



APPLICATION OF ANN TO ASSESS EMPLOYABILITY OF UNDERGRADUATE STUDENTS

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Abstract

In this study, the various employment skills sets of graduate technical students were identified. Stakeholders of campus employment activity i.e. company HR, placed Alumni, senior *T* and *P* Officers and senior Trainers authenticated the selected skill sets. All skills were grouped into four major groups as per their characteristics i.e. Aptitude, Communication,

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Technical and Personality traits. Pen and paper test was designed and conducted in Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur affiliated technical institutes to measure the skill sets. Nonlinear relationship was found between dependent variable i.e. Employment and independent variables i.e. skill sets. Due to nonlinearity, an Artificial Neural Network (ANN) approach applied to develop a relation for the assessment of students' employability. It is observed that all skill sets have positive correlation with each other and also with the Employment. Technical colleges should change their previous teaching learning process and focus more on industrial skills that best foster Employment.

1. Introduction

Today's multifold development of industries increases the demand of technocrats. The technical colleges have role to provide trained and the right kind of technical manpower. Companies and colleges should work together to develop ecosystem for the mutual benefits. As per survey carried out by educational agencies like Purple Leap, Merittrac and Aspiring Mind, the employability of technical graduates is very low. Most of the companies are unsatisfied from hired fresh technical graduates in the campus selection process at various technical colleges [1] [2] [3]. They invest huge budget to conduct technical and non-technical training to make them job ready. Technical colleges organize various technical and non technical programs to raise employability of their students. Employability means getting employment and maintaining it by fulfilling required work with the help of skills, knowledge and personal attributes.

Few researcher carried out work on the quality development of technical colleges by applying Six Sigma, Quality Circle, Statistical Quality Control, Total Quality Management etc [4] [5]. Other researchers used opinion of employed stakeholders like Company executives, Human Resource trainers, and fresh hired students to develop relationships by using questionnaires. In this research work, authors are applying ANN approach to assess employability based on industrial skills. This tool will be helpful to the colleges to focus on undeveloped skills whereas it will be useful to the companies for tapping untapped manpower. Technical students will use to plan training well in advance to avoid failure in campus placement selection process.

2. Methodology

Technical Colleges of Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur were selected to carryout study and collect samples of final year technical engineering students. Literature review helps to identify industry required skills and authenticated by 45 stakeholders. The verified questionnaires used to collect primary data on skill set performance. Secondary data about participated students about their placement in Multinational Information Technology Companies was collected. Research assumptions and data smoothening techniques- box plot was used to finalize the dataset for model preparation.

Dependent Variable

Students' Employment in IT companies through college placement activity is considered as dependant variable-Employability. The employments of first 5 IT sector companies were considered for the study. The weightage is given based on attempt required for the selection, 100%, 80%, 60%, 40% and 20% for companies 1, 2, 3, 4 and 5 respectively and remaining considered as 0% for developing a model.

Independent Variables

Required industrial skill sets of the students were identified and considered as independent variables. 45 Stakeholders involved in campus placement activity i.e. company HR, placed Alumni, senior T & P Officers and Trainers authenticated the selected skill sets. All skill sets are grouped into four groups i.e. Aptitude, Technical, Communication and Personality trait factors for the model formulation. Pen and paper test was designed and conducted in Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur affiliated Technical institutes to assess the performance of students on the skill sets. The placement records of participated students were collected from their institute and used as dependent variable. The dataset of dependent and independent variable were finalized after applying data smoothening technique box plot, as shown in table 1.

Table 1. Dataset of 362.

S. N.	Aptitude	Communicatio	Technical	Personality	Employmen
1	20	14	17	16	1.00
2	19	14	15	18	1.00
3	21	11	17	16	1.00
4	15	15	18	16	1.00
5	23	10	17	14	1.00
-	-	-	-	-	-
352	9	8	9	12	0.20
353	10	5	10	13	0.00
354	14	9	5	9	0.00
-	-	-	-	-	-
361	9	8	9	10	0.00
362	5	8	10	13	0.00

3. Data Analysis

Dataset investigation was done to find correlation of independent variables with each other. Whereas all skill sets shows affirmative correlation with employment. It is also observed that all independent variable affects the dependent variable with positive correlation [6][7]. Statistical Package for the Social Sciences (SPSS) version 20 was used for investigations. Kaiser Meyer Olkin (KMO) and Bartlett's Test [8] were used to check adequacy and Sphericity of final 362 dataset as shown in table 2.

Table 2. KMO and Bartlett's Test.

Adequacy of dataset		.637
Bartlett's Test of Sphericity	Approximate Chi-Square	662.072
	Degree of freedom	10
	Significance	.000

It is found that the adequacy of 362 dataset is 0.637 which is moderate as per Kaiser 1974. Bartlett's Test of Sphericity is found significant, $P = 0.000$ ($P > 0.05$). In real life problems, getting adequacy of collected sample in moderate range is sufficient to formulate model. Hence dataset of 362 samples used to develop ANN model to assess employability of technical graduates in software companies based on industrial skill sets.

3.1 Development of Artificial Neural Network (ANN) Model

Students' performance on skill sets i.e. Aptitude (X_1), Communication (X_2), Technical (X_3) and Personality (X_4) are considered as independent variables whereas the weight age given to Campus Placement of same participated students is considered as Employability (Y) to develop a mathematical model as shown below.

$$\text{Employability } (Y) = f(X_1, X_2, X_3, X_4)$$

An artificial neural network (ANN) is a fast growing technique that focuses on biologically inspired ways to solve real-world problems. A neural network is made up of a collection of strongly interrelated elements named as Processing Elements (PE), which are inspired by the brain's organization. Each unit is made to look and function likes a neuron in the body. Each one takes a set of weighted inputs variable and responds with an output variable. [9][10][11].

