Pioneer: Journal of Advanced Research and Scientific Progress (JARSP)
Volume: 02 Issue: 05 | 2023 ISSN: 2751-7551
http://innosci.org

A Comprehensive Analysis of Artificial Neural Network

Anirban Chakraborty
Department of Artificial Intelligence, Lovely Professional University, India

Abstract: This article provides a concise summary of the Artificial Neural Network (ANN) prediction method. It is utilised to maximise the predictability of the model with less dependence on experimental data. In addition to numerous ANN training parameters, MATLAB fundamentals are also documented. The preparation aims to reduce the typical error rate. The ANN model can be used effectively to forecast performance parameters that aid in selecting the optimal process preparation and machining parameters.

Keywords: Artificial Neural Network, MATLAB, ANN training

INTRODUCTION

ANN is a network of interconnected nodes, a branch of the AI's extensive neuron network. ANN is a computer model centred on the central nervous systems (particularly the brain) of animals that are capable of learning apparatus and recognising patterns. These are typically depicted as "neuron" structures that can measure input values via a network feeder. A learning method optimises an ANN for a specific application, such as pattern recognition or data clustering. Training in the biological system necessitates the modification of neural synaptic connections. A neural network can actually perform tasks that a linear output cannot.

When a neural network function fails, the concurrent aspect of the network enables it to continue uninterrupted. It is applicable to all programmes. A neural network is self-aware and does not require reprogramming. Therefore, ANN is gaining notoriety for forecasting outcomes on specific parameters. When appropriately trained, ANN can be used to separate response parameters from process parameters during machining processes. The application of ANN to these procedures must be performed with caution, and preparation must be made for effective operation. Therefore, the architecture of a NN differs from that of a microprocessor. For extensive neural networks, processing time is lengthy.

LITERATURE SURVEY

In the simulation based on the back-propagation algorithm, ***Bhattacharya and Pradhand [2]*** demonstrated the use of RSM and ANN. Throughout the micro-hole analysis on *Ti6Al–4V*, the processing characteristics of Micro-EDM were enhanced. The input parameters are utilised for the ANN prediction model. The performance requirements for optimisation are MRR, TWR, and overweight. Using a neural network back-propagation method that had been established through experimentation, they created an ANN model. Levenberg-Marquet teaching Algorithm has been utilised for a multilayer input network. Through evaluating the estimation of ANN answers for multi purpose optimal input method variables and experimentally gathered responses, they also determined that the error rate is very low and acceptable. For the micro-EDM cycle, you could use established ANN models in order to obtain the optimal micromachining yield combination of optimised procedure parameter settings.

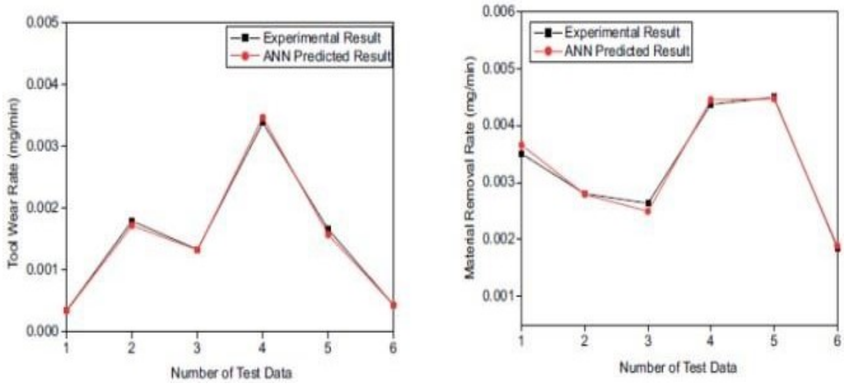

Fig. 1: 1(a) Experimental analysis of expected MRR outcomes (b) Experimental comparison of TWR and ANN projected outcomes 1(a)

Rao et al.[3] implemented the hybrid model and configured EDM surface SR using genetic algorithms (GA) and artificial neural networks (ANNs). The experiments were conducted by varying the standard current and voltage and calculating the corresponding SR values.

