Human Resource Management Through Artificial Intelligence Model in the Healthcare

Saeed Rouhani*

IT Management Department, University of Tehran, Tehran, Iran.

Mehran Rezvani

Entrepreneurship Faculty, University of Tehran, Tehran, Iran.

Yalda Madadia

Phd. student in Business management, organizational behaviour and human resource management, Aras International Campus, University of Tehran, Tehran, Iran;

Corresponding Author: Saeed Rouhani: Associate Professor in Information systems, University of Tehran, Tehran, Iran .**E-mail:** srouhani@ut.ac.ir

https://doi.org/10.32388/3936AL

Abstract

The increasing complexity of the healthcare industry necessitates the recognition of human resources as a primary sustainable source of competitive advantage within healthcare management systems. This significance is magnified when healthcare professionals, physicians and nurses are considered. When human resource management (HRM) is discussed, it must be acknowledged that personnel are not devoid of emotions. The fostering of a healthy and sustainable working atmosphere is considered a critical responsibility by professional managers. In this research, a novel human resource management model is presented, which is based on AI: machine learning within the healthcare context. A deep learning model architecture based on CNN has been designed and optimized, which is trained in two scenarios through four datasets and also customized for the target hospital. The 92% accuracy is the power of the model in the recognition. The effectiveness of the model is assessed by curating a new dataset consisting of facial images of hospital professional staff displaying eight emotions: happiness, contempt, anger, sadness, disgust, fear, surprise, and neutrality. According to the post-implementation survey findings, the model has a positive impact on human resource management and enhances staff performance, making it suitable for modern and critical organizations such as hospitals and health canters. In the healthcare domain, effective communication is deemed essential for interactions with patients, as emotions play a significant role. Emotion recognition in human resource management has a profound impact not only on optimal work output but also on the relationships among personnel, clients, and the entire managed team.

Keywords:

Artificial Intelligence, emotion recognition, human resource management, machine learning, healthcare

1. Introduction

In order to attain success, career growth, and maintain a positive public image, it is crucial for employees to display positive workplace behaviours (Van Tilburg and Igou 2017). Conversely, negative emotions such as fear, tension, frustration, hatred, and sadness can impede employee engagement and decrease work efficiency (Gallagher and Varga 2014). Our emotional responses are often tied to our activities and behaviours, and they have the power to interrupt our thought patterns. Allowing negative emotions at work can have a significant impact on your overall perspective and emotions. Conversely, positive emotions can have a positive impact on the workplace by boosting productivity and promoting innovation (Zheng, Ping et al. 2021). The impact of emotions on work preparation is substantial, as they involve complex psychological processes. There are various emotions, including: happiness, contempt, anger, sadness, disgust, fear, surprise, and neutral, which are considered in this research.

Emotion recognition is one of the interesting fields in artificial intelligence (AI). Artificial intelligence (AI) has many fascinating fields, and emotion recognition is certainly one of them. The use of AI in human resource management (HRM) can enhance the efficiency of organizations in engaging and selecting employees who are best suited to fulfil their responsibilities. Additionally, it can have a favourable impact on employee retention, growth, and efficient utilization. The power of AI has the potential to transform organizations by influencing decision-making processes (Jarrahi 2018) and redefining management methods (Kolbjørnsrud, Amico et al. 2016). Artificial intelligence can improve the speed and efficiency of human resource management activities. Facial emotion recognition is an important factor in human communication that helps to investigate user behaviours (Ko 2018), In addition, the use of facial recognition technology for surveillance purposes is on the rise (Tran, Pham et al. 2022).

Currently, we exist in an era dominated by digital technology and communication, and many jobs are undergoing profound changes (Sivathanu and Pillai 2018), and we are faced with a series of innovations and ever-increasing advances in information and communication technology, and we are witnessing the emergence of intelligent organizations. Technology is one of the most important influencing factors in an organization and industry. So that the organization needs to redefine its identity around the new concept of technology, including artificial intelligence and machine learning (Jović, Tijan et al. 2022). According to its definition, artificial intelligence is a highly intelligent machine that acts as a flexible agent, comprehends its surroundings and makes decisions that increase the probability of achieving a goal (Yawalkar 2019).

