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Employees Attrition Detection using PSONN

Yogesh, Sudhir Shrivastav

ABSTRACT— Raw materials, intermediate goods and finished goods are termed as inventories while considering it as portion of business's assets which can be considered as prepared or are prepared for sale. One of the suitable solutions is to design optimal inventory model. Major concern of industry is to design suitable inventory model. Some of the existing inventory management research works are discussed in literature. But this field is still a big area of interest. Many research works uses artificial intelligence models for inventory management. One amongst the area for inventory management is worker behavior in a company. So, employees are taken into account to be as an inventory that contributes in growth of an organization. Employee Attrition may be a big issue for the organizations specially once trained, technical and key staff leave for a far better chance from the organization. This leads to loss to interchange a trained worker. Therefore, we use the present and past worker data to analyze attrition behavior of employees.

KEYWORDS- Raw materials, Inventories, Inventory Management, Artificial Intelligence.

I. INTRODUCTION

Stock is an accounting term that refers to assets that are in various stages of their willingness to sell, including: Suppliers, expenses and work in progress or finished products recorded in books by an organization and held for a period of time in their stocks, their warehouses or their works. Manufacturers must anticipate an optimal amount of raw material inventory to reduce costs and optimize supply chain efficiency. The artificial intelligence approach involves a model that seriously controls inventory management and performs human checks. Artificial intelligence is the place where models not only make predictions or classifications, but actually respond to these predictions. It is about giving artificial intelligence the ability to act according to what is predicting.

II. RELATED WORK

Ford W. Harris [1] developed the first mathematical model for inventory management, the Economic Order Quantity Model (EOQ), introduced in 1913. It was designed for production planning purposes. EOQ is a dynamic and deterministic mono-product model, essentially very simple.

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Yogesh, M.Tech. Scholar, Department of ME Sagar Institute of Research and Technology Excellence, Bhopal, India (e.mail:yogeshyaduvanshi081@gmail.com)

Sudhir Shrivastava, Assistant professor& Dean, Department of ME, Sagar Institute of Research and Technology Excellence, Bhopal, India.

The model indicates the optimal solution for knowing the behavior of the inventory system. The closed solution is also easy to calculate. Pikulkaew Tangtisanon [2] focused on an inventory management and a stock forecasting system. Web service was implemented as a new approach for an inventory management system that helps to manage and to find the food additives that exist in the international food additive database authorized by Codex Alimentarius Commission. The stock forecasting was done with four machine learning models which are Naive Bayes, Decision Tree, Linear Regression and Support Vector Regression to predict stock of food additive. Hsiao Ching Chen [3] developed a system of intelligent agents to simulate the supply chain system. The artificial neural network (ANN) is used to derive optimal inventory policies. The proposed inventory decision, which uses an intelligent agent and an artificial neural network, provides management information on the impact of decision making on the factory, wholesale, distribution and distribution markets. Hachicha [4] utilized an AI and worked with the lot-sizing problem in supply chains by applying a meta-modelling simulation. The supply chain is handled in a make-to-order environment (no possibility of keeping stock and limited production capacity). The model is designed for multi-product, multi-stage and multi location production planning with capacity constraints and stochastic parameters such as lot arrival orders, transit time, set-up time, processing time and so on. Paul and Azaeem [5] have developed another model based on artificial intelligence that determines the optimal state of the finished product. The inputs for this model include product demand, equipment, storage and material costs from which the data comes from a manufacturing sector. The results showed that the model can be used to predict the stock of finished products in response to the input parameters of the model. In general, the constructed model can be applied to the optimization of the stock of finished products in each manufacturing company. The inventories mentioned by Shrivastava [6] are raw materials, products in progress and completely finished products, which are considered part of the assets of the company ready for sale. Developing an appropriate inventory model is a major concern in any industry. The first scientific studies on inventory management date back to the second decade of the last century, but interest in this scientific area remains high. Once again, the reliability of a process is an important feature of research activities. The values of some factors are very difficult to define or almost

unreal. In these cases, AI inventory models are important. This research work is focused on finding a well trained and experienced employee, in any organization, for giving bonus or for replacement. Hiring new employees always costs organization some hug costs. Human Resource departments generate an enormous amount of data on a daily basis: leaves, social conflicts, annual evaluations, wages and benefits, recruitments, departures, career evaluations, etc. but the big dilemma is to find out the correct and accurate replacement of the employees who will left. Here are some of the challenges faced by the hiring managers:

