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Predictive Maintenance Failure Analysis of Hacksaw Blade Using ML Algorithm

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Abstract: *The In this Research Article we are going to study Predictive Maintenance Failure Analysis of Hacksaw Blade Using ML Algorithm, with the help of previous paper related to algorithm such as ANN, CNN, SVM, KNN, PCA, etc. Different Parameters are studied related Hacksaw operation and Collected Data of same for analyze collected data we are going to used ANN algorithms with the help of ANN algorithm we will find the fault in Hacksaw operation. By using this we will obtain efficiency of hacksaw operation.*

Keywords: ANN, SVM, CNN, PCA, KNN, HACKSAW BLADE, etc.

I. INTRODUCTION

Nowadays there is an era of Data Science, so there is a need to implement algorithm to solve ANN Problems related to industry. In Mechanical field required more attention on ANN to increase the efficiency of operations and reduced the probability of failure.

The first ANN was invented in 1958, it was invented by Psychologist Frank Rosenblatt. ANN consist three layers, i.e., input layer, Output layer, hidden layer.

Artificial neural network consists of number of neurons connected with strings called synaptic weights. A neuron is fundamental operation unit of neural network which processes the information. Neuron is a junction at which all the inputs get linearly summed. In ANN neurons are arranged in groups called layers as in traditional linear models only single layer of neuron exist.

An artificial neural network belongs to artificial intelligence (AI) data modelling tool that can store and represent complex input/output relationship. The main advantages of neural network are ability to represent both linear and non-linear relationship and their ability to learn this relationship, ANNs can be used for many tasks such as pattern recognition, function approximation, optimization, forecasting, data retrieval, and automatic control.

Artificial neural network is tool of artificial intelligence which is recently most popular research area in the field construction field as it doesn't require the traditional programming based on the mathematical formula etc.

Input Layer: Also known as Input Nodes, this layer contains the inputs/information from the outside world that the model uses to learn and draw conclusions. Input nodes send data to the following layer, the Hidden layer.

Hidden Layer: A hidden layer is a group of neurons that do all computations on the input data There can be any number of hidden layers in a neural network. The most basic network has a single hidden layer.

Output layer: The output layer contains the model's output/conclusions produced from all calculations. The output layer could have one or more nodes.

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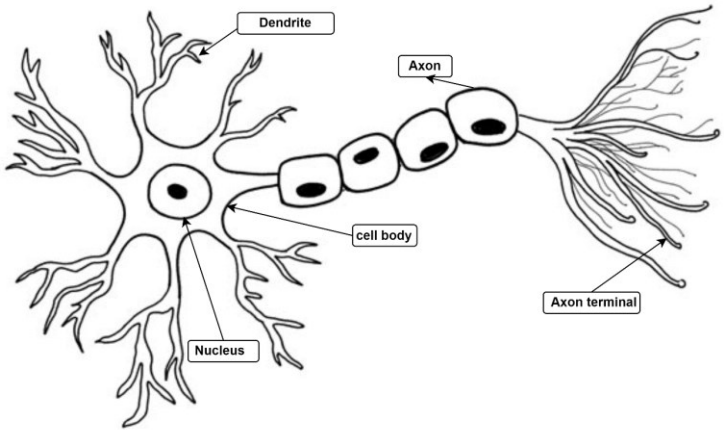

Figure: Neuron

II. PROBLEM STATEMENT

During the process of cutting operation by the use of hacksaw blade in industry, we cut the different type of metals/materials such as steel, mild steel, aluminum etc. but due to the uneven stress and wrong angle of hacksaw blade and workpiece failure is occurred.

We can overcome this failure by doing some changes in operations, we can change the angle of blade and workpiece, blade insertion, etc. parameters.

In this project we find out the failure of hacksaw blade and analyze using ML algorithm to reduce the failure of hacksaw blade.

