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RESEARCH ARTICLE

An Effective Opinion Mining-Based K-Nearest Neighbours Algorithm for Predicting Human Resource Demand in Business

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BON VIEW PUBLISHING

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Abstract: The process of estimating and preparing for an association's future supply and management of human resources is known as human resource planning (HRP). It is a significant section of directorial development. This study suggested a novel technique to HRP demand forecasting using the Modified K-nearest neighbor (M-KNN) algorithm. M-KNN is machine learning (ML) algorithms that locate the k major comparable data sample to a new information sample and uses those data sample to forecast the value of the new sample. We generate an HR order estimate pointer organization consisting of variables that pressure HR order such as market share, sales volume, and economic conditions. We use M-KNN to find the k most similar data samples to each data point in the display organization and use those data samples to predict HR command. We assessed our M-KNN algorithm using data from a actual association and find that it can correctly forecast HR command with an fault speed of less than 5%. M-KNN is a talented advance to HRP command forecasting as it is easy to use, does not necessitate a lot of data, and can exactly predict HR command in the attendance of non-linearity and haziness.

Keywords: HR demand, business, HR management, M-KNN algorithm, origin tool

1. Introduction

Human resource management (HRM) professionals often need to think outside the box to find ways to keep their businesses going and assist their employees in overcoming obstacles brought on by unusual circumstances. However, managers and HRM practitioners could benefit from more research on the impacts of COVID-19 in HRM, complexity to them, and HRM's ability to help organizations weather the crisis, provide for their employees, and protect their brand reputation [1].

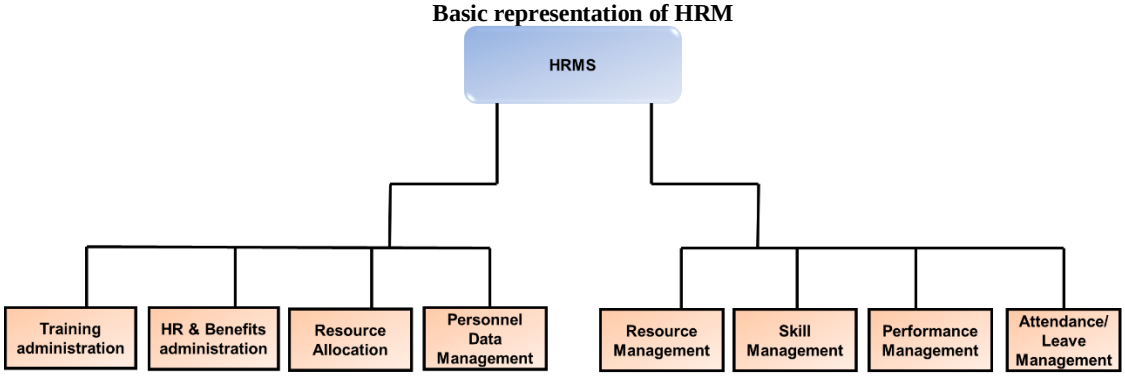
The terms "digitalization," "digital transformation," and "digital disruption" are becoming increasingly common in the field of human resource management. These terms signify an ever-increasing usage of technology and related significant developments in a variety of commercial and societal spheres. The increased usage of these sentences indicates that the idea of computerized HRM is gaining influence in the human resource management field. Conceptual elements like "transformation" and "disruption," which further indicate significant changes for HRM, allude to the ideas' undeniably significant relevance [2].

Since the declaration that COVID-19 is a global epidemic, businesses have started laying off workers and suffering from a decline in customers. The most important motive for this is the reduction in effectiveness and output from their personnel. Many companies are stressed to manage with the effects of the topical financial recession, the growing political upheaval in both developed and developing countries, and climate changing impacts. Directorial problems in the fields of advertising and person reserve organization really affect a company's probable for planned process and long-term presentation in today's fast-paced atmosphere [3].

Academic have paid a lot of concentration to human resource management (HRM) since of its significance in annoying times. Over the past two decades, HRM has developed into a more strategic function that recognizes personnel as assets that

build up an organization flexibility and its capability to conditions financial crisis. Due to its vital nature in times of crisis, HRM has garnered considerable academic concentration. Since its inception two decades ago, HRM has seen important change, variable from a center on labor organization to a more planned role that recognize employees as possessions that augment a company's competitiveness and permanence even during extensive financial downturn [4]. Figure 1 illustrate the basic association of HRM.

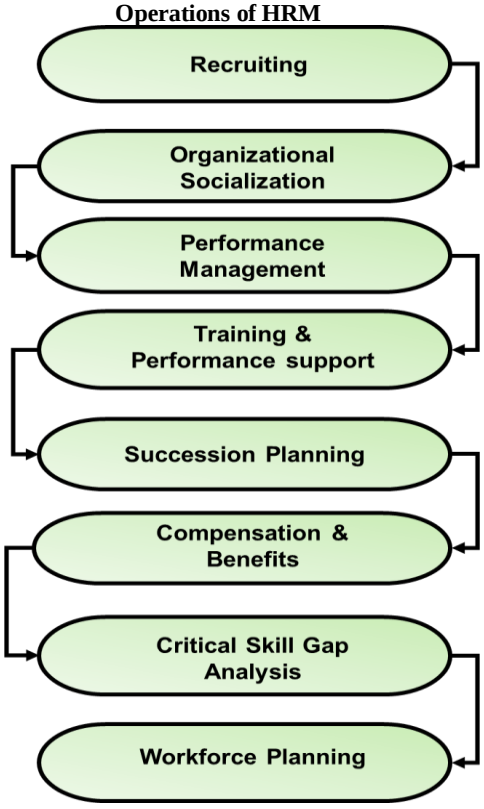
Figure 1
Basic representation of HRM



The goal of this analysis is to evaluate the efficacy of various HR policies in encouraging employees to work longer hours by synthesizing the relevant literature and identifying HR practices that organizations can use. This framework will be used to study ability, motivation, and perseverance. The purpose of this study is to set a future research agenda and promote the importance of evidence-based practice [5].

