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An Intelligent Machine Learning-Based Recommendation System For Promotions

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Abstract— **One of the most crucial procedures for human resources is the promotion process. An equitable promotion procedure inside the company is a managerial tool that inspires workers and supports business continuity. For many workers, a promotion is a significant extrinsic motivator. It guarantees the worker's involvement and dedication to the company and helps to maintain his present level of performance. It is also a crucial performance management and reward system for the company. Numerous elements are taken into account, including the employees who will be promoted's seniority, performance level, competencies, age, awards, training score, and organizational commitment. This study will examine a prediction methodology based on the factors that machine learning algorithms like Support Vector Machine, Artificial Neural Network, and Random Forest evaluate for the employees in the promotion procedures. With 98% accuracy, 96% precision, 1.0% recall, and 98% f1-score values using the ROS technique, Random Forest performed best. In order to determine the ideal conditions for a promotion, managers and HR could use this study to forecast the likelihood of a promotion.**

Index terms—**Machine Learning Algorithms, Principal Component Analysis, Support Vector Machine.**

I. INTRODUCTION

Promotion is one of the most sensitive subjects in an employee's life. When an employee is promoted, they are placed in a higher-level role with more authority, responsibility, and compensation. The success of the business and the motivation and loyalty of the staff both increase when the promotion process is implemented properly. When it comes to employee advancement, seniority and qualifications are the most crucial variables. A clear, objective promotion policy must be established and applied equitably if the organization is to succeed in career management. All employees should be informed in advance about the qualifications needed for promotion to each job, as well as the circumstances, people, and methods under which promotions will be made.

Increased authority, responsibilities, privileges, and responsibility are all indicators of career progression. Promotions have a positive and considerable effect on employees' work performance, according to research [1-2]. According to Haryano et al. [3], job performance is positively impacted by promotions.

Promotion is the process by which any employee in the company moves from their current role to one that will give them more authority, responsibilities, and status. Employee motivation is raised by the fact that they are in a better situation than they were in the institution. Because it is crucial for the worker to understand that their efforts will be appreciated and that they will have the chance to advance, both in terms of enhancing their dedication to the profession and improving their efficiency. Production, efficiency, and quality will all rise when this occurs. The business will be able to continue producing with high profitability as a result. Consequently, the employer and employee will be satisfied. An employee will be more content and dedicated to their task if they are promoted and receive

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greater benefits. Employee turnover is reduced and contented workers put in more effort and are more willing to work [4]. Work promotion, as defined by Dean and Joseph [5], is the expansion of the workforce or of employees currently working in better positions, as indicated by more duties, facilities, accomplishments, higher certification requirements, higher status, and higher incomes or salary. According to studies by Tessema and Soeters [6], there is a considerable correlation between employee advancement and performance practices. The purpose of job promotion, according to Knowles et al. [7], is to give high-performing employees greater status, recognition, and recognition. Obtain a larger income, more social standing, pride, and personal contentment. Productivity, discipline, and motivation at work are all increasing. Assure staff stability, review promotions using assessment indicators, conduct timely employee evaluations, and maintain transparency. Job promotion opportunities have a range of impacts on firms due to new occupations. giving staff members chances to develop their inventiveness and originality for the company's advantage. Increasing workplace experience and employee expertise inspires other workers. A new organizational structure is being adopted as a result of a role mutation. Shahzad et al.'s research findings [8] indicate a strong correlation between promotion and employee performance. "Since promotions have a positive relationship with employee performance and organizational productivity, there should be certain principles regarding promotions in company policies," he said.

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In this study, a decision support system regarding employee promotion eligibility is proposed for Human Resource (HR) departments. The use of unbalanced dataset methodologies to address imbalanced problems is the study's contribution. The paper's emphasis on parameter adjustment is another contribution. HR will be able to use the information to enhance key performance indicators (KPIs) in promoted positions by identifying employees who might be promoted as a consequence of this study. With 98% accuracy, 96% precision, 1.0 recall, and a 98% f1-score rate compared to SVM and ANN, RF performed better than the other algorithms in this study.

II. LITERATURE SURVEY

McIntyre states that it is optimal to stay with a company for ten years and receive three to four promotions throughout that time. "Those numbers also look good on a resume at a time like this," McIntyre adds. He says it makes sense for a worker with 30 years of experience to get promoted 10–15 times on average. In order to identify epilepsy cases from EEG signals, the study by Hameed et al. combined principal component analysis (PCA) and variable adaptive momentum (BPVAM) backpropagation, which can improve classification accuracy. They also conducted a comparative analysis with a few automated techniques. Mutlu et al. used the BUPA and ILPD datasets to create a Convolutional Neural Network (CNN)-based model for liver disease diagnosis. The effectiveness of CNN

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was contrasted with machine learning techniques including Logistic Regression (LR), K-neaest Neighbors (KNN), Support Vector Machine (SVM), and Naive Bayes (NB). In the BUPA and ILPD datasets, CNN achieved 75.55% and 72.00% accuracy, respectively, demonstrating its efficacy in liver disease classification. A model for early Parkinson's disease prediction was put forth by Rasheed et al. They used BPVAM and PCA to employ the size reduction strategy after classifying the same dataset using the variable adaptive moment-based backpropagation algorithm of ANN, also known as BPVAM. Through their research, they demonstrated that BPVAM-PCA is more effective than BPVAM. According to a regression analysis model put forth by Ufuk, there is a significant relationship between people's perceptions of promotion strategies and emotional, continuing, and normative commitment. Priority values for the candidate employees were established, and the suggested algorithm was utilized to identify the employees who would be promoted in a company. A clarification method based on the α-shear and optimism index was utilized to clarify fuzzy weights, and linguistic variables were employed to evaluate applicant individuals based on factors. This study looked at how employee performance, performance reviews, and job satisfaction relate to one another in Pakistan's banking industry. The SEM analysis method was used to sample 280 bank employees in Smart PLs. Given that employees anticipate rewards for their accomplishments, the results indicate that executives of private banks should place greater emphasis on recognition and incentive programs. In both cases, an employee's promotion is accompanied by either a higher group grade or a pay raise. It is acknowledged to be a step up in the job inside a promotion and is a continual process based on professional qualification and length of service. According to the author, there is a strong and favorable correlation between employee work performance and human resources practices like compensation, advancement, and performance reviews.

