Prediction of Job Satisfaction from the Employee Using Ensemble Method

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Abstract - In an organization, employees are the major and important resources and may quit the job unpredictably which may produce immense cost. In general, the employee attitude and their effort are influenced by their personality traits but the job satisfaction may result for an individual observations from an organization based on the environment conditions. Meanwhile, the hiring of new employee may consume time and cost. Similarly, recently hired employee may need to put certain efforts for being productive. The job satisfaction of the employee is one of the factor for leaving out from the organization. The employee attrition prediction and its reasons to leave the organization required to be performed from Human Resource Management (HRM) perspective. This kind of prediction has to be progressed from HRM for analyzing the best and experienced employee's reason for leaving their organization using various data mining technique but the exact prediction is not obtained. This can be analyzed by seeing some experienced and best employee leaving their organization. Therefore, this paper has attempted for developing an ensemble model which assist in providing an accurate prediction of the employee attrition based on the HR analytics dataset. The proposed research work focus in analyzing the job satisfaction mentioned by the employee in the "Employee Attrition" has been considered by predicting the dataset using Weighed Average Mechanism (WAM) in ensemble method with Logistic Regression (LR). Moreover, the performance evaluation of proposed ensemble method attaints the higher accuracy of 98.2% which outperforms the other three existing methods for analyzing the better prediction of job satisfaction from the employees.

Keywords: *Job satisfaction, Ensemble Method, Employee, Organization, Weighted Average Mechanism, Human Resource Management (HRM), Prediction.*

I. INTRODUCTION

Acquisition, research, and review of data are producing new information in today's successful economy and its increasing technical specialization which are denoted to as the "knowledge economy." Technological developments is not only a source of data, but also an enabler of data analysis allowing for the processing of massive data sets and the extraction of information from them. Many companies including those involved in business processes, have turned to data as a strategic asset across multiple sector. The implementation of emerging technology supports all forms of organizations, analysis, management and data collection which provides various benefits of productivity and reasonable improvements [1]. In general, analyzing huge volumes of data may contribute to improve the processes of decision-making, achieving a pre-determined organizational goals, and increased market efficiency [2, 3]. There are several areas within the organization where adoption of ML affects the decision-making of a business [4, 5]. Human resources (HR) has received more attention in recent years, as the productivity and expertise of workers have become a development driver and a true competitive advantage for businesses [6]. Indeed, after growing rapidly in sales and marketing, Machine Learning (ML) is now being used to help companies for make decisions about their employees in order to predict HR management decisions on empirical data rather than subjective factors [7–9]. In general, businesses strive to increase their revenues. Since they have less contractual commitments, employees in companies where they perform basic tasks may choose for on-call, temporary or occasional jobs. However, the specialization and continuity of the employees' work is important for organizations in which employees perform more specialized tasks. For companies, the value of skills, expertise, and the opportunity to learn on the job has proven to be critical. The use of ML in the field for the HRM helps

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companies to turn data into information by applying predictive models. In addition, these models are admitted for identifying the employee forecasts based on data obtained about previous year activities from the organization by reducing the certain problems of the employees and even assist in optimizing the HR activities [10, 11].

Companies spend a lot of money and time for staff recruitment and training based on their strategic requirements [12]. Based on the obtained results, the employees are established with significant investment to an organization. In general, the employee leaving from an organization may not only cause the loss of employee but also losing the valuable resource. This is particularly a loss in investment of HR staff time and spends money to hire a respective employee as well as prepare them by feeding various tasks and skill enhancement program during their training. As a result, the company needs to continue their investment in new employee's recruitment, training, and development for fulfilling the job vacancies. However, the resigning or withdrawing of an employee from an organization is said to be employee attrition whereas new employee training is a lengthy and an affluent process for an organization. Hence, an organization best interest is to monitor and reduce employee attrition. Furthermore, happy, highly motivated, and loyal workers are at the heart of an organization and have effect on an organization's efficiency.

According to the job satisfaction exploration study, influential predictors of both separations and resignations, including salaries, hours and typical demographic and job variables, are available. This report made by the HRM progressed in paying and critical to their general occupation fulfillment whereas pay, including employer stability also consistently remained on the rundown of the best five activity satisfaction factors generally important to officials. Due to raise of economic growth, the employees are looking for high package and high contract rate which has become the issue to an organization. During this occasion, the HR of an organization need to plan for providing better compensation package to their best and experienced employee. This is one of the best strategies for an organization to retain their best and experienced employees.