Traditionally, business management has prioritized quarterly earnings over long-term employee needs. As the public becomes more aware of the potential economic, environmental, and social implications of the corporate environment, companies' commitment to sustainability is becoming increasingly critical [6]. Figure 2 shows the roles of human resource management.

Figure 2
Operations of HRM



Management must continually create new approaches to human resources (HR) in order to maximize this asset, ensure the effective implementation of policies and procedures, and improve long-term performance. Human resources have a significant impact on business outcomes and are valued by company leadership. Human resources (HR) can bring about modernization, long-term presentation, and the effective use of commercial property, all of which can help decrease possibility and dispute and keep a production aggressive in the advertise. Employee commitment and correlation is complicated to preserve in a hybrid or isolated effort atmosphere. This study recommend an M-KNN approach for predict prospective conscription requirements. M-KNN utilizes tactics to cultivate robust executive traditions, advance team growth, and moderate approach of separation [8].

Contribution:

1) The Modified K-Nearest Neighbors (M-KNN) algorithm anticipated for determine production require for human resources current a considerable involvement to the field of personnel arrangement and organization.

2) The datasets gathered pertain to business demand for HRs, focusing on predicting such require.

3) The data was pre-processed using the Min-Max Normalization.

4) An M-KNN algorithm can be effectively applied to predict business demand for human resources by incorporating specific features relevant to workforce planning.

Following portion of the article: related works are provided in part 2. The proposed methodology is explored in part 3. Part 4 examined the results and discussions. Conclusions are determined in part 5.

2. Related Works

Snell et al. [9] provided a description of a collection of management academic publications that address an analysis roadmap for potential HR environments and examines the ecology of labor and organizations. To provide the academics with the clear roadmap to conduct independent function of HR with the job and organizational environment by presenting the findings and trends in this particular volume. Obeidat et al. [10] improved the field of green human resource management (GHRM) with the concrete examination of a thorough method that examines the impact of green strategy on the execution of GHRM, the potential relationship between GHRM and green power the relationship between sustainable performance and the circular economy. The relationship among GHRM and sustainable achievement was examined, having a focus on its function as a mediator.

Iqbal et al. [11] investigated impact of GHRM procedures to organizational citizenship behavior for the environment (OCBE) and employees environmental commitment (EEC) within intermediary capacity about harmonious environmental passion (HEP).The findings showed a substantial relationship between GHRM procedures and both EEC and OCBE. Additionally, the connections between GHRM procedures and EEC with OCBE that was assisted in part by HEP. Panjaitan [12] determined Human Resource Information System (HRIS) adoption was boost HRM effectiveness. They used an analytical qualitative technique to conduct. The information utilized to gathered through previous investigations and a variety of research findings. The findings indicated that the presence of HRIS has the ability to boost the efficacy and effectiveness of HRM.

Mathushan et al. [13] utilized the Scopus database to examine the conceptual framework of management, the business, and accounting domain. To incorporate the bibliographic evaluations, which were sophisticated with modern techniques for examined the scientific materials. Liu [14] utilized comprehensive excavation technology to perform a thorough examination of the strategic use of human resources assessment. The HRM generates a vast quantity of data, specifically the data classification and evaluation were suggested using data mining techniques. The possibility to use predictive analytics to classify the workers deemed most probable to advance in the careers. Kakulapati et al. [15] used the ML approaches to examine employee data to improve that person's position in the company. The study using random forest (RF) classification to make it easier to classify employees based on the monthly salaries and to accomplish qualitative statistical techniques on data. It examined the employee performance employing methods of clustering based on the similarity of the performance metrics. In the global economy of present-day, anything could provide a business an advantage over peers and affect the long-term viability. The HRM and corporate social responsibility have developed to be extremely effective measures for businesses. In the global economy of present-day, anything could provide a business an advantage over peers and affect the long-term viability. The HRM and corporate social responsibility have developed to be extremely effective measures for businesses. Herrera and de las Heras-Rosas [16] examined the scientific production trends pertaining to HRM and Corporate Social Responsibility (CSR). The results show that over the past decade, there has been a massive increase in interest in studying these ideas. HRM and CSR were not thoroughly examined in terms of their potential, development, and measurement. Abdulmajeed et al. [17] presented a human resources department implementing machine learning during the recruiting process, machine-learning algorithms assist in choosing the greatest applicant for a position based on many criteria. Factors can include age, prior experience, and educational attainment. The binary classification approach was used to create a decision system based on these variables. It aimed to list the several factors that were closely related to recruiting. Meraliyev et al. [18] offered the machine learning-related answer to the issues facing the HR industry. Analysis of the traits that previous candidates have most frequently displayed was part of the study technique. Abdullah et al. [19] developed a secure authentication system that allows utilization of human resource management and data updates by utilizing the CNN classification algorithm to securely identify the user's face. Arfaee et al. [20] presented a technique for creating individualized and suitable training plans for each employee based on organization data analysis. Staff training planning generally incorporates job performance, organizational advancement, and layoffs. The tax assessor's information was looked at for this reason. Gangwani et al [21] developed a machine learning model for forecasting business performance using statistics of the business that includes data among entrepreneurs to Fortune 1000 businesses. Predicting

corporate performance has two primary challenges: (1) Determining the characteristics that define company performance; (2) Choosing and designing features based on the relationship between investors, businesses, and markets to ensure that predictive modeling produces positive results. Gao [22] utilized (M-KNN) algorithm to predict target users' consumption behavior by analyzing probable consumer demand. This assists with the targeted marketing of e-business items. Lu [23] aimed to provide a forecasting model for the need for human resources using intense human resources development, company development, and economic advantages as guiding principles. They use this model to forecast and assess the overall utilization of human resources within the organization as well as the personnel and quality structures.