Incorporating machine learning into human resource management has been linked to enhancing the efficiency and effectiveness of HR functions. By leveraging machine learning applications, the employee experience can be improved, and organizational operations can be streamlined (Garg, Sinha et al. 2022). In the modern world, nearly everything is run as a business, and the success of those businesses hinges on their employees - who are their most valuable asset. In today's highly competitive landscape, the ability to satisfy customers is crucial to achieving success, and many organizations have made it their top priority to meet their customers' needs (Urkude, Urkude et al. 2021). Organizations that can take advantage of new technologies are more successful. In the hiring process and division of work, the face recognition feature holds significant importance. Through the use of artificial intelligence, machine learning and employee information evaluation, people's performance can be measured (Nawaz 2020).

Facial emotional recognition helps to check the user's behaviour and is also attractive for monitoring. Emotional skills and good communication with customers and patients lead to satisfaction. The mental condition of people shows their behaviour. When

an employee can control his emotions, he has a better ability to solve problems when dealing with patients.

In this research, we proposed a human resource management model based on machine learning for improving performance and quality at health scopes. We trained the proposed model by the combination of three general motion datasets and evaluated the model by preparing a new dataset of facial images of hospital professional employees in eight emotions such as happiness, contempt, anger, sadness, disgust, fear, surprise, and neutral.

2. Related Work

Today, intense competition and business intelligence have prevailed in various business fields, and remaining in this environment requires quick and accurate decision-making by the managers of organizations (Rouhani and Zamenian 2021).

The impact of artificial intelligence and machine learning on human resource functions leads to the transformation of human resource management. Artificial intelligence increases productivity through the re-formation of methods used in human resource management processes. We should seek to design methods that can complement each other with artificial intelligence, machine learning, and human resource management. The integration of these is accompanied by increasing the efficiency and effectiveness of human resources functions. Human resource management has various processes, including division of labour, hiring, and attracting the best people. To succeed in the industry, be it product or service or knowledge management, organizations must strive to achieve better customer satisfaction, satisfaction is the key to their survival. Health and treatment centers are not exempt from this. Nowadays, due to the increase of diseases, emergency services have faced an increasing demand. On the other hand, due to the lack of manpower, overcrowding of medical centers, fatigue, and mental and

psychological tensions of people, it is possible to recognize the external characteristics of people and analyse emotions. Achieved better results when dividing tasks.

A wide range of techniques, tools, and philosophies can be used to plan human resources and monitor their work, and in this way, you can be sure that the right staff will be available. face-recognition systems are one of the most widely used (Huang and Alhlffee 2023).

Today, AI has penetrated various organizational processes. Intelligence machines will soon take the place of many humans in decision-making. AI determines its strength in organizational decision-making processes in conditions of uncertainty, complexity, and ambiguity with more calculations, information processing capacity, and analytical and cognitive approach when dealing with complexity. AI can be used to support essential businesses in times of crisis (Jarrahi 2018). AI assists HR managers to make better decisions and assess on employees' intellectual and emotional capabilities, in order to assign the right employee to the correct positions (Budhwar, Malik et al. 2022).

Hospitals and health centers are complex organizations that provide health services and deal with the life and health of people and society needs scientific, efficient, and up-to-date management. Human resources in hospitals include doctors, nurses, midwives, dentists, pharmacists, paramedics, technicians, managers, and supervisors who are involved with them to improve people's health. Therefore, the labour force is a vital element in strengthening hospitals (Belhaj and Tkiouat 2013). An employee with the right mental conditions can be a productive employee, and choosing the right person for the right job is one of the most important functions in human resource management.

Human resources are valuable resources for organizations and their analysis and forecasting are very important (Yuan, Qi et al. 2022). The key to delivering exceptional healthcare services to patients lies in the development of a skilled and competent

workforce. With the right personnel in place, healthcare organizations can ensure the delivery of top-notch services to patients (Ramadevi, Gunasekaran et al. 2016).

