

The Impact of Emotional Intelligence of Employees at Work Place Using Machine Learning Techniques

Dr. J. Jebamalar Tamilselvi

Research Supervisor & Associate Professor

Department of Computer Science

Faculty of Science and Humanities,

SRM Institute of Science and Technology

Ramapuram, Chennai

jebamalj@srmist.ed.in

Mrs. R. Lalitha

Assistant Professor,

J.B.A.S College for Women(A.N)

Teynampet, Chennai-18

lalith.cath@gmail.com

Article Info

Page Number: 4706 - 4716

Publication Issue:

Vol 71 No. 4 (2022)

Abstract

The capacity to integrate cognitive thinking skills with affective skills, often known as intelligence and emotion, is known as emotional intelligence, or EI. The term "emotional intelligence" (EI) refers to the ability to recognise, manage, and evaluate emotions. According to the researchers, either emotional intelligence is a trait that humans are born with or it can be developed through learning to strengthen one's weaknesses. The condition of emotional intelligence has an impact on how the brain develops. It affects a person's behaviour and speech. It has an impact on a person's way of thinking and relationships with others. Various testing methods have been developed to quantify passionate knowledge, yet each test's content and methodology differ. If a specialist has strong emotional intelligence, they should be able to understand the emotions of individuals they deal with and convey their sentiments in a

way that is effective, improving relationships at work and performance. A worker with high emotional intelligence is more likely to be able to communicate their emotions constructively and understand the emotions of others they work with, which will improve their working relationships and performance. With the rise of Machine Learning techniques in this paper, various machine learning algorithms like Naive Bayes, SVM, Random Forest, KNN, Neural Network and CNN were utilized for the forecast of Emotional Intelligence dependent on conduct credits. The outcomes that resulted with the general precision was 0.99%. The dataset used for prediction had 10 behavioural attributes and 6 more individual attributes.

Article History

Article Received: 25 March 2022

Revised: 30 April 2022

Accepted: 15 June 2022

Publication: 19 August 2022

KeyWords: Emotional Intelligence, Machine Learning, Neural Network, CNN-Convolution Neural Network, KNN.

1. INTRODUCTION :

This research paper's major goals are to improve employees' emotional intelligence at work and to provide light on why some employees perform exceptionally well while others don't in the future. Emotional intelligence asks for identifying and comprehending organisational problems so that an organisation can pick a plan and course of action to enhance employee performance[16]. Increased emotional self-awareness, emotional expression, creativity, increased tolerance, increased trust and integrity, improved relationships within and across the organisation, and improved relations all contribute to increased performance for each individual employee as well as the organisation as a whole. "One of the few essential traits that breeds strategic leaders in organisations is emotional intelligence." Emotional intelligence is vital for the organisation and is increasingly used to judge who is a good employee. It also boosts productivity and builds trust inside and between departments.[17]

The purpose of this study is to learn more about the emotional intelligence of employees and, using the data gathered, to suggest ways to improve that intelligence. They can analyse themselves better and grow as a result of this. Only a small part of the entire population was represented by the sample size that was selected.

1.1 EMOTIONAL INTELLIGENCE

Knowing one's own feelings, controlling emotions, inspiring oneself, recognising emotions in others, and managing relationships are the five components of emotional intelligence. Examining the factors that affect employees' emotional intelligence at work is one of the study's key goals and to determine how much employees are aware of emotional intelligence.

According to Trait Emotional Intelligence gives a practical application for the Petrides and colleagues paradigm, which conceptualises emotional intelligence (EI) in terms of personality. The exam consists of 15 subscales that are divided into four categories: sociability, emotionality, self-control, and well-being. In a study on a population of French speakers, the psychometric features of the Trait were examined, and it was shown that the scores were reliable and worldwide regularly distributed.[14]

Well-Being: A state of being Happiness, optimism, and self-esteem are the three separate characteristics that make up the well-being factor. They gauge how well-rounded people perceive their level of life satisfaction. People's perceptions of their general happiness and contentment, as well as their level of self-esteem and future optimism, are reflected in their level of wellbeing.

Self-Control: How much people believe they can control their impulses—or to what extent they are governed by them—is measured by the self-control factor. Impulse Control, Stress Management, and Emotional Regulation are among its three different characteristics. It responds to several significant issues, including: Do you repress your urges and think things through before acting? In both your personal and professional life, how well do you handle stress?