Daneshfar et al. [25] provided an organized and thorough analysis of SSGC techniques, including both traditional and novel approaches. At the intersection of semi-supervised learning (SSL) and graph clustering, SSGC has become a key field that provides creative answers to challenging data analysis issues. Nevertheless, in spite of its importance and broad range of applications, there is a noticeable gap in the literature a thorough assessment that is exclusive to SSGC techniques and their many applications is noticeably lacking. Hernita et al., [26] explored three key areas: enhancing the ability of small and medium-sized enterprises' (SMEs) HR to function effectively as an important component in enhancing the productivity and labor absorption, determining the impact of HR capacity enhancement, business efficiency, utilization of technology, and diversification of businesses on the long-term viability of SMEs and increasing the role of government in promoting business development, increasing profitability, business stability, and sustainability of SMEs. The results demonstrated that enhancing human resource capacity, utilizing technology and expanding the business were all beneficial for raising SMEs productivity. The field of HRM has experienced a digital renovation known as Digital HRM (DHRM). Mobile devices, multimedia, social media via the internet, and information technology (IT) could be used in the DHRM's operation. Varadaraj and Al Wadi [27] intended to demonstrate that DHRM can enhance the efficiency of a company. The outcomes of the study could be essential to the business's implementation of digital HRM and for enhancing and optimizing company performance.

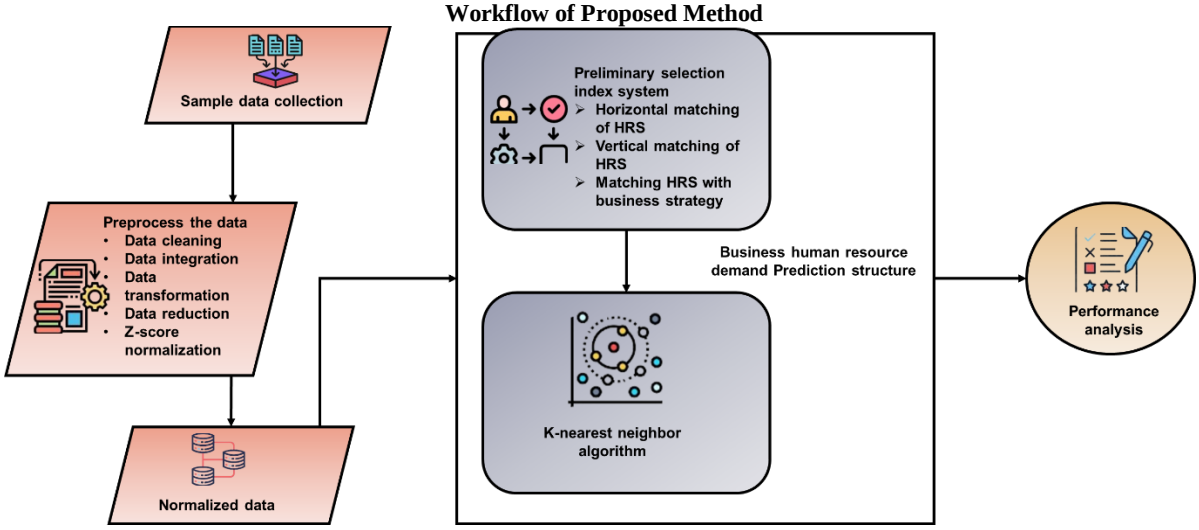
2.1. Problem statement

Predicting the need for human resources in a business takes into consideration complex variables like seasonal trends, expansion plans, employee turnover, market expansion, and the long-term impacts of the COVID-19 pandemic, making it a difficult task. In an economic environment where the global health crisis still has an impact, organizations will be able to strategically plan hiring, maximize budget usage, and manage their workforce based on the insights derived from this prediction. To tackle these issues, we propose a powerful M-KNN approach for predicting future staffing requirements.

3. Proposed Work

HRM entails activities such as recruiting, selecting, on-boarding, providing orientation, improvement, assessing function, determining advantages and salaries, motivating workers and maintaining professional relationships. For efficient HRM, this paper proposes M-KNN algorithm and Figure 3 depicts the workflow of proposed method.

Figure 3
Workflow of Proposed Method



3.1. Data collection

The data was gathered at three upscale hotels situated in three different Chinese urban areas. Each hotel has at least 200 rooms and has been operating for more than four years. The others are privately held; however, one is run by a major global hotel company. It is possible to get in touch with management via relationships, which is beneficial for conducting research in China. A survey was sent to every hotel that is taking part. Following its completion, sealing, and return to the researcher by the hotel's HR manager. For all three hotels, a total of 810 sincere responses were obtained from front desk employees. Many research on Chinese management have noted this high response rate There were 326 (40.2%) male employees and 484 (59.8%) female employees in the sample. The workforce's average tenure was 26.6 months (SD ¼ 37.15) and its average age was 25.5 (SD ¼ 7.9) years. Sixty-eight percent of the staff members were qualified from trade schools or high school, and they were paid more than those of their peers in other nearby accommodations. Every hotel has a number of service divisions, including food, security, and reception. For instance, a hotel's banqueting, beverage, restaurant, and room service departments are all included in the catering division. There were 64 entries in our dataset, including the three hotels [7].

3.2. Preprocessing

To overcome the issue of a large number range dominating the dataset, the attributes of the dataset were normalized. The min-max normalization process is frequently employed for normalizing the data as it exists. In this technique, we change the absolute minimum and absolute maximum values in the input data elements to the digits 0 and 1, respectively, and all other numbers to a decimal value between 0 and 1. Every input element's normalized value is determined by the equation (1),

$$w_j' = New_{min} + (New_{max} - New_{min}) * \left(\frac{w_j - w_{min}}{w_{max} - w_{min}}\right) \quad (1)$$

$w_{min}, w_{max}$to$New_{min} - New_{max}$ data are proportionally adjusted using this approach. This approach is preferable because it maintains the integrity of all data-value linkages. There is no possibility of bias being introduced into the data.