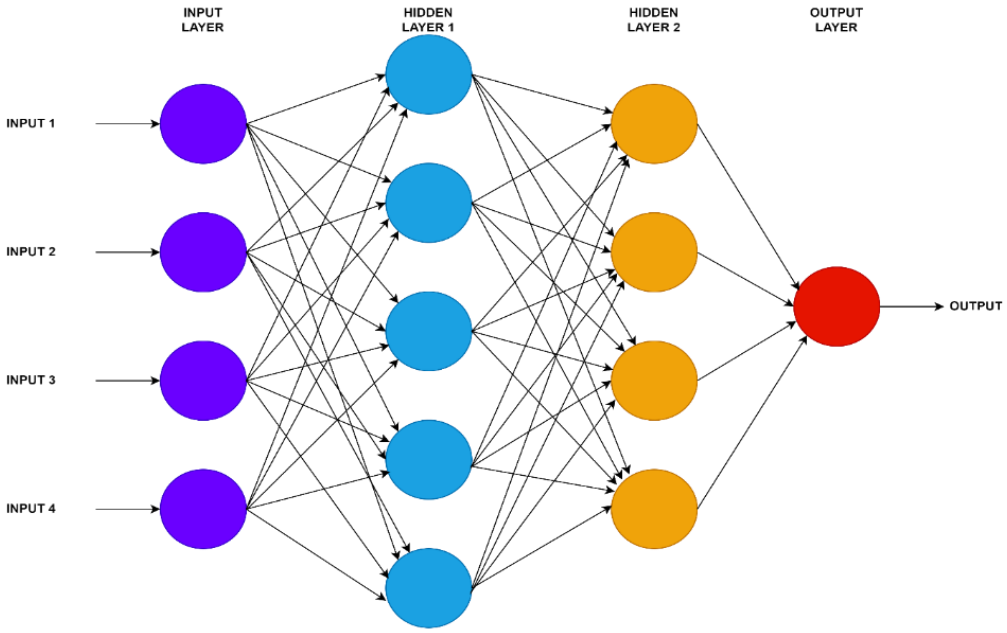

Figure: ANN Architecture

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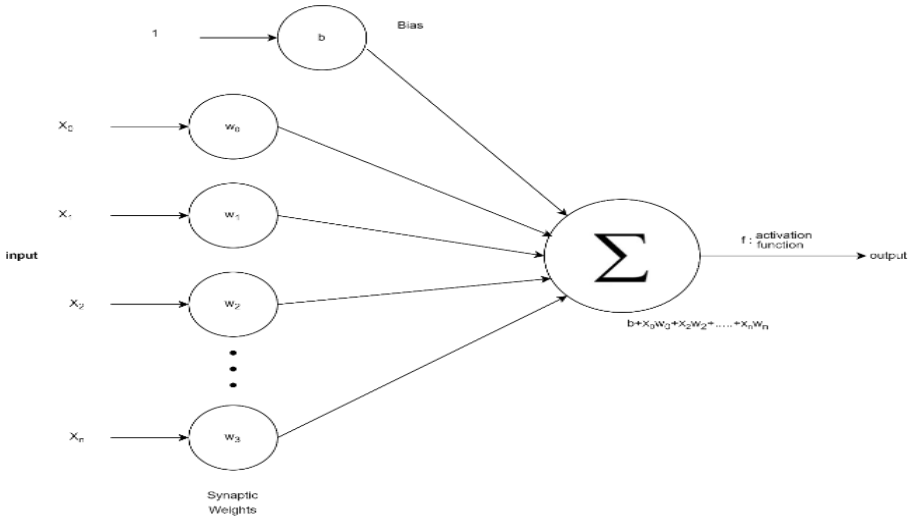

Parameters Observed During Cutting Operation:

Parameter	S1	S2	S3	S4	S5
Gender	M	M	F	M	F
Age	18	18	19	18	20
Right/ Left-Handed	R	R	R	L	L
No, of Minutes of operation	45	55	60	40	65
Height of Operator (CM)	170	172	168	180	165
Material of Blade	CS	CS	CS	CS	CS
Dimension of blade	18 TPI	18 TPI	24 TPI	18 TPI	18 TPI
W/P shape and Material	Rectangular	Rectangular	Rectangular	Circular	Rectangular
Workpiece Dimension	15*10*5	15*10*5	15*10*5	15*10*5	15*10*5
Blade Insertion	Full	Full	Full	Full	Full
Angle of blade with W/P	35	40	40	50	30
Quality of blade	Good	Good	Bad	Bad	Good
Success/Failure	Success	Failure	Failure	Success	Success