Using Neuro Solutions, multi-perceptron neural network models are constructed. The GA definition is utilised to maximise network variable weightings. When the network is configured using GA, the mean square loss is drastically reduced.

As a result of using the hot work steel copper anode DIN1.2344, ***Atefi et al.[5]*** studied the effect of various EDM parameters, such as beat rate, beat voltage, beat on-schedule and pulse off-time at the finishing point, on MRR. Complete factor tests were selected, and statistical analysis was performed on the MRR data collected for the study. For the completion phase of hot-worked DIN1.2344 steel, an appropriate ANN for MRR estimation was intended. Eventually, a hybrid approach, consisting of statistical analysis and the ANN algorithm was developed to address the error in the ANN.

Gao et al. [6] described the ANN / GA combination for evaluating a parameter optimisation model. In order to optimise parameters for optimisation performance, the Levenberg-Marquardt calculation was applied to the relationship between the MRR and the info parameter in the ANN model. The effectiveness of the model has been demonstrated, and the MRR machining parameters have been optimised. We discovered that the network is performing better, resulting in faster convergence. GA has been used to optimise parameters. Utilising standardised parameters has enhanced MRR.

Fig. 2 provides a summary of the regression between MRR and station estimation.

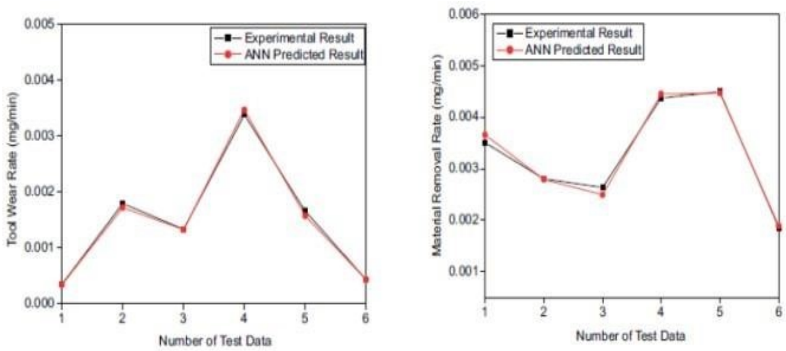

Fig. 2:(a) Analyzes of regression between MRR and b) Review of regression between MRR and forecast

Wang et al. used a hybrid Artificial Neural Network and Genetic Algorithm technique for the simulation and optimisation of the two answers, i.e. Mechanical and electrical machining MRR and SR. In addition, they utilised a two-phase hybridization technique for ANN modelling and multi-objective optimisation. In the first phase, the multilayer feed-forward neural network model for learning algorithms incorporated genetic algorithms. In the second phase, they utilised the exercise functionality for GA-based optimisation with model equations extracted from an ANN simulation. Gene-Hunter was utilised to optimise. The ANN model's optimised error for MRR and SR was **5.60** and **4.98**, respectively. These two responses indicated that they recognised the pattern.

Fig. 3. depicts an integrated configuration phase for the hybrid system.

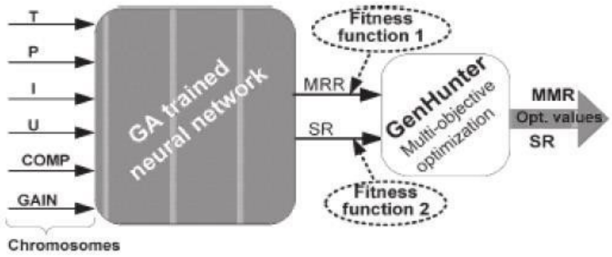

Fig. 3: Structure of hybrid system at optimized phase

Mathew et al.[7] has also published on micro-EDM modelling and optimisation development. ANN evaluated the MRR parameter optimisation model. To improve MRR prediction, a feed-in neural network has been programmed to maximise the number of neural cells and the number of hidden layers. We hypothesised that a low RMSE improved model precision. The selection of crucial production factors is of the utmost importance, as they determine output. Results indicate that the ANN model can accurately predict the machining response.