Emotionality: Empathy, emotion perception, emotion expression, and relationships are the four characteristics that make up the emotionality factor. Together, they reveal your potential level of sensitivity to both your own and other people's feelings. Your ratings on these characteristics often reflect how much you value this "emotional literacy" and how and when you utilise it. When appropriate, self-aware individuals who employ emotion in a healthy manner respond compassionately to the feelings and emotions of others. Additionally, they are able to articulate their own emotions in a way that is both clear and understandable and do not allow sentiments or perceptions to cloud their judgement. These characteristics are necessary to collaborate well with others.

Sociability: The sociability factor reflects how at ease people feel in various social situations, such as formal business meetings and social events. You indicated in the questionnaire how comfortable you are arguing your point of view, how confident you are in interacting with a variety of people,

and how much influence you believe you have. The capacity to get along with people is crucial for leadership roles. It assists leaders in inspiring a variety of people to work toward common objectives, deal with challenging circumstances, and improve underperformance. The attributes of assertiveness, social awareness, and emotion management make up the socioability factor.

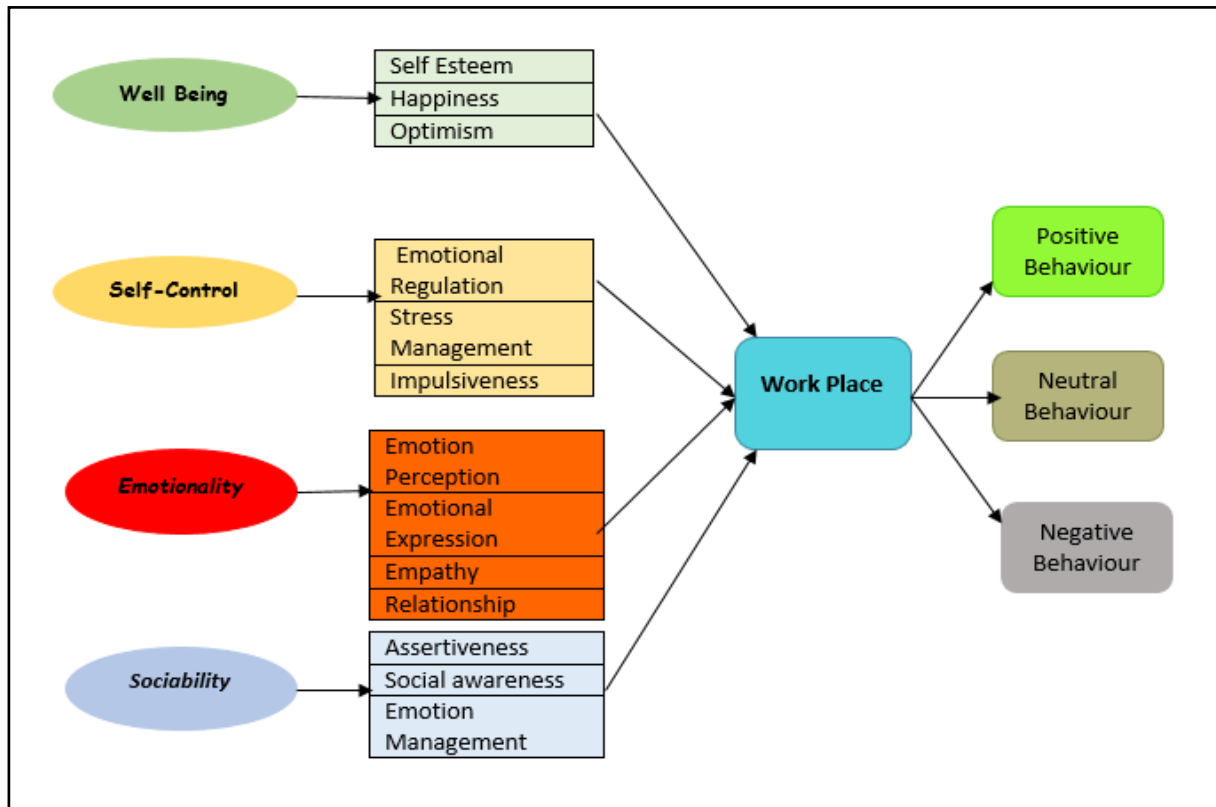


Fig1: Factors of Emotional Intelligence

2. METHODOLOGY:

The goal of machine learning is to have machines replicate human intelligence. It is the study of computer algorithms that get better on their own over time, and its main objective is to extract broad patterns from a little amount of data. Data mining, formal languages and automata, pattern recognition, Graph Theory, artificial intelligence, neural networks, statistics, economics, organisational behaviour, and evolution are all strongly related to machine learning. Supervised, unsupervised, and reinforcement learning are the three basic methods used in machine learning. Semi-supervised learning is one of the hybrid approaches that can be customised to the issue a researcher is trying to solve. Each strategy has certain advantages and disadvantages, and some methods are more effective at solving particular kinds of issues than others. Classification

algorithms are used to build classification models which are used for prediction. The model is first trained with some data which are referred to as training data and then it is tested for prediction on the unseen testing data. Below are the steps of building classification model.