Therefore, this research assist in illustrating the exact result in analyzing the employee expectation and helpful for HR to provide sufficient requirement to employee without losing the best employee for their organization. This can be analyzed through quantitative analysis by rating of the organization using various classification methods. These quantitative advantages are incorporated extra downtime, passes to occasions, trips, meals, open acknowledgement. There are few advantages are ordered by law, for instance, government disability, joblessness remuneration and laborer pay but the representative advantages incorporate annuity, medical coverage, incidental advantages, welfare and among others. These kinds of facilities are utilized by employees and asked for rating the facilities provided to them from the organization are measured statistically by classification concept and data visualization to analyze the employee job satisfaction from the HR. The main purpose of this paper has to predict or identify about their employee job satisfaction from the HR with the help of ML classifier using the ensemble algorithm.

This paper determines employee job satisfaction using Ensemble algorithms using WAM for improve predictions. The process of stacking is an Ensemble approach that uses Meta learning to combine several ML algorithms. The base level algorithms are trained using a full training data set, and the Meta model is trained using the final results of all base level models as a function. This strategy employs the bagging and boosting methods for dealing with bias and variance by a higher-level WAM that acquires the best aggregation of individual data. As a result, it considers the weights for specific features based on their value in order to increase model prediction accuracy.

The paper is organized is as follows. Section 2 encloses the literature review and state of the art work on employee job satisfaction using various classification algorithm. Section 3 describes proposed ensemble method with Weighted Average Mechanism (WAM) architecture with algorithm, Section 4 discusses the experimental results based on performance evaluation, Section 5 ends with conclusion.

II. LITERATURE REVIEW

In this section, many researches have been done using identification of job satisfaction based on ML technique. The current research focused in analyzing the job satisfaction mentioned by the employee using various classification methods.

With the aid of ML classifier, Anwar Hossen et al. [13] explain how to predict employee turnover. Using some prediction models, they were able to identify employee turnover selection variables. The attributes were then scaled. Second, a Sequential selection algorithm was used to decrease the number of features from a higher value to a small signal-canton. Then use the important algorithms of Chi-square and Random Forest to define the most important common features. The Random Forest classifier had the highest accuracy of

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99.4% when using the reduced feature with 10-fold cross-validation. Fallucchi et al. [14] explore analyzing how quantitative variables affect employee turnover in order to determine the major factors that influence an employee's choice to leave an organization and to predict when a specific employee would leave. HRM has been shown to be effective in working situations, development and management, and defining relationships with efficiency by a number of researchers [15, 16]. Indeed, the findings indicate that the influence of HRM on efficiency has a positive impact on a company's capital growth [17]. Many of the studies [18, 19] concentrate on evaluating and tracking businesses and their actions, but they do not discuss a company's key asset, which is portrayed by its employees. Many experiments have been conducted to investigate employee turnover. Existing research [20] has shown that the demographics and work characteristics of employees are most important factors affecting the turnover of employees, such as salary and duration. The effect of population attributes and the staff absenteeism on attrition was assessed by Nagadevara[21]. Rombaut and Guerry[22] focused exclusively on the factors of work. Usha and Balaji [23] compared the probability of an employee leaving the company using J48 Decision Tree (DT) and Nave Bayes (NB) classifier. Each algorithm is evaluated using two methods namely 10 fold cross validation and 70% split. However, the accuracy performance results of J48 DT by 10 fold cross-validation are 82.3% and the accuracy result using 70% split is 82.7%. Similarly, the accuracy results for NB classifier using 10 fold cross-validation is 78.9% and in the case of 70% split is 81.8% respectively. Hence, the performance of accuracy is high in the