Effective human resource management is crucial to the success of any organization. Without people, an organization cannot function properly. People are a valuable asset for any organization and managing them effectively is essential for success in today's competitive landscape. If human resource management is integrated with artificial intelligence and machine learning, there will be a fundamental and significant change in the field of human resources (Yabanci 2019). The success of an organization relies heavily on the capabilities of its human resources to meet objectives. Human resources play a crucial role in achieving organizational goals and enhancing overall efficiency (Pap, Mako et al. 2022).

Having specialized skills to manage human resources for the competitiveness of attracting people and talents is increasing. This trend has led to an increase in the use of software and new technologies such as AI to achieve better efficiency in human resources processes, recruitment, and proper placement of personnel. AI and ML-based tools lead to more efficient and cost-effective recruitment and deployment of employees (Kulkarni and Che 2019). Therefore, by placing and dividing the work of human resources appropriately based on mental, and physical conditions, experience, information, and specialized knowledge, it is possible to provide quality services.

Emotions are emotional states associated with physiological responses. Recognizing emotions is very important in human interaction. Recognizing, diagnosing, and analysing people's feelings and mental and emotional states is very important and important for successful performance in life and work. It is possible to understand people's behaviour by recognizing and analysing people's mental states through their faces (Jain, Shamsolmoali et al. 2019). Facial expressions and facial changes give

information about a person's emotional and mental state. Being able to understand a situation is crucial for effective human interactions. Facial expressions are a significant aspect of communication between individuals. The utilization of facial recognition techniques can be incredibly beneficial in making informed decisions. Recognizing facial expressions can provide valuable information about an individual's emotional state, allowing for appropriate adjustments to be made during conversations. By knowing the general moods of people, you can have good interactions with people (Kulkarni, Reddy et al. 2009).

Machine learning can change the way human resource management works in an organization (Cabrera, Ganchozo et al. 2022). Many organizations have incorporated artificial intelligence and machine learning into various aspects of their operations, including human resource management. The main objective is to make decisions based on objective data analysis rather than subjective factors (Fallucchi, Coladangelo et al. 2020).

With the integration of artificial intelligence, human resource management has undergone digitalization. Its application has expanded to various areas like recruitment, performance evaluation, employee satisfaction, compensation, profit analysis, best practice analysis, employee training and development systems, and discipline management (Ritz, Donisi et al. 2023).

The incorporation of digital technologies in human resources results in enhanced organizational performance by facilitating talent-related decisions, forecasting workforce demands, and optimizing talent development and planning. Human resources play a crucial role in helping organizations achieve their goals by making informed decisions. They are responsible for managing employees by recruiting, training, ensuring employee satisfaction, enhancing productivity, and assigning tasks based on skill levels. Utilizing

digital technology in human resources results in enhanced organizational performance through better decision-making, planning, and workforce forecasting. An effective technique in achieving this is machine learning, which enables computers to emulate human thought processes and identify patterns (Priya and Sinha 2022).

The research conducted by Swati Garg and colleagues in 2021(Brooks, Puri et al. 2021) shows that human resource management has accepted machine learning. Although this technology is in its early stages, it has received a lot of attention from technology researchers. The applications of machine learning in the fields of recruitment and performance management are stronger. For complex processes, machine learning applications are still in the early stages, and there is a need for HR professionals and machine learning experts to work together. The implementation of machine learning in human resource management enhances the efficiency and effectiveness of HR functions. Its applications improve the employee experience and streamline operations within the organization (Garg, Sinha et al. 2022).

Many organizations consider artificial intelligence technology as an essential component of their business model, while various sectors of business, medicine, and governments worldwide view it as a crucial strategic element in their plans (Dwivedi, Hughes et al. 2021). Big data, artificial intelligence, and other cognitive computing technologies (CCT) facilitate the development of human resource management programs. Machine learning is one of the technologies that is currently making great strides in simplifying and improving HR performance.