- Eligible Candidates Finding and sorting the best candidates
- Another area of research is to find out the candidates that would prove to be an asset to the firm if hired.
- If a selected candidate drops off, then firm have to repeat the cycle of complete processes and find a replacement again.

III. METHODOLOGY

Methodology Consists of Following Phases:

- The dataset is taken.
- The Useful information is selected for deciding Attrition of Employees using Co-relation Analysis (Pearson, Kendall and Spearman).
- Classifying new employee for their attrition behavior using PSONN.

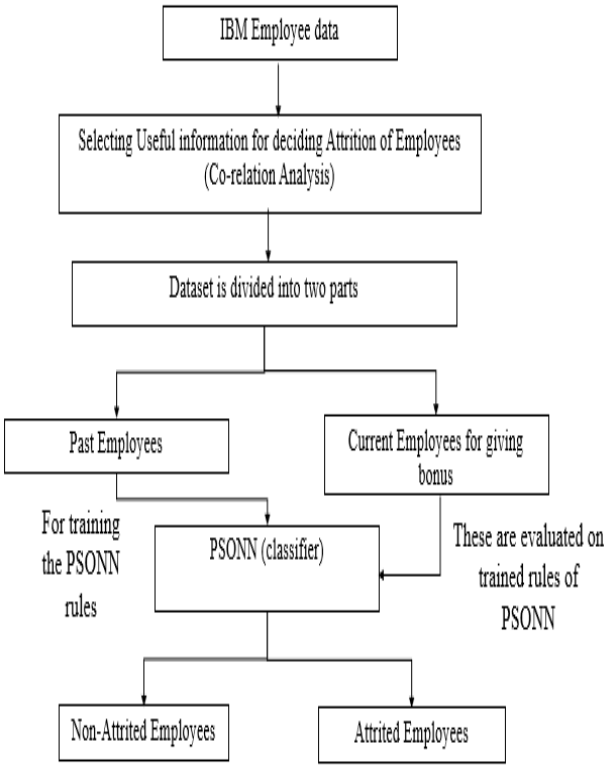

Fig. 1: Methodology for Employee Attrition Detection

A. Finding Spearman, Pearson and Kendall Correlation:

Spearman Correlation coefficient σ is calculated by the formula mentioned below:

- $\sigma = 1-(6\Sigma d_i^2)/n(n^2-1)$
- In the formula,
- d_i stands for the difference between variables P and Q
- n stands for the sample size

Kendall Correlation coefficient τ is calculated by the formula as given below:

- $\tau = (n_c - n_d)/(1/2n(n-1))$
- n_c = number of concordant values (if $x_i<x_j$)
- n_d = number of discordant values (if $x_i>x_j$)
- n stands for the sample size

Pearson Correlation coefficient ρ is calculated by the formula as given below:

$$\rho = \frac{E[AD] - E[A]E[D]}{\sqrt{E[A^2] - (E[A])^2}\sqrt{E[D^2] - (E[D])^2}}$$

where:

A stands for the first element (attribute)

D stands for the second element (attribute)

E [ ] stands for the sum of the elements

B. Particle Swarm Optimized Neural Network (PSONN)

It presents an intelligent and an optimal model using hybridization of Artificial Neural Network (ANN) and Particle Swarm Optimization (PSO). Artificial network is simple three-layer neural network having one input, hidden layers and output layer. The number of input layer neurons are equals the number of inputs.