3.2.1. Data cleaning

Finding and fixing erroneous, missing, or unnecessary information within a dataset is known as data cleaning. It is a time-consuming, labor-intensive, and expensive process, but it is essential for ensuring the quality of data. Data quality issues can occur at any level of granularity in a database. For example, a database of customer records might have problems with inaccurate addresses, incomplete phone numbers, or irrelevant demographic data. Data cleaning methods vary depending on the specific data quality issues that need to be addressed. Some common data cleaning methods include:

1) Data validation checks the accuracy of data by comparing it to known values or rules.
2) Data standardization converts data into a consistent format.
3) Data sanitization removes reproduction or immaterial information.
4) Data integration combines information from several source into a single dataset.

The complication and size of the dataset, the capital accessible, and the exacting information excellence concern that require being address all authority the selection of data cleaning method. For example, to address the issue of duplicate records, one could use a name matching algorithm to identify records that refer to the same person. The optimal term recognition method is going to differ depending on the particular data set, as there are several strategies available. An integral component of managing information is data cleansing. By ensuring the quality of data, data cleaning can help to improve the accuracy of analyses, the effectiveness of decision-making, and the overall efficiency of an organization.

3.2.2. Data integration

Data integration in HR applications refers to the automated sharing of employee, applicant, and job-related data between HR applications, or the centralization of data from multiple sources into a single database. Automation and data integration is the next step in improving HR productivity and efficiency. In a database of sufficient size and age, it is rare to find data from a single data source that has been collected and entered in the same way over time. In almost all cases, databases are compiled from data collected from multiple sources using a variety of methods over time. Additionally, many databases grow by merging with other existing databases. This merging process almost always necessitates addressing discrepancies between the databases in terms of data formats, units, measurement periods, and other factors.

3.2.3. Data transformation

Data transformation is one of the keys supporting tasks in data preparation. It modifies data both structurally and instance-wise to suit the needs of analytical tools. While there are several commercial solutions for transformation challenges, such as Oracle Data Warehouse Builder or Microsoft Data Transformation Service, they perform transformation in a batch-like way and do not offer an exploratory and interactive approach. HR transformation is the process of transforming the HR department by

prioritizing radical change over incremental improvement. At the heart of HR transformation is the creation of a human resources department that reflects and contributes to the greater business and its strategic goals.

3.2.4. Data reduction

Recruiting, training, development, efficiency, and compensation are just a few of the HR processes that can be improved through HR data analysis. By using data-driven decision-making, human resource managers can help businesses achieve their goals more efficiently.

3.2.5. Z-score normalization

It is feasible into transform data values into a particular range via the preprocessing stage of standardization, that involves the decomposition of information into its numerical attributes. Z-score standardization modifies a value from a characteristic to an earlier unfamiliar scope, That can be noticed in formula (2).

$$A' = \frac{a_t - n_t}{std(T)} \quad (2)$$

A'= Standardizationoutcome value

A_t= The characteristic value that needs to be equalized

n_t=Characteristic for the median value

$std(T)$=Usualvariationcharacteristics$S$

3.3. Preliminary selection index system

The objective structure and the Delphi approach are two common selection index mining methodologies. Human resource planning requires an intuitive understanding of the concepts, benefits, and drawbacks of several methodologies in order to choose one that fits the primary selection index system's design.

3.3.1. Horizontal matching of HRs

We argue that horizontal alignment of employment practices and job design is necessary to capture the dual nature of performance goals and to enable the participation of both management and employee input into job design. A perfect design would have the highest level of horizontal fit, which is when a company's HR policies and processes are internally coherent.

3.3.2. Vertical matching of HRs

Vertical fit refers to how well an HR system aligns with other organizational characteristics, such as the business strategy. Vertical fit is achieved by allocate workforce to the most imperative responsibilities at tender and by using a contingency-based strategy. A contingency-based approach is a management approach that takes into account the unique circumstances of each organization. By using a contingency-based approach, HR professionals can ensure that their HR system is tailored to the specific needs of their organization.

3.3.3. Matching HRs with business strategy

Human resources (HR) can increase more manipulate and ability in executive across the association if it is associated with industry strategy. This can lead to augmented worker efficiency and approval, as well as superior collaboration and arrangement towards organizational goals.

3.3.4. M-KNN algorithm

M-KNN algorithm can be efficiently functional to forecast commerce command for HR by incorporate exact description applicable to workforce preparation. At first, the algorithm would necessitate training data surrounding past patterns of HR demand, such as seasonality, industry trends, and company growth trajectory. Additionally, variables like job roles, skill requirements, employee turnover rates, and economic indicators should be included to enhance prediction accuracy. Furthermore, feature scaling and normalization techniques can be employed to mitigate the influence of varying scales among different attributes. Algorithm 1 shows the pseudocode of MKNN.A M-KNN system had been finely tuned to handle the critical difficulties of data packet scheduling in WSN cyber security. Utilizing the M-KNN method, this system intelligently classifies arriving packets based on their similarity to previously observed patterns, thereby enhancing the infrastructure capability to identify, and stop internet threats efficiently. However, "Weighted k-nearest neighbor (WKNN) and dual WKNN (DWKNN)" Methods execute efficiently in contrasts, alongside the conventional M-KNN technique, the susceptibility of the categorization efficiency into options of the community size Yet departures, primarily in the information disproportion conditions. And we observed which the accelerating of few distance, that is selected as the balancing design, demonstrates improved categorization accuracy and less variation. Influenced through the efficiency of the explosive of few distance for categorization, we assume that it must be an improved applicant that is selected as the distribution plan. In this article, we develop an M-KNN method to moreover primarily defeat the impact of the surroundings in the instance of the downpour data set along with, an irregular dispersion. Assume a sample data alongside groups, where is the specimen values of, and is the attribute magnitude. In our M-KNN method, the category tag of a inquiry spot is provided through the subsequent stages.