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III. LITERATURE REVIEW

1) Taylor Regan, Christopher Beale, Murat Inalpolat

We have studied the paper and discussed the need for structural health monitoring (SHM) of wind turbine blades due to their exposure to high operational loads and variable environmental conditions. The authors propose a novel acoustics-based damage detection technique for enclosed cavity structures like wind turbine blades. They focus on selecting statistical features and identifying competent machine learning algorithms for damage detection. The study involves the construction of a laboratory-scale wind turbine with hollow composite blades for testing. The blades can be tested in stationary or rotating conditions, and time and frequency domain information are collected to establish baseline characteristics. The researchers use an external microphone attached to the tower and wireless speakers to monitor blade health and ensonify the blades internally.

2)J.A. Rodríguez, Y. El. Hamzaoui, J.A. Hernández, J.C. García, J.E. Flores, A.L. Tejeda

The paper focuses on the prediction of the useful life (UL) of blades in steam turbines, which are prone to failures and can cause significant economic losses in the turbo machinery industry. The authors propose the use of an Artificial Neural Network (ANN) approach to predict the UL of the blades. The ANN model is configured with 6 input neurons, 3 hidden neurons, and 1 output neuron. The authors achieve excellent agreement between experimental and simulated UL values using the hyperbolic tangent sigmoid and linear transfer functions in the hidden and output layers, respectively. The model exhibits a high coefficient of determination (R2 = 0.9912) and a low root mean square error (RMSE = 0.00022), indicating the accuracy of the predictions.

IV. RESULTS

Train Set Evaluation

MAE	**0.00110954435452558844**
MSE	**1.2736055997262867e-06**
RMSE	**0.0011285413599933581**
R^2 Square	**0.9999999949055776011**

Test Set Evaluation

MAE	**0.30942453635743494**
MSE	**0.10789166431702098**
RMSE	**0.32846866565476374**
R^2 Square	**0.0**