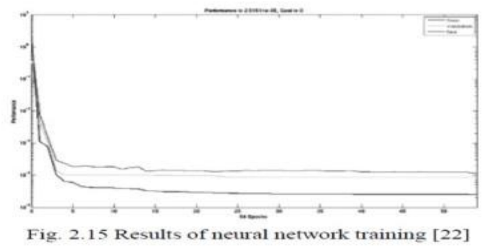

Fig. 4: Neural network simulation tests

ANN stages in MATLAB The fundamental ANN stages in MATLAB are outlined below:

A. Input-output data processing VS Data Collecting.

B. Planning and design of neural networks.

C. Input-output processing in advance.

D. Evaluation of neural network performance.

Input and output data set collection:
The output values are determined based on the various experimental modifications of input parameters received through experiments. The capacity of the ANN model to create data is dependent on a number of aspects, including an acceptable range of input-output method parameters, the appropriation of info-yield dataset, and the introduction of info-yield dataset to the neural system.

Pioneer: Journal of Advanced Research and Scientific Progress (JARSP)
Volume: 02 Issue: 05 | 2023 ISSN: 2751-7551
http://innosci.org

Input-output data set preparation:

The 'newff' feedback propagation in Levenberg-Marquardt is a network system with a background instructor, 'trainlm,' and a background weight and biassing feature, 'learngdm,' in Levenberg-Marquardt. As every feature may be approximated, a two-layer forward feed network is used, and a limited number of interruptions are provided in the hidden layer by means of neurons. To train neural networks using divider-and-date feature, samples from the testing phase were reclassified into three groups. As a result of the mean Square Error (MSE) of validation tests, the Levenberg-Marquardt retropropagation method ceases training since generalisations are no longer being reinforced. Feedback propagation like **Fixunknotes, removeconstantrows, mapminmax** as well as input processing routines were used.

The $\mathbf{i^{th}}$ layer's transition feature is **tansig / purelin** - The secret layer 'tansig 'and the display layer 'pureline '. The output processing functions utilised were **removeconstantrows** and **mapminmax**. In Training and setup of the network ,the network infrastructure is a crucial factor in predicting.

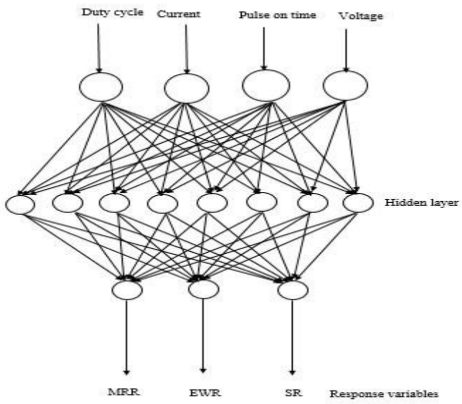

Fig. 5: Neural networking Architecture

The following approaches may be used to evaluate the performance assessment of the Optimum network design training model for neural networks. Formula for ***F2*** is given in Equation 1.

$$F2= 1 - \left[\frac{\sum_j (t_j - o_j)^2}{\sum_j (o_j)^2}\right]$$

where,

F2 = *Coefficient of determination*

Tj = *Target Value*

J = *Processing Elements*

Oj = *Output Value*

An ANN must be designed and implemented such that the data set yields a desired output (direct or relaxing). There are several methods for measuring the relationship strengths. In other words, weights using a prior knowledge may be set directly, or the net can be shaped by taking care of learning instances and enabling the net to change/alter loads according to a given rule.

The following are examples of experience-centered solutions:

Supervised Learning: When the framework is constructed by evaluating inputs and coordinating output designs. These input/output pairings are often given by an external instructional component or the network itself, which is referred to as a self-controlled solution.

Unsupervised Learning: When the net (output) device is educated in the input system to recognise clusters of patterns. In this model, the framework will examine statistically significant characteristics of the sample population. The framework should develop its own interpretation of the input stimuli relevant to the controlled research procedures, rather than grouping the patterns into a single category.