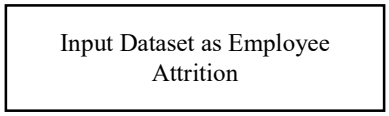
J48 DT while compared with NB on both 10 fold cross-validation and 70% split. Ponnuru et al. [24] investigated the use of Logistic Regression to predict employee turnover and found that it had an accuracy of 85% and a false negative rate of 14%. Kumar Gupta et.al [25] this study, data mining, ML and data science methods are applied to data captured on Twitter. A total of 142,656 tweets were made and these tweets were worked on. Among the applied algorithms, the highest success rate belongs to the Grandient Boosted Tree and it can accurately classify on a nearly balanced and bipolar dataset with a success over 99%. Jayadi et al. [26] employs ML to predict employee efficiency in an organization. The ML process adheres to the Cross-Industry Norm Data Mining Process (CRIPSDM). The prediction model is built using the NB classification process. The results show that NB correctly categorized instances in 95.48%. According to the report in [27], shows a high level of precision in the XGBoost classification for employee turnover. Because of the formulation, it is a reliable technique which is capable of dealing with data noise. Meanwhile, as per [28], at each organizational level, have at least the real turnover rate and turnover intention rate, and then report to the organization's leader at each level. The aim of Davidescu et.al [29] is to look at the effects of various forms of flexibility, such as functional, contractual, workspace flexibility and working time for recognizing the employee growth and flexibility significance in satisfying the specific requirement of an employee is an essential factor for sustainable HRM.

III. RESEARCH METHODOLOGY

The proposed research work has to examine for generating the most successful trends in predicting job satisfaction among the employee in the organization. The target variable present in the dataset is "job satisfaction". Data has been collected from employee attrition dataset with different job functions such as sales, Research and Development and Human Resource (HR) from an organizations [30]. There are nearly 500 samples of employee attrition records based on job satisfaction from the professionals which contains various attributes namely, age, employee no, gender, department, education field, employee count, job level, job role, job satisfaction, job involvement etc. are used for analysis in figure.1.

	Age	Departme	Education	Gender	JobInvolv	JobLevel	JobRole	JobSatisfa	MaritalSta	MonthlyIr	MonthlyR	NumComp
2		Sales	Medical	Male	3	2	Sales Exec	1	Single	8463	23490	0
3	53	Research	Medical	Female	4	2	Manufacti	1	Divorced	4450	26250	1
4	24	Human Re	Human Re	Male	1	1	Human Re	3	Married	1555	11585	1
5	45	Research	Life Scien	Male	3	3	Research	1	Divorced	9724	18787	2
6	36	Research	Life Scien	Male	3	2	Laborator	2	Single	5914	9945	8
7	34	Sales	Technical	Female	3	1	Sales Repi	3	Divorced	2579	2912	1
8		Research	Life Scien	Male	1	1	Laborator	3	Single	4230	19225	0
9	39	Research	Medical	Female	3	1	Laborator	3		2232	15417	7
10	45	Sales	Medical	Female	2	3	Sales Exec	4	Single	8865	16840	6
11		Research	Life Scien	Male	4	1	Laborator	4	Married	2269	4892	1
12	47	Sales	Life Scien	Female	2	1	Sales Repi	4	Single	3294	13137	1
13	43	Sales	Marketing	Female	2	3	Sales Exec	4	Single	10231	20364	3
14	44	Research	Medical	Male	3	2	Healthcar	2	Single	5933	5197	9
15	40	Research	Life Scien	Female	4	1	Laborator	3	Married	2213	22495	3
16	22	Research	Life Scien	Male	3	1	Research	3	Single	3375	17624	0
17	30	Research	Technical	Female	2	1	Research	1	Single	4968	26427	0
18	29	Research	Life Scien	Male	4	2	Healthcar	3	Single	6294	23060	8
19	36	Research	Life Scien	Female	4	1	Laborator	1	Single	2743	8269	1
20	47	Research	Life Scien	Male	3	3	Manager	2		11849	10268	1
21	34	Research	Medical	Male	3	4	Research	1	Divorced	17007	11929	7
22	31	Research	Medical	Male	2	1	Laborator	2	Single	3479	11652	0
23	47	Research	Medical	Female	3	2	Manufacti	4	Divorced	5070	7389	5