Locate MKNN for the unidentified interrogation spot W in the sample data S, and let $\bar{S} = \{ (W_j^{MM} d_j^{MM}) \}_{j=1}^{l}$ signify the group of M-KNN for W, and the $W_1^{MM}, W_2^{MM} \cdots W_l^{MM}$ are ordered in an rising sequence based on their associated geometric interval to W.Assign diverse weights to M-KNN, and the mass, ω_i of "i-th nearest neighbor" is ascertained as

$$\omega_i = \{\exp\left(-\left(\left(\frac{c_l - c_i}{c_l - c_1}\right).\left(\frac{c_l + c_1}{c_l + c_i}\right)\right)\right) \quad c_l \neq c_1 \; c_l = c_1 \tag{3}$$

Classify the inquiry sign w within the group d via a most adjusted ballot of its residents.

$$\ddot{d} = \arg max_d \sum_{(W_i^{MM} d_i^{MM}) \epsilon \ddot{S}} \omega_i \,.\, \delta\,(d = d_i^{MM}) \tag{4}$$

Algorithm 1: M-KNN Pseudocode

Step 1: Calculate Distances
For each instance in the training set
Calculate the distance from the current instance to the new instance X
Store this distance in an array along with the corresponding class label
End For
Step 2: Sort the distances
Arrange the distances in the array in an ascending sequence
Step 3: Choose the instances of K closest
Choose the first K instances from the sorted array
Step 4: utilize the voting system weight to forecast the group of X
For each of the K instances
Add the class of the instance to the class count, but weight this by 1/distance
Step 5: Decide the group of another occasion X
The group with highest weighted count is the prediction for the group of the another occasion X
Return predicted group of X
End Procedure

4. Result and Discussion

This experiment utilizes Python 3.11 to develop novel algorithms on a Windows 10 laptop equipped with 32 GB RAM. Currently used techniques include support vector machine (SVM), random Forest (RF) and artificial neural network (ANN) [24]. We suggest MKNN approach. Using actual data within a work environment, the MKNN algorithm is applied to show the successful in forecasting demand for HR. We used the following parameters: precision, recall, accuracy, prediction error, and prediction rate.

4.1. Accuracy

An accurate forecast reduces the possibility of understaffing and overstaffing, maximizing to utilize of available property and raising the overall effectiveness of the organization. The prediction model's dependability depends on its capacity to reliably provide outcomes that substantially resemble the real HR requirements, offering a strong basis for tactical workforce management.

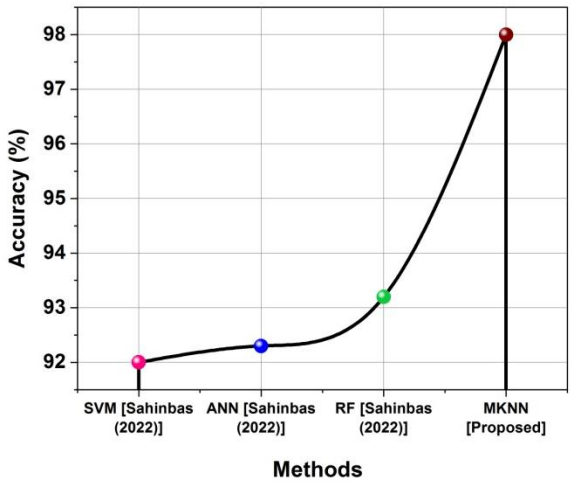
Accuracy is the measure of agreement between one's own and other employee's ratings. Accuracy is also the capacity for, or demonstration of, exactness or precision.

Another definition of accuracy is the degree to which a result in a measurement, computation, or specification satisfies a standard or the proper value. Accuracy is the tolerance to the real value of the measured value when a standard level and a standard wavelength are used to measure a value. Our suggested approach, MKNN (98%), offers a high level of accuracy compared to SVM (92%), ANN (92.3%), and RF (93.2%). Figure 4and Table 1depicts the comparative study about accuracy.

Table 1
Numerical outcomes of accuracy

Methods	Accuracy (%)
SVM [Sahinbas (2022)]	92
ANN [Sahinbas (2022)]	92.3
RF [Sahinbas (2022)]	93.2
MKNN [Proposed]	98

Figure 4
Comparative analysis of accuracy



4.2. Precision

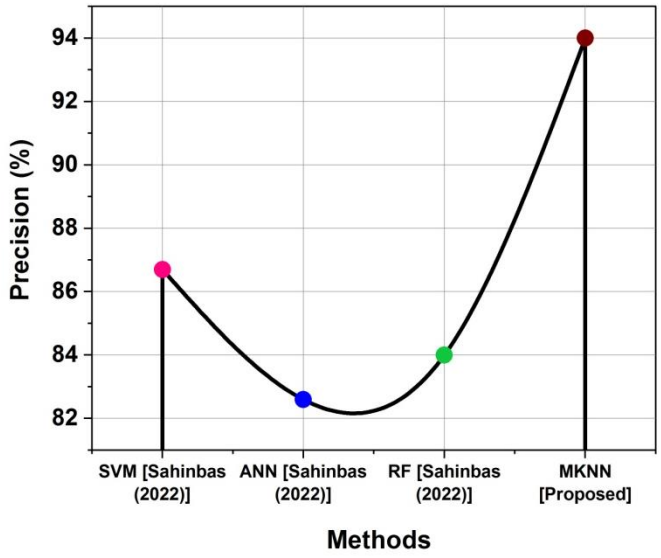
Precision is an important statistic for HR forecasting since it guarantees that the recognized demand closely matches the real demands for resources, allowing businesses to plan and manage personnel more intelligently.