In the method of reinforcement learning, the virtual system incorporates environmental intervention and gives input. Based on the environment's response, the learning variable evaluates its behaviour as either positive or negative and revises its criteria. In general, the adjustment cycle is continued until surfaces reach a condition of equilibrium where no more adjustments are necessary.

An ANN is a system of fundamental processing elements (neurons) whose complicated global behaviours are specified by the relationships between the processing elements' parameters and the items. Neural networking provides several benefits, such as the ability to find dynamic, nonlinear relationships between interacting and independent factors, the ability to identify any possible correlations between predictor variables, and the availability of alternative training techniques. In the fields of estimate, data mining, mission planning, and automatic capital allocation, ANN-based systems give excellent results / insights into very complicated situations.

CONCLUSION

Artificial Neural Networks are vital in the current world. Consequently, scientists are designing algorithms that are less complex in order to facilitate future technological advancement. Intelligence Artificiale is the future of technology. Numerous models of Neural Networks are shown at exhibits to offer an approximation of the technological progress of future generations.

REFERENCES

1. Vishnu D. Asal and R. I. Patel, “A review on prediction of EDM parameter using artificial neural network”, International Journal of Scientific Research, Vol.2(3), 2013
2. B.B Pradhan and B Bhattacharyya, “Modelling of micro-electrodischarge machining during machining of titanium alloy Ti–6Al–4V using response surface methodology and artificial neural network algorithm”, Journal of Engineering Manufacture, Vol.223, pp.683-693, 2009
3. G. Krishna Mohana Rao and G. Rangajanardhaa, “Development of hybrid model and optimization of surface roughness in electric discharge machining using artificial neural networks and genetic algorithm”, Journal of materials processing technology, Vol.209, pp.1512–1520, 2009
4. RR Nadikattu, 2016 THE EMERGING ROLE OF ARTIFICIAL INTELLIGENCE IN MODERN
5. SOCIETY. International Journal of Creative Research Thoughts. 4, 4 ,906-911.
6. Reza Atefi, Ali Razmavar, Farhad Teimoori and Farshad Teimoori, “The influence of EDM parameters in finishing stage on MRR of hot worked steel using ANN”, Journal of Basic and Applied Scientific Research,
7. Vol.2(3), pp.2307-2311, 2011
8. Sikender Mohsienuddin Mohammad, "CONTINUOUS INTEGRATION AND AUTOMATION",

9. International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882, Volume.4, Issue 3, pp.938-945, July 2016, Available at :http://www.ijcrt.org/papers/IJCRT1133440.pdf

10. Qing Gao and Qin-he Zhang, Shu-peng Su, Jian-hua Zhang, “Parameter optimization model in electrical discharge machining process”, Journal of Zhejiang University SCIENCE, Vol.9 (1), pp.104-108, 2008 [8] Kesheng Wang, Hirpa L. Gelgele, Yi Wang, Qingfeng Yuan and Minglung Fang, “A hybrid intelligent method for modelling the EDM process”, International Journal of Machine Tools & Manufacture, Vol. 43, pp.995–999, 2003

11. Rahul Reddy Nadikattu, 2014. Content analysis of American & Indian Comics on Instagram using Machine learning", International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882, Volume.2, Issue 3, pp.86-103.

12. K. P. Somashekhar, N. Ramachandran, and Jose Mathew, “Optimization of material removal rate in Micro-EDM using artificial neural network and genetic algorithms”, Materials and Manufacturing Processes, Vol.25, pp.467-475, 2010

13. Sikender Mohsienuddin Mohammad, "IMPROVE SOFTWARE QUALITY THROUGH PRACTICING

14. DEVOPS AUTOMATION", International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882,

15. Volume.6, Issue 1, pp.251-256, March 2018, Available at :http://www.ijcrt.org/papers/IJCRT1133482.pdf [12] Atul R. Saraf and M. Sadaiah, “Application of artificial intelligence for the prediction of undercut”, International Journal of Mechatronics and Mechatronics Systems, Vol.6 (2), pp.183-194, 2013

Mr. Anirban Chakraborty