Figure.1 Sample Input data of employee attrition records



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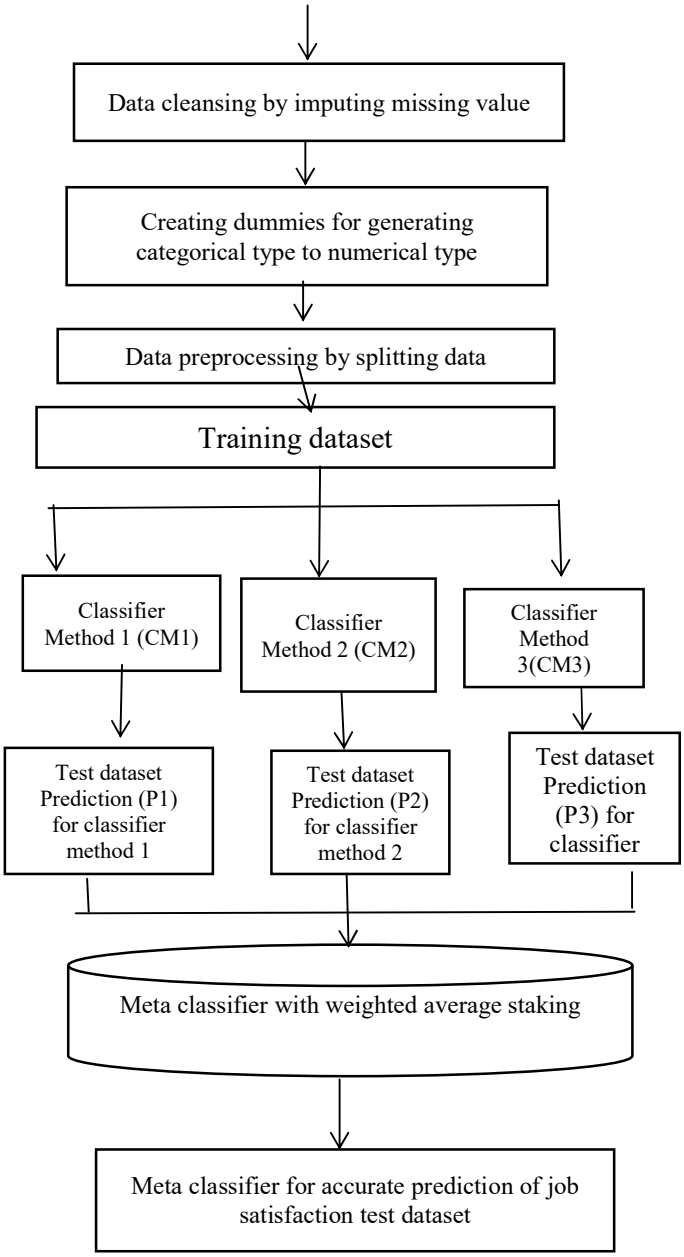

Figure 2 Proposed ensemble method with Weighted Average Mechanism (WAM) architecture

The proposed ensemble method with WAM architecture based prediction about of satisfaction of the employee is shown in figure 2. Initially data cleansing process has utilized for finding and imputing the missing value and progressed with creation of dummies to generate the categorical type value into numerical type.

A. Ensemble Model with WAM

Once the categorical variable have been modified in term of numerical variables by providing dummy function, the dataset is quiet easy to study the variable in an easy manner and the dataset is divided into train data and a test dataset, the train dataset used 70% whereas test dataset used 30% of the entire dataset. In this proposed ensemble method, there are three classifier have been selected for classification namely CM1 as K-Neural Network (KNN), CM2 as Random Forest (RF) and the CM3 as Naïve Bayes (NB). These three classifier predictions are obtained using ensemble technique (Bagging) with WAM's which aims to reduce the similarity between estimators in an ensemble model by training classifiers on random samples of features rather than the entire feature set. This WAM mechanism has considered the weights for particular features based on the essential of target variable and gets the final result is shown in figure 3.

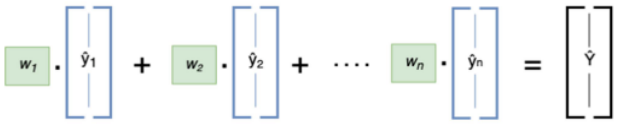

Figure 3 Weighted average stacking for ensemble model

Stacking is an ensemble learning technique which combines various ML algorithms through ML method. The basic level algorithms are trained using the entire training dataset, while the Meta classifier is developed using the final results of the entire base level model as a function. This research involves both bagging and boosting method to handle bias and variance that assist in train the stacking that improved the ensemble model prediction accuracy. However, the extension of stacking is voting classifier or regression using a blending level that assist in learning the best individual results aggregation. Hence, the stacking with WAM is benefit for specific with an individual algorithm result may be very complex in the case regression. The WAM can be expressed in the equation 1.

$$A_W = P_1 * w_1 + P_2 * w_2 + P_3 * w_3 + \cdots + P_n * w_n (1)$$

Where,
A_W = Weighted average of Meta classifier model

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P_n = Prediction of n^{th} individual classifier model
w_n = Weight of specific feature of n^{th} individual classifier model

Thus, the WAM assisted ensemble model with LR has predicted the job satisfaction status of the employee with high accurate manner. The algorithm of WAM based ensemble is illustrated below.