ANN example is explained in above figure. In artificial neural network currently predicts weights and biases. To predict weight and bias, data are inserted and forwarded though the entire network. The total net input to each hidden layer neuron is the total net input using an activation function, then repeat the process with the output layer neurons. So, the total net input for h1 as:

$$net_{h_1} = w_1 * i_1 + w_2 * i_2 + b_1 * 1$$

Then sum of layer to get the output of h_1

$$out_{h_1} = \frac{1}{1 + e^{-net_{h_1}}}$$

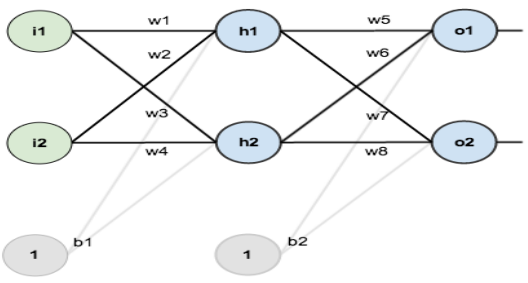

Fig. 2: Neural Network

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Further carrying out the same process for h2 in figure 2: Then process is repeated for the output layer neurons, using the output from the hidden layer neurons as inputs. Here's the output for o_1 as in equation (ix):

$$net_{o_1} = w_5 * out_{h_1} + w_6 * out_{h_2} + b_2 * 1$$

And carrying out the same process for o_2. Then error is calculated for each output neuron using the squared error function and sum them to get the total error as in equation (x):

$$E_{total} = \sum \frac{1}{2}(target - output)^2$$

The working of the neural network is focused towards adjusting the weights associated with entire network in order to reach the target data values, for minimizing the error between output and target values.

These obtained links in entire network are further optimized (reduced), only best links are selected with minimum error rate, using PSO algorithm. PSO ALGORITHM works as:

- (Initialization) Randomly generate initial particles (links) in groups.
- (Fitness) Measure the fitness of each particle in the population.
- Find best fitness value link termed as Pbest.
- Among all Pbest find the best value called Gbest.
- (Termination) Stop the algorithm if the termination criterion is satisfied; return to Step 2 otherwise.

IV. RESULTS AND DISCUSSIONS

In order to evaluate the performance of methodology, the proposed algorithm is simulated in following configuration:
Pentium Core I5-2430M CPU @ 2.40 GHz
4GB RAM
64-bit Operating System
MATLAB Platform

For simulation result, the research is focused towards co-relation feature extraction for attrition analysis from employees. For executing this simulation, IBM employees dataset is prepared with 1470 employees. For this the research methodology is designed using PSONN for predicting either attrition or non-attrition behavior of the employees. These evaluations are performed on testing dataset. The training testing dataset is divided into 85:15 ratio, 80:20 ratio, 70:30 ratio, 60:40 ratio and 50:50 ratio. The result analysis is performed to find accuracy of the proposed methodology and to decide the behaviour of the employees either it is of attrition or not as shown in Table I.

Accuracy = (TP+TN)/(TP +TN+FP+FN)

Where, TP= True Positive, that means if employee is of attrition behavior and the predicted label also stands for attrition behavior.

TN= True Negative, that means if employee is of non-attrition behavior and the predicted label also stands for non-attrition behavior.

FP = False Positive, that means if employee is of non-attrition behavior and the predicted label stands for attrition behavior.

FN= False Negative, that means if employee is of attrition behavior and the predicted label stands for non-attrition behavior.

Table 1: Performance Evaluation for PSONN Algorithm

No. of Employees (out of 1470)	Accuracy (in %)	Attrition	Non-Attrition	Not-Decided
220	94.09	19	188	13
294	93.19	23	251	20
441	92.97	34	376	31
588	92.51	44	500	44
735	92.51	63	617	55

V. CONCLUSION

Employee attrition can affect an organization in many ways like goodwill, revenues and cost in terms of both time and money. The predictive attrition model helps in not only taking preventive measure, but also making better hiring decisions as well as providing appreciations to best employees that contributes to the benefit of the organization. In this research work, PSONN is designed to predict attrition behavior of the employees. The result shows that the efficiency of model is approx. 94%.

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