuro ns areclassified as different algorithm e.g. LMS, NLMS, VSSNDLMS, PROPOSED MSE,algorithm, Performance of neurons depends upon in stantaneoussurrounding conditions. So a efficient vital approach for ANC has been proposed to minimise noise cancellation by implemented in mat lab.

Keywords— *Active noise cancellation, decision tree technique ,Least mean square , Winner filter,Artificial neural network.*

I. INTRODUCTION

The Active noise cancellation (ANC) has become a effective mechanism for control of low frequency acoustic noise. The main application areas of ANC are exhaust , motor noise ,HVAC systems , mobile phone echo and vibration cancellation.The wiener filter based Least means squa red (LMS)algorithm family is most sought after solution of ANC .This family includes LMS , NLMS.VSSNDLMS,PROPOSED MSE, and many more . Then there are Kalman filter algorithm which are basically based on recursive least square algorithm .Some of these are nonlinear algorithm, which
provides better solution for non linear noisy environment. Th ecomponents of the ANC systems like microphones and loudspeaker exhibit nonlinearities themselves. The nonlinear transfer function of primary and secondary path may itself creates worse situation .If there is only one reference microphone , one loud speaker and one error microphone then the situation is termed as Single channel case in ANC. Single channel is not sufficient for complex real time application , where noise is normally of multi order nonlinear characteristics .Recently , done work suggests several methods for the development of active control of noise process for a single channel case. Multichannel approach model is close to actual conditions of field or area where noise minimise is required. Nonlinear Multichannel model with
trigonometric expansion give better results than voltra series method [4]. The PROPOSEDMSE algorithm behave good than second order VSSNDLMS algorithm in conditions as the following.

1) First, The noise signal received by a reference microphone is non-linear and predictable (chaotic) ,while the secondary path transfer function of an ANC system is non-minimum phase.
2) The primary path exhibits nonlinearity.

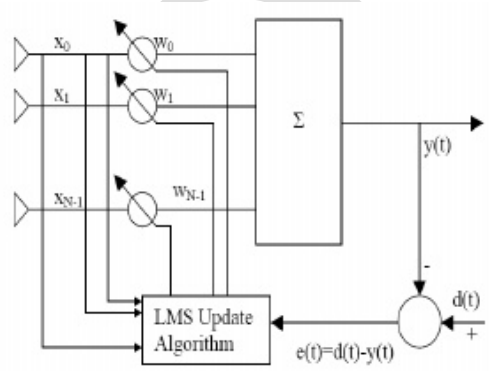

Figure 1. Multichannel ANC Model

The It was Shown that proposed MSE out performs the VSSNDLMS as well as Proposed MSE under the situations where the noise signal received by a reference microphone is nonlinear and chaotic, while the secondary path transfer function has non minimum phase[2], [3]. So, in a particular noisy environment specific algorithm may exhibit better performance than other algorithm.So if by any mean it can be decided that, which particular algorithm will suits most to the problemapp lication , may give wonderful solution to solve the problem efficiently. This is a task which is some sort of a prediction of suitable solution to problem.
The Neural Network (NN) is suitable for approximation problem. The radial basis Function (RBF NN) have beenknown to be suitable for non linear function approximation[5],[6].The topology of RBF is a two layer network with one hidden layer and one output layer with the basis function used for the hidden layer neurons being usually Gaussian. The classical approach to RBF implementation is to fix the number of hidden neurons based on some property of the input data, and estimate the weights connecting the hidden and output neurons using linear least square method. The disadvantages of this approach are that it results in too many hidden neurons. If ineffective hidden neuron can be detected and removed a slearning progresses then a more effective network to pology can be realized. This minimise process of ineffective hidden neurons is called decision tree Technique[5].So decision tree becomes imperative for identification of nonlinear systems with changing dynamics because failingto prune the network , in such case will results innumerous inactive hidden

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neurons being present as the dynamics which caused their creation becomes nonexistent.This has been our approach to combine decision tree Technique of artificial neural network (ANN) to ANC algorithms.
The experimental work has been done on matlab and Texas ‘s dsk kit TMS3206713 series. DSK 6713 isaud io video application processor , capable to perform realtime processing on signals. various program based onindividual algorithm were written first e.g.LMS,NLMS,VS SNDLMS,PROPOSEDMSE, RLS. Each of them isconsidered as a separate hidden neuron of network .The input data sequence was based on

1) real time noisy signal of air cooling duct in our office area.
2) Second order nonlinear noise signal .