B. WAM with ensemble algorithm

Step 1:Let input data of employee attrition dataset is splitting into train and test as data preprocessing.
Step 2: Let considered the split train dataset to multiple and different classifier as CM_1, CM_2 and CM_3.
Step 3: Each classifier is working independently with different hypotheses and algorithms which represented as sub model and predicting the target as P_1, P_2 and P_3.
Step 4: The prediction of the classifier methods are weighted as w_1, w_2 *and* w_3 from the respective classifier.
Step 5: Stacking of all specific correlated results from classifier with the WAM as A_W as per equation 1.
Step 6: Ensemble the resulted prediction with Meta classifier as LR with high accuracy.

Thus, the prediction of ensemble method generate high accuracy by selecting the specific correlated feature results from the different classifier for accomplishing better result in predicting the job satisfaction of the employees in the organization.

IV. Result and Discussion

In this research, the dataset of employee attrition contain 500 instances whereas the 70% of the dataset is considered for the sample of training set and the remaining 30% as random sample present in the dataset is considered as testing set. In order to determine the better prediction using three other classifier model as an individual classifiers. The individual classifier testing prediction is identified and the confusion matrix parameter value for KNN, RF, NB and proposed WAM with ensemble LR is shown in Table 1. Similarly, the confusion matrix for proposed method is shown in figure 4. The implementation is carried out by python programming language and the results accomplished for performance evaluation of proposed WAM with ensemble model is compared with existing individual classifier prediction of confusion matrix parameter values.

Table 1 Confusion Matric value for proposed model with other existing classifier

Model Description	True Positive	False Positive	True Negative	False Negative
KNN	40	0	40	31
Random Forest	65	0	40	6
Naïve Bayes	68	3	39	0
Proposed WAM with ensemble LR	71	2	38	0

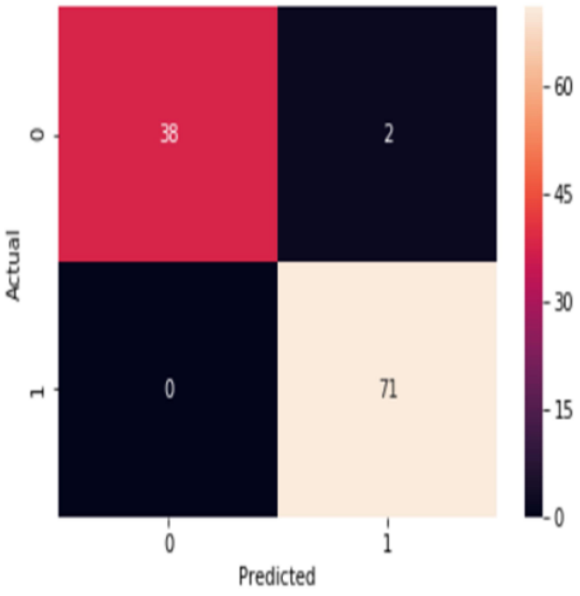

Figure 4 Confusion matrix for proposed WAM with ensemble LR

The metrics of confusion matrix have assisted to evaluate the performance efficiency of the model for predicting the job satisfaction of the employee effectively. Accuracy is the metric which can be calculated by number of correct prediction by total number of patients considered for observation. The accuracy score for ensemble model is 0.982 which illustrates the prediction of job satisfaction with most accurate while compare with other existing model KNN, LR and RF is shown in Table 2. Similarly the precision can be calculated as number of positive prediction by total amount of

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positive prediction whereas the proposed WAM with ensemble LR model is 0.973 which is comparatively lesser than KNN and RF and higher than NB is shown in figure 5.

Error rate is total amount of incorrect prediction by overall employee dataset in which proposed method is 0.018 that illustrate better prediction of job satisfaction for the employee in the organization using this model while compared to other existing model.