When there is a high level of agreement between multiple independent observations, we say that the material is accurate. For example, weigh something five times and get 3.2 kg each time, that have a very precise but not necessarily accurate measurement. Precision does not require accuracy; the precision of a measurement is shown by the degree to which the difference between two measurement results (expressed as a decimal) is negligible. Our suggested approach, MKNN (94%), offers a high level of precision compared to SVM (86.7%), ANN (82.6%), and RF (84%). Figure 5and Table 2shows the comparative analysis of recall.

Table 2
Numerical outcomes of precision

Methods	Precision (%)
SVM [Sahinbas (2022)]	86.7
ANN [Sahinbas (2022)]	82.6
RF [Sahinbas (2022)]	84
MKNN [Proposed]	94

Figure 5
Comparative analysis of precision



4.3. Recall

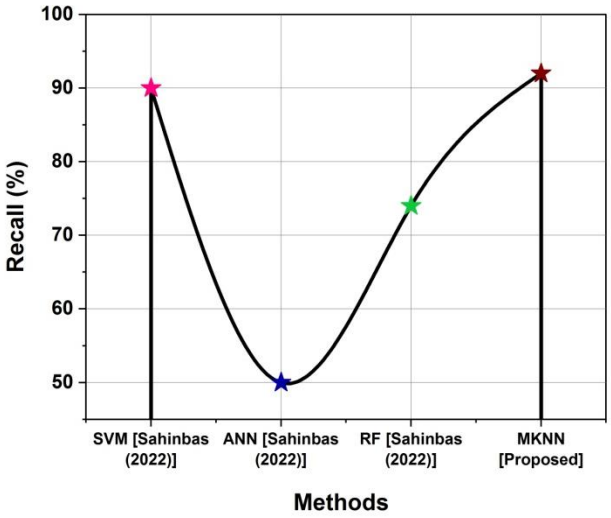
Recall is a crucial metric to make sure the predictive model fully determines the HR resources required to satisfy the ever-changing needs of the business environment.

When a product is recalled, the product shipments are stopped immediately. All stakeholders are informed, and a comprehensive plan is developed to recover or repair the defective goods. Recalls are conducted to protect consumers from potentially harmful products. An employee or the company will issue a public alert. You may be instructed to destroy a recalled product. Other recalls may require you to send the product in for repair or replacement. Identifying and swapping out faulty products is recognized as a product recall. Any expenses incurred by the business or producer for remediating damaged goods or making back lost revenue are covered. Our suggested approach, MKNN (92%), offers a high level of recall compared to SVM (90%), ANN (50%), and RF (74). Figure 6 and Table 3 shows the comparative study of prediction error analysis.

Table 3
Numerical outcomes of recall

Methods	Recall (%)
SVM [Sahinbas (2022)]	90
ANN [Sahinbas (2022)]	50
RF [Sahinbas (2022)]	74
MKNN [Proposed]	92

Figure 6
Comparative analysis of recall



4.4. Prediction error

Organizations are embracing an approach to continuous enhancement by seeing prediction error as a necessary component of the forecasting process. HR practitioners may improve the overall accuracy of projecting business demand for HR by integrating new data sources, refining existing forecasting processes, and learning from past mistakes via frequent analysis.

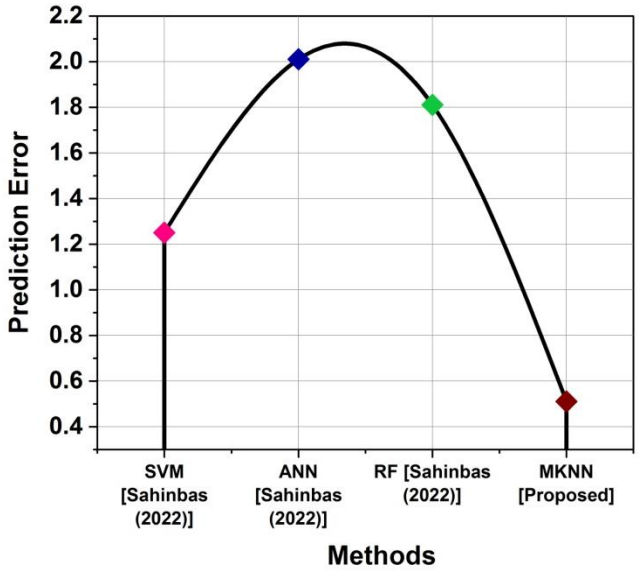
A prediction error occurs when a projected event does not take place. The percentage prediction error is often calculated using the formula: (predicted value - measured value) / measured value * 100. An unexpected occurrence is indicated by a positive prediction error when it occurred and it is indicated by an incorrect prediction error if it not performs. Our proposed method, MKNN (0.51), has a low degree of prediction error compared to SVM (1.25), ANN (2.01), and RF (1.81). Figure 7and Table 4 shows a comparison of prediction error analysis.

Table 4
Numerical outcomes of prediction error

Methods	Prediction Error
SVM [Sahinbas (2022)]	1.25
ANN [Sahinbas (2022)]	2.01
RF [Sahinbas (2022)]	1.81

MKNN [Proposed]	0.51

Figure 7
Comparative analysis of prediction error



4.5. Prediction rate

Prediction rate is a metric used to evaluate the accuracy of predictions made by a model or system. A high prediction rate indicates that the model is making accurate predictions, while a low prediction rate suggests that the model's predictions are less reliable. It is often used alongside other evaluation metrics to assess the overall performance of a predictive model. We need to study the predicted numbers to understand how a test functions in the real world. These numbers tell us about the test's potential for use in a population setting.