A. Data Collection

Analysis and interpretation of collected data is the brain of this work. The dataset used in this study was collected from Questions were framed based on the behavioural traits of a person and collected data on emotional intelligence by asking the respondents to give their opinion on the following questions. Data is collected from people from many educational institutions. The dataset had ten behavioral features (AQ10-Adult) plus ten individual characteristics which are found very effective in determinants of emotional balance. The dataset had 800 samples with 21 attributes. After eliminating duplicate data there were 750 samples. After eliminating the unnecessary attributes there were 750 samples with 16 attributes. After analysis of data, only one can arrive at the findings with the related problem identified. This finding which has been arrived after analysis and interpretation helps to find out the hidden solution for the problem and give the most appropriate suggestions for overcoming problems.

Table I. represents the attribute names, types and descriptions.

Name of attribute	Number of values
A1_Score	2
A2_Score	2
A3_Score	2
A4_Score	2
A5_Score	2
A6_Score	2
A7_Score	2
A8_Score	2
A9_Score	2
A10_Score	2
Age	4

Gender	2
Designation	5
Job	11
Place	20
Result	4

B. Data Pre processing

Age, Gender, Designation, Job, place ascribes had downright information. The unmitigated information were encoded first. They were changed over to mathematical qualities. The trait named "Result" was the whole of the scores of inquiries (A1-A10). The worth of "age_desc" was '25 and more' in every one of the examples. These two credits were pointless. In this manner, the properties "Result" and "age_desc" was killed as well. The copy columns were erased. Afterward, the whole dataset was parted into preparing set and testing set. 80% of the information was saved for preparing and 20% was saved for testing. Component scaling was applied to place every one of the information in same reach and same scale.

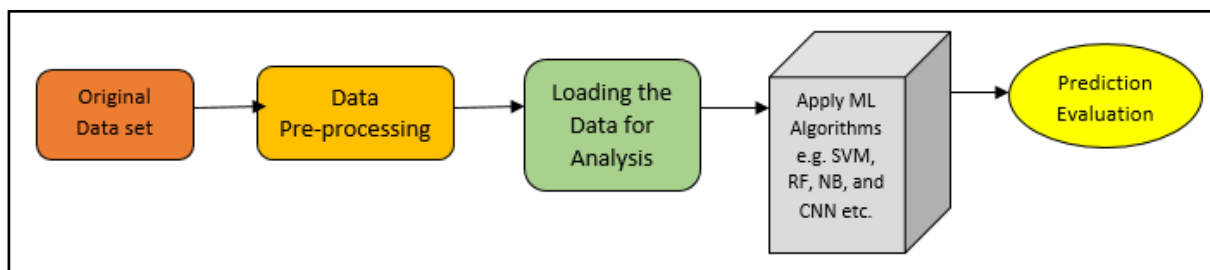


Fig 2: Steps for the Proposed Methodology

SUPPORT VECTOR MACHINE (SVM) FOR CLASSIFICATION:

Support vector machine is a machine learning technique hosted by Cortes and Vapnik. SVM was developed to resolve the binary and multi-classification problem. It is comes in a supervised model. The Support Vector Machines neural network is a hybrid algorithm of support vector machines and neural networks. For a new set of examples, it always tries to classify them into two categories Yes or No (1 or 0). SVMs are generally used for binary classifications.

NAIVE BAYES CLASSIFICATION:

Naive Bayes classifier is known as a simple probabilistic classifier based on the application of the Bayesian theorem with solid objectivity of conventions. Naive Bayes classifier adopts that the existence of a specific feature in a class is discrete to the presence of any other feature. It is proved that it has been applied well in several complex real-world difficult Bayesian classification theories and that are useful for analyses form to predict future data trends and make an brainy decision. Classification is a predictive machine learning technique which creates the prediction of using historical data. Predictive models can forecast the class membership of a variable given for the known values of the other variables. Classification map the data into predefined groups. It is referred as supervised learning since the classes are determined earlier by investigating the data by an expert or many experts of the domain.

k-NN CLASSIFICATION :

K-Nearest Neighbourhood is one of the meekest Machine Learning algorithms created from the Supervised Learning technique. K-NN algorithm adopts the resemblance among the new case/data and available cases and put the new case into the group that is most related to the available groups. K-NN algorithm stores all the available data and classifies the new data point created by the similarity. This means when a new data performs then it can be easily categorised into a good suite group by using K- NN algorithm. K-NN algorithm may be used for Regression and also for Classification but commonly it is used for the Classification problems. KNN is an algorithm created from machine learning, there do not have many training parameters, its computational complications are not high, and the performance is acceptable.