Table 2 Performance evaluation result for predicting Job satisfaction

Model Description	Accuracy	Precision	Recall	Error rate
KNN	0.721	1.00	0.563	0.279
Random Forest	0.946	1.00	0.915	0.054
Naïve Bayes	0.973	0.958	1.00	0.027
Proposed WAM with ensemble LR	0.982	0.973	1.00	0.018

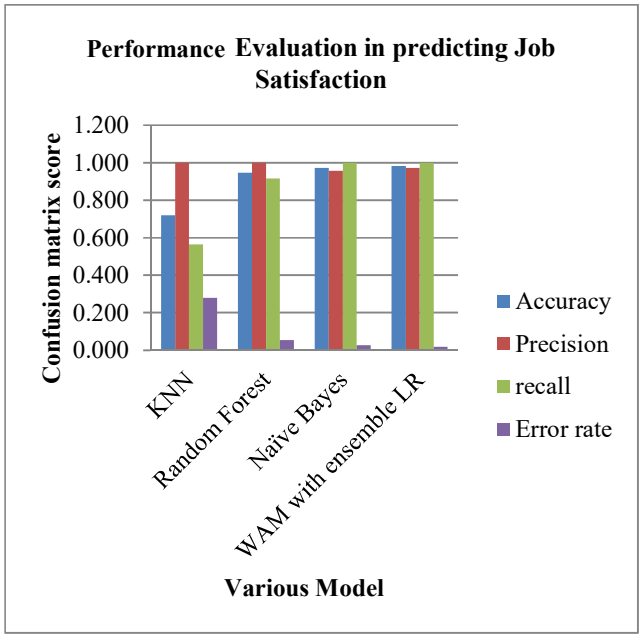

Figure 5 Performance Evaluation of WAM with ensemble model Vs existing model

The major metrics considered for evaluating the performance of the job satisfaction dataset is sensitivity and specificity. The sensitivity is measured as total correct positive prediction by total number of positive prediction in dataset. The sensitivity of proposed WAM with ensemble LR is 1.0 which is higher while compared with other existing KNN and RF is shown in Table 3. In other hand, the specificity can be measured as number of correct negative prediction by total number of negative prediction in dataset. The proposed WAM with ensemble LR is 0.95 comparatively lesser than KNN and RF whereas it is higher while compared with NB is shown in figure 6. Thus, the evaluation of performance assists in predicting the dataset very precisely with better prediction in job satisfaction for the employees. This prediction may assist HRM to find out the issues faced by the employees and focus the experienced and best employee to keep them in their organization by fulfill the employee requirement.

Table 3 Performance evaluation based on sensitivity and specificity in predicting Job satisfaction

Model Description	Sensitivity	Specificity
KNN	0.563	1.00
RF	0.915	1.00
NB	1.00	0.929
Proposed WAM with ensemble LR	1.00	0.950

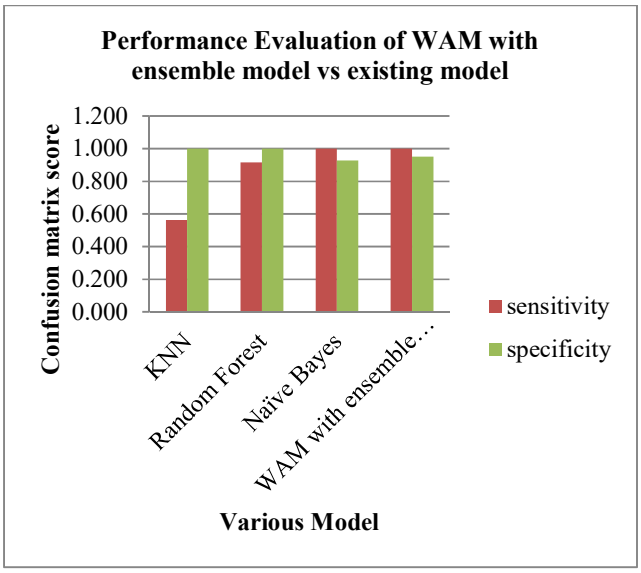

Figure 6 Performance evaluations for sensitivity and specificity

Hence, the proposed WAM algorithm plays a main role for better way of feature extraction which makes the dataset with significant variables related to the target of the dataset. The weighted average of ensemble model with LR has accumulated the significance features from the three individual classifiers namely KNN, RF and NB. Thus, the

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accumulated weighed average of classifier prediction has enhanced the prediction level with more accuracy score of 0.982.