Kulkarni et al. (Kulkarni and Che 2019) studied emotion recognition for recruiting and talent acquisition gaining importance within the HRM field. They represented that AI-based tools can significantly help to improve organizational efficiency. Barrett et al. (Barrett 2021) like Kulkarni et al. expressed AI for emotion has wide applications in

HRM in business organizations. It helps the HRMS during the recruitment of a candidate for selection and set them in the best position. Through an analysis of over 6 million YouTube videos, it was discovered that people across the globe display comparable facial expressions in similar social situations. Jain et al. (Jain, Shamsolmoali et al. 2019) analysed people's feelings and mental and emotional states for successful performance in life and work. They expressed that understanding people's behaviour is possible by recognizing and analysing people's mental states through their faces. They used a Deep Neural Network (DNN) model and trained it on two datasets Extended Cohn–Kanade (CK+) and also Japanese Female Facial Expression (JAFFE) Dataset. Li et al. (Li, Mai et al. 2020) studied hotel employees' interactive service. The individuals stated that hotel staff who experience emotional exhaustion also feel less connected to the company. This will negatively impact organizational effectiveness. They expressed HRM can serve as a solution to the problem. Their results showed that emotional exhaustion situations have a significant negative impact on organizational outperform and commitment. Ahmad et al (Ahmad, Zhang et al. 2021) in their research showed that emotions are expressed in different ways, including facial expressions, sounds, physiological signals, and text. Depending on the change of emotions, the physiological symptoms change rapidly. They used a Convolutional Neural Network (CNN) algorithm used to learn features in emotion recognition and obtained 94.86% accuracy. A technique was suggested by Sahu et. al. (Sahu, Kithani et al. 2021) to identify the seven emotions (happiness, contempt, anger, sadness, disgust, fear, surprise, and neutral) of employees in the workplace by analysing their facial expressions through their computer's web camera and evaluating the stress level. A report was produced for the company's human resources department at the conclusion of each day, which would evaluate the employees' stress levels. The HR

department could then engage with and advise the employees, boosting their motivation to produce high-quality work.

In the research conducted by Isah Salim Ahmad et al. in 2021, it is noted that emotions are expressed in different ways, including facial expressions, sounds, physiological signals, and text. Depending on the change of emotions, the physiological symptoms change rapidly (Ahmad, Zhang et al. 2021). The convolutional neural network (CNN) is one of the deep learning algorithms (DL) which is used to learn features in emotion recognition. Convolutional neural network performs well in emotion recognition. The proposed model is listed with 94.86% accuracy (Ahmad, Zhang et al. 2021). Neural network models consist of various levels of neuron representation, such as the input layer, hidden layer, and output layer. The convolutional neural network is a neural network structure that is primarily used for training models. Recognized as the most vital element of the human body, the face plays a significant role in identifying and verifying a person. This makes it useful for various applications in daily life (Musa, Vishi et al. 2021).

Facial expression is a common signal for all humans to convey and express their moods. Facial expressions can be used in various contexts. Emotion recognition can be used to provide better service and customer interaction. A person's feelings can have important consequences in service delivery. Expressing emotions is important in-service jobs, including providing healthcare services. The mental and psychological condition of the person providing patient care services plays a role in the quality of health and treatment measures (Mehendale 2020).

3. Materials and Methods

We proposed a human resource management model based on machine learning for improving performance and quality at work. This study is applied research that can be

used in many organizations. In this research, the Meta-synthesis method has been used as a suitable method to obtain comprehensive information about artificial intelligence, machine learning, human resource management, etc. In order to implement the Meta-synthesis, the seven-step model of Sandelowski, & Barroso (2007) (Sandelowski, Barroso et al. 2007)was used. Using Maxqda software, which is a special application for qualitative research, we analysed categories and articles. Also, since this research is trying to design a model, it is exploratory. In the following, we explain the conceptual and deep learning model architectures.

3.1. Conceptual Model Architectures

The architecture of the proposed model with two different scenarios is shown in Figures 1, 2. In Figure 1, we illustrated our model which performs via offline testing data (our generated dataset), while Figure 2 shows an extended model when testing data are online (each photo is captured every 30 minutes). We proposed an offline scenario of the model (Figure 1) to assess how our model works well in emotion recognition and then introduced an extended model for an online scenario (Figure 2) to assess how our model works well in improving performance and quality at the real workplace.