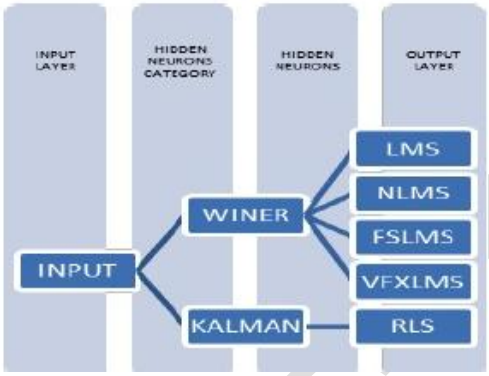

Figure 2. ANN based ANC model

In case two primary noise signals is chosen to be alogistic chaotic type
$X(n+1)=\lambda x(n)[1-x(n)]$,$\lambda=4$, $x(0)=0.001$ [2].
All the neurons were allowed to run for 500 iterations, and respective obtained results were compared with standard threshold value.
LMS algorithm weight update equation is as
$w(n+1)=w(n)-\mu e(n)v(n)$
$v(n)=x(n)*a(n)$
where a(n) is approximation of secondary path transfer function .
w(n) if filter weight , μ is step size factor[2].
The calculation of threshold depends upon number of parameter and it may vary according to surrounding situation and instantaneous noise characteristics . We had adopted threshold parameter Which was based on following equations.
For each input Xn
$Øk(Xn)=\exp(-1/\sigma 2(\ ||X\ N-\ \mu K||2))$
Where is σ variance,μ is is weight factor of particular neuron [5]. This approach is based on pruning technique of ANN. We are using this technique to prune less effective neurons from network and finally running systems with successful neuron only. In different conditions different neuron may give better results . The survival chances of neurons depends upon its algorithm efficiency in given circumstances .The step size factor μwas varied between .001 to .1,depending upon the optimization required between complexity and amount of noise cancellation.

II. RESULTS

(1) In case of air cooling duct PROPOSEDMSE algorithm was most suitable . In 500 iteration , it was far ahead of other liner and nonlinear algorithms . the value of DECISION TREE threshold was 0.5 %away from the desired values , where as in LMS algorithm it was found near 12 %.

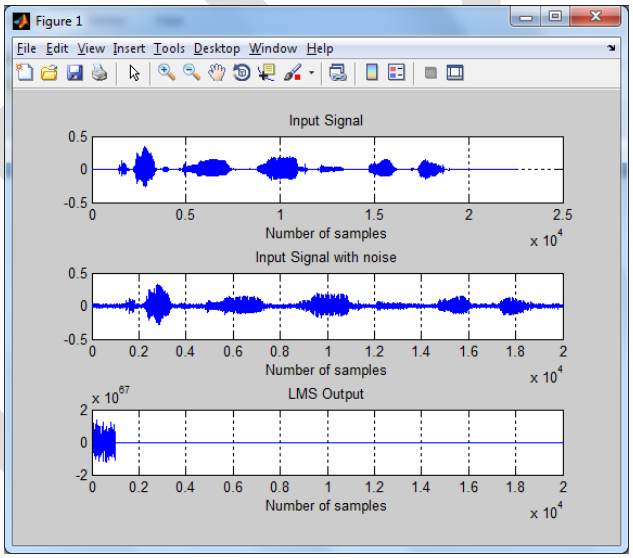

Figure 5. PROPOSE MSE algorithm output waveforms

(2). In Noisy conditions of case two PROPOSEDMSE algorithm was most efficient. Remaining all algorithm were NON LINEAR, as they were far away from standard threshold value.

III. CONCLUSION

It was found out that in particular noisy conditions most suitable algorithm can be sort out using our decision tree method. This method can also be applied to echo cancellation for frequency domain and time domain, vibration cancellation and signal estimation problems.Our future task is to apply this n ovel concept for Kalman and Winer filter’s family alg orithmsimultaneously. Whereas we are also trying to implement it for outer noise minimise in automobiles and echo cancellation in head phones , mobiles. Noise performance can be upgraded by finding pr oper step factor and threshold value. The algorithm level up- gradation of threshold and pruning criteria may improve performance.

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