V. ONCLUSION

This study analyzes the compensation as a source of employee job satisfaction. This examination is attempted in measuring the pay obtained for the job on fulfillment of representative's employment. In addition, the integrated research model has demonstrated the job satisfaction of employees by mediating the role of psychological support and reducing the influence of proactive personality. Moreover, the extracted dataset is trained and tested with subset of classifier namely KNN, RF and Naïve Bayes. It is used as the trained input for ensemble LR model whereas the WAM has been utilized for accumulating the significant features as the trained dataset that help in improving the prediction as the results. As a result of the findings, it can be inferred that a lack of pride in employer's work can have a significant effect on overall job dissatisfaction. Similarly, looking for a new job may have a direct link to job dissatisfaction whereas a challenging work environment has had a significant effect on job dissatisfaction classifications. The benefit of ensemble learning technique for aggregating the output of several data mining models KNN, RF and Naïve Bayes for classification and LR is used for predicting the job satisfaction finding with the help of those classifier models. The proposed WAM with ensemble LR is implemented using python programing language and performance is evaluated by comparing ensemble models with a three individual classifier models. Therefore, the experimental results illustrated that prediction accuracy is 98.2% and sensitivity is 1.00 of proposed method is comparatively higher than other existing method which outperformed results obtained from bagging ensemble. Moreover, the results are not sufficient in justifying the accurate or exact amount of job satisfaction or dissatisfaction employees due to many resignations happening after this analysis. Thus qualitative analysis is required using of their social media conversation about their job discussion with their colleagues in their organization.

REFERENCE

[1] Cockburn, I.; Henderson, R.; Stern, S, "The Impact of Artificial Intelligence on Innovation. In The Economics of Artificial Intelligence: An Agenda", University of Chicago Press: Chicago, IL, USA, 2019; pp. 115–146.

[2] Jarrahi, M, "Artificial intelligence and the future of work: Human-AI symbiosis in organizational decision making", Bus. Horiz. 2018, 61, pp.577–586.

[3] Yanqing, D.; Edwards, J.; Dwivedi, Y, "Artificial intelligence for decision making in the era of Big Data", Int. J.Inf. Manag. 2019, vol-48, pp.63–71.

[4] Paschek, D.; Luminosu, C.; Dra, A, "Automated business process management-in times of digital transformation using machine learning or artificial intelligence", In MATEC Web of Conferences; EDP Sciences: Les Ulis, France, 2017; Volume 121.

[5] Varian, H, "Artificial Intelligence, Economics, and Industrial Organization", National Bureau of Economic Research: Cambridge, MA, USA, 2018.

[6] Vardarlier, P.; Zafer, C, "Use of Artificial Intelligence as Business Strategy in Recruitment Process and Social Perspective In Digital Business Strategies in Blockchain Ecosystems", Springer: Berlin/Heidelberg, Germany, 2019; pp. 355–373.

[7] Md. Anwar Hossen, Emran Hossain, ZahereelIshwar Abdul Khalib and FatemaSiddika, "Ensemble method based architecture using random forest importance to predict employee's turn over", Journal of Physics: Conference Series, 2021, doi:10.1088/1742-6596/1755/1/012039.

[8] Francesca Fallucchi , Marco Coladangelo , Romeo Giuliano and Ernesto William De Luca, "Predicting Employee Attrition Using Machine Learning Techniques", Computers 2020, vol-9, No.86; doi:10.3390/computers9040086.

[9] Marchington, M, Wilkinson, A., Donnelly, R., Kynighou, A, "Human Resource Management at Work" , Kogan Page Publishers: London, UK, 2016.

[10] Van Reenen, J, "Human resource management and productivity", In Handbook of Labor Economics; Elsevier: Amsterdam, The Netherlands, 2011.

[11] Deepak, K.D, Guthrie, J, Wright, P, " Human Resource Management and Labor Productivity: Does Industry Matter? ",Acad. Manag. J.,2005, vol-48, pp.135–145.

[12] Gordini, N and Veglio, V, "Customers churn prediction and marketing retention strategies. An application of support vector machines based on the AUC parameter-selection technique in B2B e-commerce industry", Ind. Mark. Manag. 2016, vol-62, pp.100–107.

[13] R. Lokeshkumar, E. Maruthavani, and A. Bharathi , A new perspective for decision makers to improve efficiency in social business intelligence systems for sustainable development, International Journal of Environment and Sustainable Development 2018 17:4, 404-416.