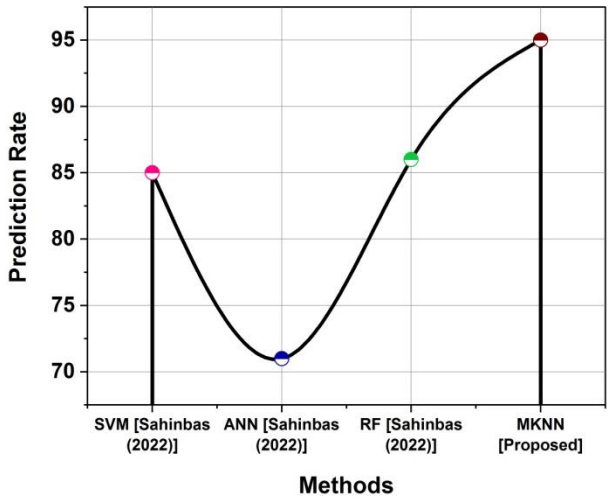
The experiment outcome indicates the possibility of precisely identify a subject's situation.

Our proposed approach, MKNN (95), offers a high level of prediction rate compared to SVM (85), ANN (71), and RF (86).Figure 8 and prediction rate is determined in Table 5.

Table 5
Prediction Rate Outcomes

Methods	Prediction Rate
SVM [Sahinbas (2022)]	85
ANN [Sahinbas (2022)]	71
RF [Sahinbas (2022)]	86
MKNN [Proposed]	95

Figure 8
Comparative analysis of prediction rate



1) Discussion

SVM can great effort with handling large datasets powerfully due to their computational difficulty, which can create challenges in real-time application. In addition, SVMs classically necessitate cautious assortment of hyperparameters, such as the option of kernel purpose, which can affect the model's presentation and simplification capability. ANN's performance heavily relies on the quality of input features and model architecture, potentially leading to suboptimal results if not appropriately configured. Finally, ANN's ability to generalize to unseen data may be compromised in dynamic business environments, necessitating frequent model updates and retraining. RF models rely heavily on input data quality; if the dataset is incomplete or biased, predictions may be inaccurate. Additionally, RF can struggle with extrapolation beyond the range of training data, potentially leading to poor forecasts during unprecedented circumstances. MKNN is proposed as a predictive model for forecasting business demand for human resources. MKNN leverages the principle of similarity to make predictions depending on the features of distant data points. In this context, it analyses historical data on factors such as project requirements, employee skills, and market trends to anticipate future HR needs.

5. Conclusion

HRM is a critical issue in favor of the socio-economic growth of all organizations, countries, and territories. This study achieves accuracy (98%), Precision (94%), recall (92%), prediction error (0.51), and prediction rate (95).

1) HRM is the procedure of acquire, increasing, and administration the HR of an association.
2) Human wealth is the information, skill, ability, and practice of the workers of an association.
3) HRM can supply a sustainable competitive advantage (SCA) for an association by selection it to magnetize, keep, and expand the best workers.

Prospective advertising and HRM procedures have been significantly impacted by the COVID-19 global crisis.

1) The pandemic has forced business for adjusting the HRM techniques for the new reality of remote working and with a distributed workforce.
2) It has also led to a enhanced emphasis on staff welfare and mental health.
3) The epidemic has also had a significant impact on marketing strategies, as organizations have had to adapt to the changing needs of consumers.

The proposed algorithm is a novel approach to HRM that can help organization to get better their effectiveness and usefulness.

1) The algorithm uses ML to examined data on worker presentation, skill, and preference.
2) This in order can then be used to make better decision about hire, preparation, and expansion.
3) The algorithm can also be used to recognize and tackle possible difficulties to employee well-being.
The proposed algorithm has the possible to transform HRM and help organization to succeed in the new normal.

5.1. Limitation and future scope

Organization and supporting employee's appointment, efficiency, and happiness in a practical place of work has become more complicated with the unexpected change to distant work. Due to fundamentals like being alone, impulsiveness, and the moving back of work-life limitations, the epidemic has a considerable unenthusiastic pressure on staff efficiency and psychological health. Plastic and capable personnel are necessary due to the express change in employment requirements and market dynamics. Future research on the arrangement of knowledge, data analytics, and artificial intelligence (AI) is predictable to change the natural world of jobs and call for a close assessment of the altering weight located on HR department in technically advanced workplaces.

Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The author declares that he has no conflicts of interest to this work.

Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Author Contribution Statement

Shashi Kant Gupta: Conceptualization, Methodology, Software, Validation, Formal analysis, Data curation, Writing - original draft, Writing - review & editing, Visualization, Supervision, Project administration.

References

[1] Hamouche, S. (2023). Human resource management and the COVID-19 crisis: Implications, challenges, opportunities, and future organizational directions. *Journal of Management & Organization*, 29(5), 799-814. https://doi.org/10.1017/jmo.2021.15
[2] Strohmeier, S. (2020). Digital human resource management: A conceptual clarification. *German Journal of Human Resource Management*, 34(3), 345-365. https://doi.org/10.1177/2397002220921131
[3] Kalogiannidis, S. (2021). The impact of COVID-19 on human resource management practices and future marketing. *International Journal of Industrial Marketing*, 6(1), 43-55. https://doi.org/10.5296/ijim.v6i1.17994
[4] Ngoc Su, D., Luc Tra, D., Thi Huynh, H. M., Nguyen, H. H. T., & O'Mahony, B. (2021). Enhancing resilience in the Covid-19 crisis: lessons from human resource management practices in Vietnam. *Current Issues in Tourism*, 24(22), 3189-3205. https://doi.org/10.1080/13683500.2020.1863930
[5] Pak, K., Kooij, D. T., De Lange, A. H., & Van Veldhoven, M. J. (2019). Human Resource Management and the ability, motivation and opportunity to continue working: A review of quantitative studies. *Human Resource Management Review*, 29(3), 336-352. https://doi.org/10.1016/j.hrmr.2018.07.002
[6] Macke, J., & Genari, D. (2019). Systematic literature review on sustainable human resource management. *Journal of cleaner production*, 208, 806-815. https://doi.org/10.1016/j.jclepro.2018.10.091
[7] Li, X., Frenkel, S. J., & Sanders, K. (2011). Strategic HRM as process: How HR system and organizational climate strength influence Chinese employee attitudes. *The International Journal of Human Resource Management*, 22(9), 1825-1842. https://doi.org/10.1080/09585192.2011.573965
[8] Ziyadeh, M. W., Othman, M., & Zaid, A. A. (2023). Effects of green human resource management on organisational sustainability: the mediating role of corporate social responsibility and organisational citizenship behaviour. *International journal of organizational analysis*, 32(2), 357-372. https://doi.org/10.1108/IJOA-11-2022-3506
[9] Snell, S. A., Swart, J., Morris, S., & Boon, C. (2023). The HR ecosystem: Emerging trends and a future research agenda. *Human Resource Management*, 62(1), 5-14. https://doi.org/10.1002/hrm.22158
[10] Obeidat, S. M., Abdalla, S., & Al Bakri, A. A. K. (2023). Integrating green human resource management and circular economy to enhance sustainable performance: an empirical study from the Qatari service sector. *Employee Relations: The International Journal*, 45(2), 535-563. https://doi.org/10.1108/ER-01-2022-0041
[11] Iqbal, R., Shahzad, K., & Chaudhary, R. (2024). Green human resource management practices as a strategic choice for enhancing employees' environmental outcomes: an affective events theory perspective. *International Journal of Manpower*, 45(4), 801-819. https://doi.org/10.1108/IJM-09-2022-0445