Neural network approaches are essentially a more sophisticated version of experimental methods with factor fitting. They entail a mathematically based assessment of complicated system inter-relationships. It searches for non-linear regression correlations between the input and output variables, therefore, the quantity and quality of the database are important to the

model's correctness. Mostly we presume a linear correlation exists between input and an anticipated outcome, are incapable of capturing more nuanced correlations in dataset. A neural network is made up of a series of interconnected processing units. Non defining specific function and capture of nonlinear correlation are the advantage of ANN.

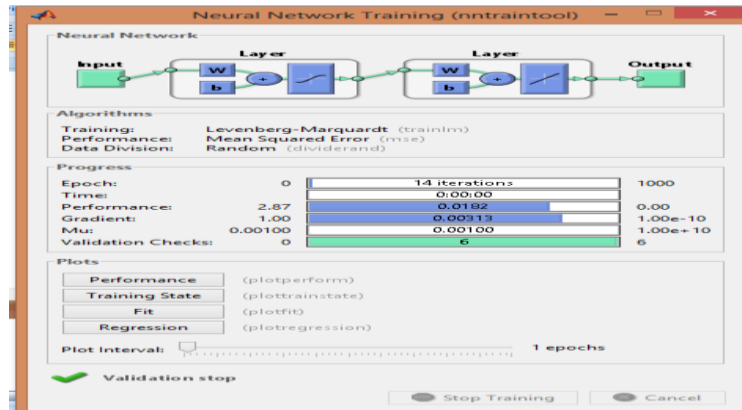


Figure 1. Multi-layer Perception.

Multi-layer perception (MLP) is used in neural network topologies, which allow non-linear function for identify correlations. MLPs are feed forward networks that are often educated via static back-propagation. The number of processing elements in an ANN model is chosen (PE). The choice of PEs is critical since a small number of PEs limits the network's discriminating power. To get the optimal network, PE modified from 2 to 20 nodes. The experiment began with a modest number of PEs and observes the learning curve behavior. Network performance achieved good result at 20 Processing Element (Neurons) after 14 iterations as shown in figure 1.

Supervised training method was used and categorized the dataset into three sub groups namely Training set, Testing set and Validation set. The training set allows the system to create relationships between input variables and expected outputs. The ANN model was developed using a sample of 362 student data. About 70% of the total data (254) was utilized for Training, 15% (54) for Testing and 15% (54) for Validation. Multi-layer perception with two hidden layers with 20 processing elements per layer was used to develop the model. The R2 values of Training set, Testing set, Validation set and overall are 0.95, 0.92, 0.90 and 0.94 respectively as shown in figure 2. The

performance of developed network was observed and found best at epoch 8. The Mean Square Error (MSE) is 0.0294 at optimum performance of Training, Testing and Validation network as shown in figure 3.

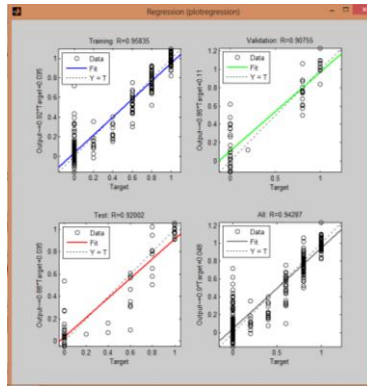


Figure 2. Regression Analysis.

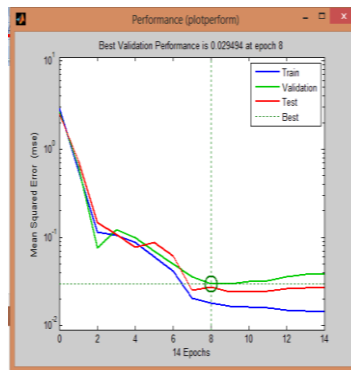


Figure 3. Mean Square Error.

During iterations, the number of neurons varies from 2 to 20 and observes the performance of network. ANN network performs best with R2 is 0.9428 and Mean Square Error is 0.0294 at 20 neurons. MATLAB software is used to develop ANN model and the details are shown as in table 3.

Table 3. Summary of ANN Model.

Overall R^2	0.9428
Training R^2	0.9583

Validation R^2	0.9075
Testing R^2	0.9200
Mean Square Error	0.0294
Hidden layers	2
Processing Elements	20
Independent	4 (A, C, T, P)
Dependent variable	1 (Y-Employment)

4. Conclusions

In this research work, the authors have found positive correlation of selected skill sets with each other and also with the Employment/Employability. The developed model achieved good R^2 which shows that ANN is one of the best approaches for nonlinear relationship between the independent and dependent variables. After various iterations, the best overall R^2 is found as 0.9428 and Mean Square Error is 0.0294, achieved at 2 Layers, 20 neurons. It means that the entire technical colleges need to change their focus on conventional skill and put more energy on developing industrial skills that foster the best Employability. Stakeholders will use this approach to tap the untapped talent from the rural and urban region. This method will support to AICTE, RTMNU and similar technical institutions for providing equal opportunity to all the eligible engineering students.

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