[14] S. Balakrishnan, V. K. and M. S. S. Hameed, "An Embarking User Friendly Palmprint Biometric Recognition System with Topnotch Security," 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS), 2021, pp. 1028-1032, doi: 10.1109/ICICCS51141.2021.9432230.

[15] V. Arulkumar A Survey on Multimedia Analytics in Security Systems of Cyber Physical Systems and IoT, 2021 2nd International Conference on Smart Electronics and Communication (ICOSEC) pp 1556-1561, Nov 2021. 10.1109/ICOSEC51865.2021.9591754

[16] Ravi Kumar Poluru & Lokesh Kumar R (2021) An Improved Fruit Fly Optimization (IFFOA) based Cluster Head Selection Algorithm for Internet of Things, International Journal of Computers and Applications, 43:7, 623-631, DOI: 10.1080/1206212X.2019.1600831

[17] Selvan.C, S.R.Balasundaram, (2020), Data Analysis in Context Based Statistical Modeling in Predictive Analytics, IGI Global, Handbook of Research on Engineering, Business, and Healthcare Applications of Data Science and Analytics, pages 98-114.

[18] V. Arulkumar An Intelligent Face Detection by Corner Detection using Special Morphological Masking System and Fast Algorithm, 2021 2nd

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International Conference on Smart Electronics and Communication (ICOSEC) pp 1556-1561, Nov 2021.

[19] Keramati, A, Jafari-Marandi, R, Aliannejadi, M, Ahmadian, I,Mozaffari, M, Abbasi, U, "Improved churn prediction in telecommunication industry using data mining techniques",Appl. Soft Comput. 2014, vol-24, pp.994–1012.

[20] Alao, D and Adeyemo, A, "Analyzing employee attrition using decision tree algorithms",Comput. Inf. Syst. Dev. Inf. Allied Res. J. 2013, vol-4, pp.17–28.

[21] Nagadevara, V, "Early Prediction of Employee Attrition in Software Companies-Application of Data Mining Techniques",Res. Pract. Hum. Resour. Manag. 2008, vol-16, pp.2020–2032.

[22] Rombaut, E and Guerry, M.A, "Predicting voluntary turnover through Human Resources database analysis" ,Manag. Res. Rev, 2018, vol-41, pp.96–112.

[23] Usha, P and Balaji, N, "Analyzing Employee attrition using machine learning", Karpagam J. Comput. Sci. 2019, vol-13, pp.277–282.

[24] Ponnuru, S. Merugumala, G. Padigala, S. Vanga, R and Kantapalli, B, "Employee Attrition Prediction using Logistic Regression", Int. J. Res. Appl. Sci. Eng. Technol, 2020, vol-8, pp.2871–2875.

[25] Sandeep Kumar Gupta, Reznik Nadia P, Esra SIPAHI, Sayonara de FátimaTeston and AbrhamFantaw, "Analysis of the Effect of Compensation on Twitter Based on Job Satisfaction on Sustainable Development of Employees Using Data Mining Methods", Talent Development & Excellence, vol.12, N0.3s, 2020, pp.3289-3314.

[26] RiyantoJayadi, Hafizh M. Firmantyo, Muhammad T. J. Dzaka, Muhammad F. Suaidy and Alfitra M. Putra, "Employee Performance Prediction using Naïve Bayes", International Journal of Advanced Trends in Computer Science and Engineering, Volume 8, No.6, https://doi.org/10.30534/ijatcse/2019/59862019.

[27] R. Punnoose and P. Ajit, "Prediction of Employee Turnover in Organizations using Machine
Learning Algorithms", Int. J. Adv. Res. Artif. Intell., vol. 5, no. 9, pp. 22–26, 2016.

[28] G. Cohen, R. S. Blake, and D. Goodman, "Does Turnover Intention Matter? Evaluating the Usefulness of Turnover Intention Rate as a Predictor of Actual Turnover Rate", Rev. Public Pers. Adm., vol. 36, no. 3, pp. 240–263, 2016.https://doi.org/10.1177/0734371X15581850

[29] Adriana AnaMariaDavidescu ,Simona-AndreeaApostu , Andreea Paul and IonutCasuneanu, "Work Flexibility, Job Satisfaction, and Job Performance among Romanian Employees— Implications for Sustainable Human Resource Management", Sustainability 2020, vol-12, pp.6086; doi:10.3390/su12156086.

[30] https://www.kaggle.com/colearninglounge/employee-attrition.

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