III. PROPOSED SYSTEM

The overview of our proposed system is shown in the below figure.

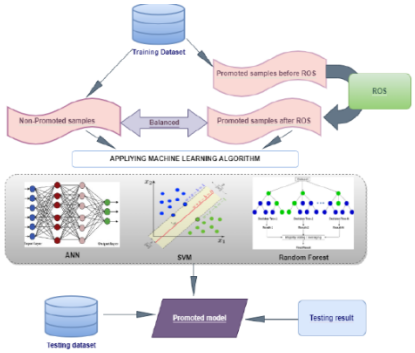

Fig. 1: System Overview

Implementation Modules

User Module

- In this module, user register and login to the system enter the employee details and predict whether employee promoted or not.

Preprocessing

- The employee data set is preprocessed in this module using techniques like data transformation, data cleansing, and data normalization. identifies the independent and dependent variables for additional analysis.

Split Data

The service provider divided the employed dataset in this module into 70% train data and 30% test data, accordingly. Thirty percent of the data is regarded as test data, which is used to evaluate the model, and

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seventy percent is regarded as train data, which is used to train the model.

Train Model

- The model is trained in this module using train data. Here, machine learning models like SVM and RF are being used.

Test Model

- The model is tested in this module using test data. In order to assess the model's performance, compute the accuracy, precision, and recall using the confusion matrix.

Prediction

- To determine whether an employee will be promoted or not, this module loads employee data.

Implementation Algorithms

Random forest

- It creates a number of decision trees, each of which makes a prediction based on a portion of the data sample.
- The outcome that the greatest number of trees were able to produce is then regarded as the final forecast.
- A supervised learning algorithm called Random Forest employs the ensemble learning approach for regression and classification. A bagging approach, random forests have trees that operate in parallel without interacting with one another.
- During training, a Random Forest builds many decision trees and outputs the mean of the classes as the prediction of each tree.

Support Vector Machine

Support-vector machines (SVMs, also known as support-vector networks) are supervised learning models in machine learning that use related learning methods to examine data for regression and classification. As a non-probabilistic binary linear classifier, an SVM training technique creates a model that allocates new samples to either category.

SIV. RESULTS

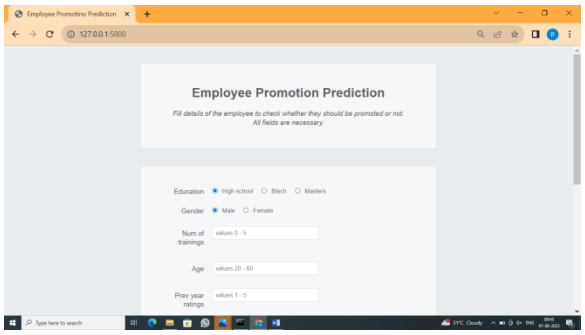

Fig. 2: Home Page

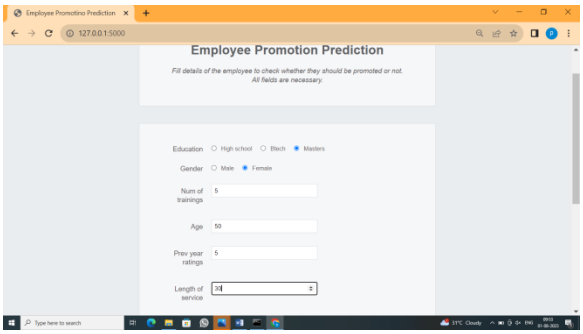

Fig. 3: Employee login

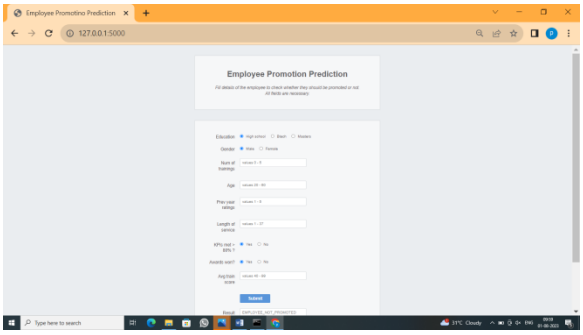

Fig. 4: Predicting employee Data

V. CONCLUSION

To pinpoint the earthquake in real time, we use the location of the seismic stations and the discrepancies in P-wave arrival times. In order to solve this regression

problem, random forest (RF) has been presented; the RF output is the difference in latitude and longitude between the seismic stations and the earthquake. Its instant applicability and highly successful performance are demonstrated by the usage of the Japanese seismic area as a case study. From neighboring seismic stations, we extract all events with at least five P-wave arrival timings. To build a machine learning model, we then divided the retrieved events into training and testing datasets. Furthermore, the suggested approach may train on just three seismic stations and 10% of the available dataset, yet still achieve promising results, demonstrating the adaptability of the suggested algorithm for real-time earthquake monitoring in more difficult regions. Numerous synthetic datasets can be used to make up for the lack of ray routes in a target area caused by inadequate catalog and station dispersion, even if the sparse distribution of many networks worldwide makes it challenging to train an effective model using the random forest method.

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