NEURAL NETWORKS:

The neural network is a kind of technology, it is not a method, it is a sort of network which has weights, and the weights will be adjusted. An artificial neural network is an arrangement of hardware or software that is demonstrated concerning the working of neurons in the human brain and nervous system. An Artificial neural networks has a range of deep learning technology, which originates under the domain of Artificial Intelligence. A neural network features a sizable amount of Processors. These processors can operate in parallel but they are arranged as layers. The first layer obtains the raw input like the optic nerve obtains the raw information from the human beings.

Each consecutive layer then receives the input from the layer before it and then passes its output to the layer after it. Then the last layer processes the absolute output.

CONVOLUTIONAL NEURAL NETWORKS:

A convolutional neural network (CNN) uses a variation of the multilayer perceptrons. A CNN contains one or more than one convolutional layers. These layers can either be completely interconnected or pooled. Before passing the result to the next layer, the convolutional layer uses a convolutional operation on the input. Due to this convolutional operation, the network can be much deeper but with much fewer parameters. Convolutional Neural Network (CNN) the neurons in one layer don't connect to all the neurons in the next layer. Rather, a convolutional neural network uses a three-dimensional structure, where each set of neurons analyses a specific region or "feature" of the data. CNNs filters connections by proximity, making the training process computationally achievable. In CNN each group of neurons focuses on one part of the data.

RANDOM FOREST:

Random Forest is an ensemble method, which works through generating a forest of Decision Trees. An ensemble is a series of classifiers. Random Forest combines a series of Decision Tree classifiers. Decision Tree has been considered as a widely used classification technique. A Decision Tree is structured like a flow diagram and a test based on an attributes value is represented by a node. The outcome of the test is represented by a branch of the tree. Classes or class distributions are represented by tree leaves. Random Forest combines the predictions made by a lot of Decision Trees and each tree is built based on the values of independent set of random vectors. Random vectors are used for generating Decision Trees.

2.1 PERFORMANCE EVALUATION

There are many metrics to evaluate a classification model's performance. However, we have used three classification performance measures to assess the performance in this case. Sensitivity, Specificity and overall Accuracy were the three measures.

Formulas for calculating these measures are shown below.

$$\text{Accuracy} = (TP + TN) / (TP + TN + FP + FN) \dots\dots\dots(1)$$

$$\text{Sensitivity} = TP / (TP + FN) \dots\dots\dots(2)$$

$$\text{Specificity} = TN / (TN + FP) \dots\dots\dots(3)$$

Another good metric for performance evaluation is the Receiver Operating Characteristics (ROC) curve. The curve is plotted with TPR is on y-axis and FPR is on x-axis where TPR is the true positive rate and FPR stands for false positive rate.

Formulas for calculating

$$\text{TPR \& FPR are: } \text{TPR} = \text{TP} / (\text{TP} + \text{FN}) \dots\dots\dots (4)$$

$$\text{FPR} = \text{FP} / (\text{TN} + \text{FP}) \dots\dots\dots (5)$$

Here, TP stands for True Positive, TN stands for True Negative, FP stands for False Positive and FN stands for False Negatives. True positives are the outcomes of the model's correct predictions of the positive classes and true negatives are the outcomes when the model correctly predicts the negative classes. On the other hand, false positives are the outcomes of the model's incorrect predictions of the positive classes and false negatives are the results of incorrect predictions of the negative classes.

Various machine learning techniques have been used experimentally, with all features being selected. To determine the specificity, sensitivity, and accuracy of the predicted model, all 16 attributes are chosen in this. Gaussian NB has been applied to the Naive Bias method implementation. 0.1 gamma value RBF Kernel has been utilised for SVM. N=5 has been employed in KNN. CNN makes use of the Relu activation Function, Adam Optimizer, binary cross-entropy loss function, 16 & 32 filters, and 0.5 dropouts with 150 epoch.[15]

Table2 : Results of Proposed Algorithms

	SPECIFICITY	SENSITIVITY	ACCURACY
RANDOM FOREST	0.9375	0.9745	0.9666
SVM	0.9574	0.88888	98.11
NAÏVE BAYES	0.9361	96.96	96.22
KNN	0.9148	0.9696	95.75
CNN	1.0	0.9939	99.53