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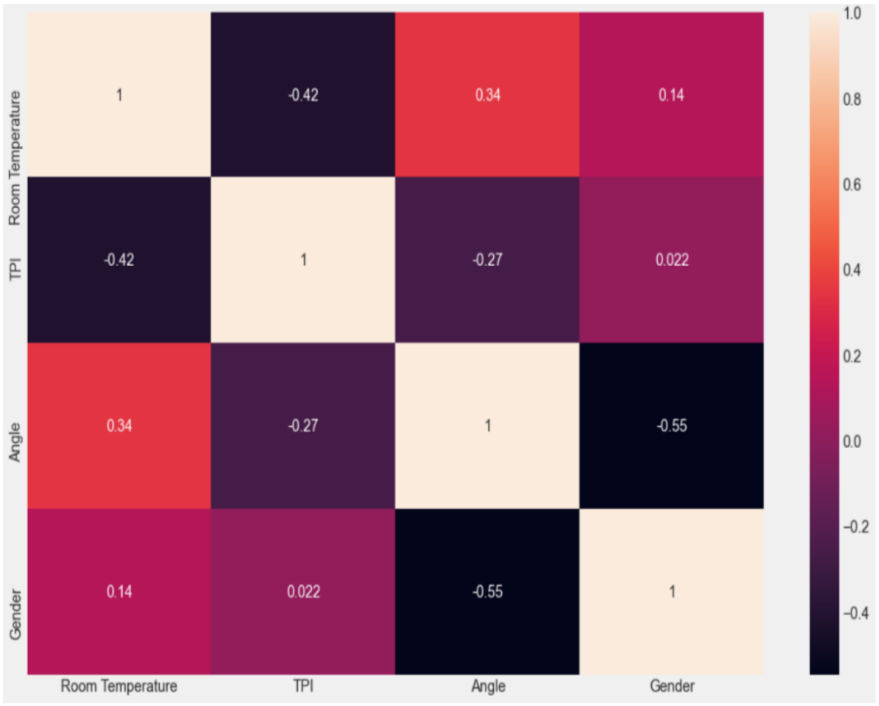
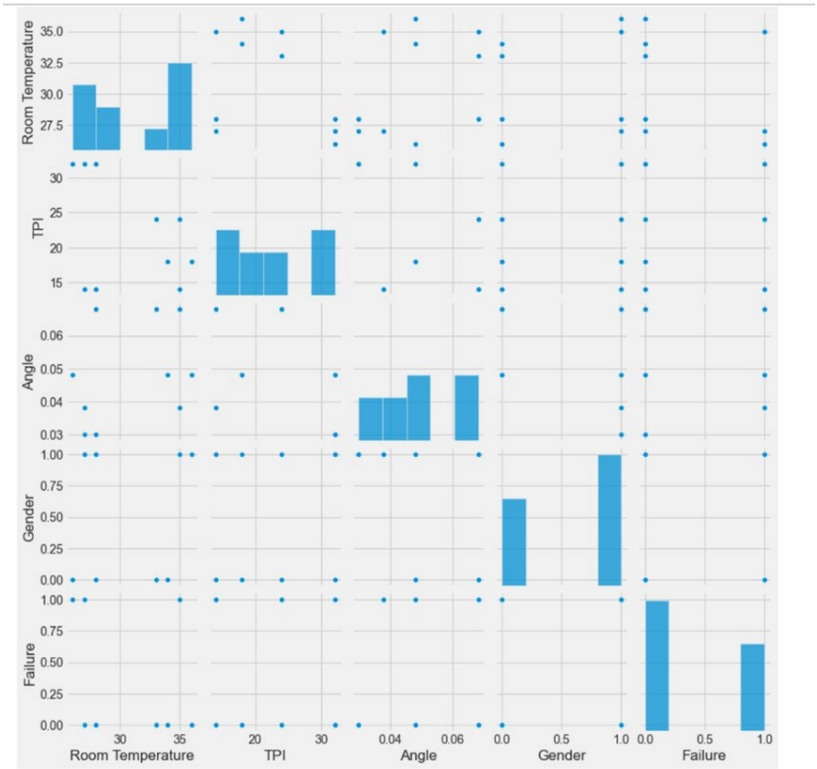


Figure: Heat Map



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V. CONCLUSION

In this research work we have studied five number of parameters and concluded that failure of hacksaw blade on following parameters with accuracy criteria used as MSE, RSME, MAE, R^2. From the heat map it is concluded that TPI and angle of cutting and responsible of hacksaw blade.

The MSE and RSME is not affected by the outliers present in the data so we consider MSE and RSME parameters as validation factor.

REFERENCES

[1] Du, Y.; Zhou, S.; Jing, X.; Peng, Y.; Wu, H.; Kwok, N. Damage detection techniques for wind turbine blades: A review. Mech. Syst. Signal Process. 2020, 141, 106445.

[2] Jin, X.; Chen, Y.; Wang, L.; Han, H.; Chen, P. Failure prediction, monitoring and diagnosis methods for slewing bearings of large-scale wind turbine: A review. Measurement 2021, 172, 108855

[3] K. Worden, G. Manson, N. R. Fieller, Damage detection using outlier analysis, Journal of Sound and Vibration 229 (3) (2000) 647–667.

[4] Predictive maintenance enabled by machine learning: Use cases and challenges in the automotive industry https://www.sciencedirect.com/science/article/pii/S0951832021003835

[5] Taylor Regan, Christopher Beale, Murat Inalpolat, https://doi.org/10.1115/1.4036951

[6] https://doi.org/10.1016/j.engfailanal.2013.05.002

[7] https://www.researchgate.net/publication/316634133_Blade_fault_diagnosis_using_artificial_neural_network

[8] https://doi.org/10.1016/j.renene.2018.10.047