[12] Panjaitan, E. H. H. (2023). Implementing human resource information system (HRIS) for efficient human resource management. *International Journal of Science and Society*, 5(2), 128-139. http://dx.doi.org/10.54783/ijsoc.v5i2.676
[13] Mathushan, P., Gamage, A. S., & Wachissara, V. (2023). Human Resource Management and Artificial Intelligence: A Bibliometric Exploration. *Journal of Business Research and Insights (former Vidyodaya Journal of Management)*, 9(I). https://doi.org/10.31357/vjm.v9iI.6370
[14] Liu, J. (2022). Deconstruction and Implementation of Strategic Human Resource Management Evaluation Algorithm Using Data Mining Technology. *Mobile Information Systems*, 2022(1). https://doi.org/10.1155/2022/8890859
[15] Kakulapati, V., Chaitanya, K. K., Chaitanya, K. V. G., & Akshay, P. (2020). Predictive analytics of HR-A machine learning approach. *Journal of Statistics and Management Systems*, *23*(6), 959-969. https://doi.org/10.1080/09720510.2020.1799497
[16] Herrera, J., & de las Heras-Rosas, C. (2020). Corporate social responsibility and human resource management: Towards sustainable business organizations. Sustainability, 12(3), 841. https://doi.org/10.3390/su12030841
[17] Abdulmajeed, I., Nassreddine, G., Amal, A., & Younis, J. (2023). Machine Learning Approach in Human Resources Department. In S. Kaddoura (Ed.), *Handbook of Research on AI Methods and Applications in Computer Engineering* (pp. 271-294). IGI Global. http://doi.org/10.4018/978-1-6684-6937-8.ch013
[18] Meraliyev, B., Alibekova, B., & Bekturganova, I. (2023). Machine Learning as an effective tool for Human Resource management in recruiting process in the higher educational field. In *2023 17th International Conference on Electronics Computer and Computation (ICECCO)*, 1-5. https://doi.org/10.1109/ICECCO58239.2023.10147133
[19] Abdullah, R. M., Alazawi, S. A. H., & Ehkan, P. (2023). SAS-HRM: Secure Authentication System for Human Resource Management. *Al-Mustansiriyah Journal of Science*, 34(3), 64-71. http://doi.org/10.23851/mjs.v34i3.1332
[20] Arfaee, M., Bahari, A., & Khalilzadeh, M. (2022). A novel prediction model for educational planning of human resources with data mining approach: a national tax administration case study. *Education and Information Technologies*, 27(2), 2209-2239. https://doi.org/10.1007/s10639-021-10699-6
[21] Gangwani, D., Zhu, X., & Furht, B. (2023). Exploring investor-business-market interplay for business success prediction. *Journal of big Data*, 10(1), 48. https://doi.org/10.1186/s40537-023-00723-6
[22] Gao, X. (2023). KNN-based Precision Marketing Data Mining Algorithm for E-business Platform. In *2023 International Conference on Networking, Informatics and Computing (ICNETIC)*, 634-638. https://doi.org/10.1109/ICNETIC59568.2023.00136
[23] Lu, X. (2022). A human resource demand forecasting method based on improved BP algorithm. *Computational Intelligence and Neuroscience*, 2022(1). https://doi.org/10.1155/2022/3534840
[24] Şahinbaş, K. (2022). Employee promotion prediction by using machine learning algorithms for imbalanced dataset. In *2022 2nd International Conference on Computing and Machine Intelligence (ICMI)*, 1-5. https://doi.org/10.1109/ICMI55296.2022.9873744
[25] Daneshfar, F., Soleymanbaigi, S., Yamini, P., & Amini, M. S. (2024). A survey on semi-supervised graph clustering. *Engineering Applications of Artificial Intelligence*, 133. https://doi.org/10.1016/j.engappai.2024.108215
[26] Hernita, H., Surya, B., Perwira, I., Abubakar, H., & Idris, M. (2021). Economic business sustainability and strengthening human resource capacity based on increasing the productivity of small and medium enterprises (SMES) in Makassar city, Indonesia. Sustainability, 13(6), 3177. https://doi.org/10.3390/su13063177
[27] Varadaraj, A., & Al Wadi, B. M. (2021). A study on contribution of digital human resource management towards organizational performance. The International Journal of Management Science and Business Administration, 7(5), 43-51. https://doi.org/10.18775/ijmsba.1849-5664-5419.2014.75.1004

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