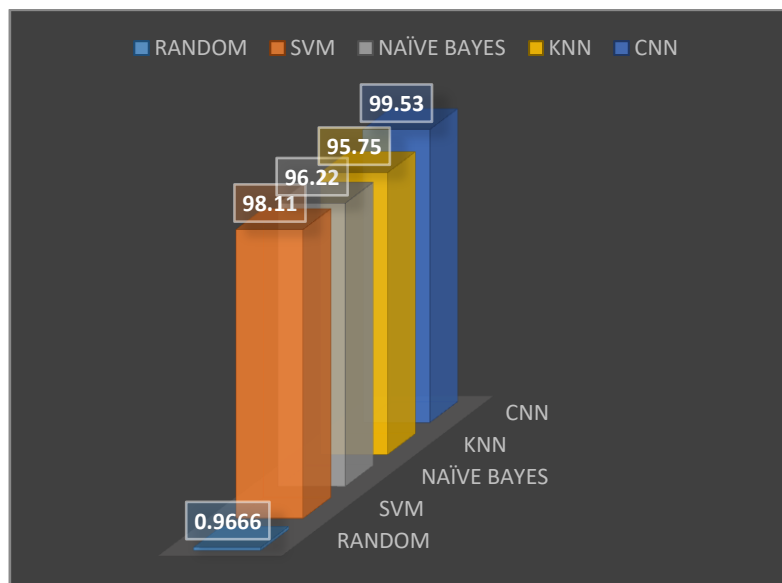


Fig 3: Accuracy Levels of Algorithms

CONCLUSION: In this work, evaluation of Emotional Intelligence under work place was attempted using various machine learning and deep learning techniques. Various performance evaluation metrics were used to analyse the performance of the models implemented. When comparing the result with another latest study on this problem got an enhanced result of the CNN classifier instead of SVM with including all its features attributes after handling missing values. In this work CNN based model was able to succeed highest accuracy result than all the other measured model building techniques, These results sturdily suggest that a CNN based model can be implemented for Emotional intelligence in workplace is worthy instead of the other conventional machine learning classifier suggested in earlier researches.

REFERENCES

- [1]. Bar-On, R. (1997). The Bar-On Emotional Quotient Inventory (EQ-I): A test of emotional intelligence.
- [2]. Carmeli, A., & Josman, Z. E. (2006). The relationship among emotional intelligence, task performance, and organizational citizenship behaviors. Human Performance.
- [3]. Baksh Baloch, Q., Saleem, M., Zaman, G., & Fida, A. (2014). The Impact of Emotional Intelligence on Employees' Performance. Journal of Managerial Sciences.
- [4]. Narayan, P. R., Narashiman. Emotional intelligence and Work performance: A conceptual study. ISOR Journal of Mechanical and Civil Engineering.

- [5]. Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. Imagination, Cognition and Personality.
- [6]. Vratskikh, I., Al-Lozi, M., &Maqableh, M. (2016). The impact of emotional intelligence on job performance via the mediating role of job satisfaction. International Journal.
- [7]. Shahhosseini, M., Silong, A.D., Ismaill, I.A., &Uli, J.N. (2012). The role of emotional intelligence on job performance. International Journal of Social Science.
- [8]. Salovey, P., & Mayer, J. (1990). Emotional intelligence, imagination, cognition, and personality. Sage Journals.
- [9] Boyatzis, R. &Boyatzis, R. E. (2009). Competencies as a behavioral approach to emotional intelligence. Journal of Management Development
- [10] Boyatzis, R., Koman, E. S., & Wolff, S. B. (2008). Emotional intelligence competencies in the team and team leader. Journal of Management Development.
- [13] Brooks, K. &Nafukho, F. M. (2006). Human resource development, social capital, emotionalintelligence. Journal of European Industrial Training.
- [14] H. Harald Freudenthaler ,Aljoscha C. Neubauer , Petra Gabler , Wolfgang G. Scherl ,Heiner Rindermann (2008) Testing and validating the trait emotional intelligence questionnaire(TEIQue) in a German-speaking sample
- [15] Suman Raj,SarfarazMazood (2020) Analysis and Detection of Autism Spectrum Disorder Using Machine Learning Techniques
- [16] Dr.DestiKannaiah, Dr. R. Shanthi (2015) A Study on Emotional Intelligence At Work Place
- [17]Dr.P. Julia Grace, N. NasreenBanu (2015) Machine Learning on Emotional Intelligence and Work Life Balance