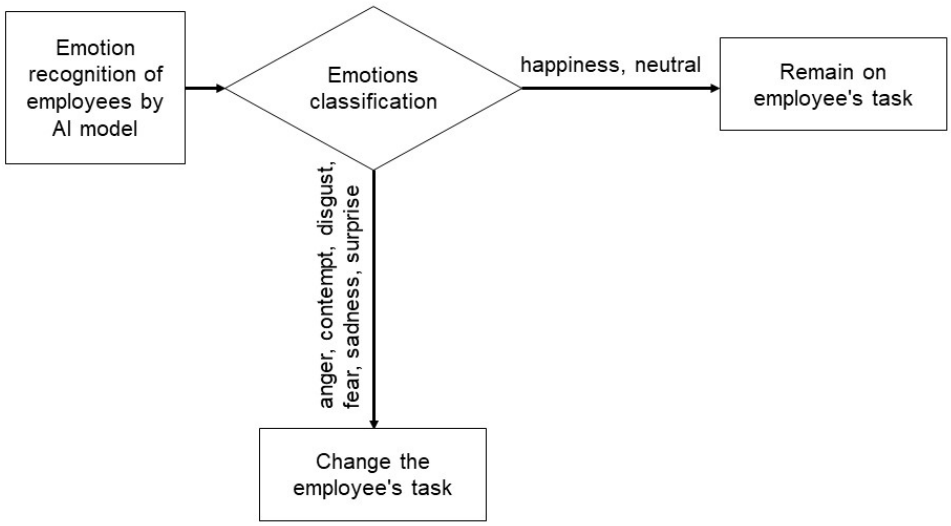

Figure 1. The architecture of emotion recognition in HRM model.

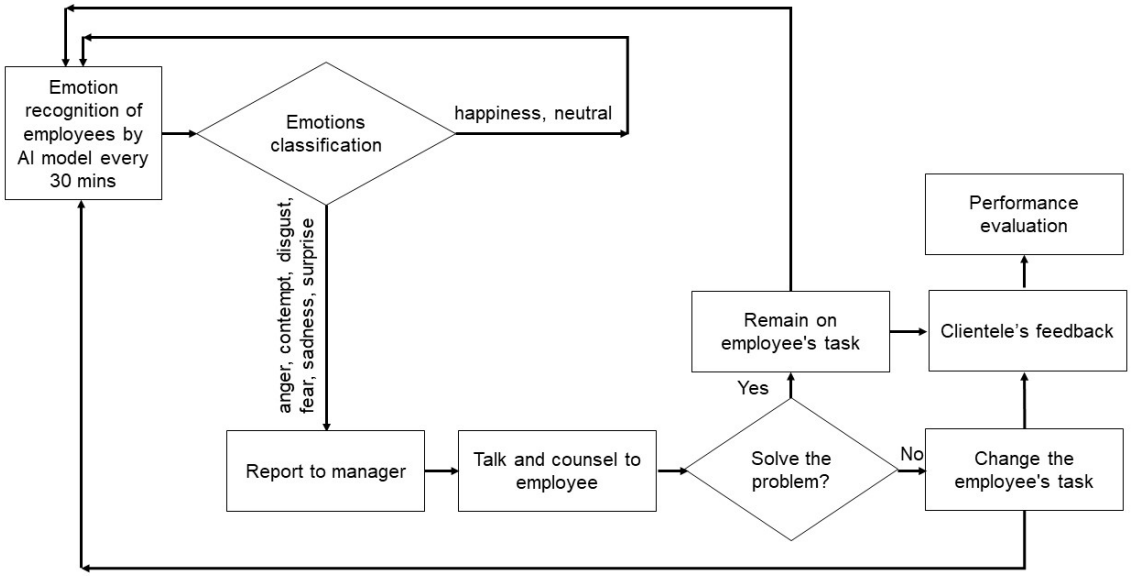

Figure 2. The architecture of extended emotion recognition in HRM model.

In the offline scenario of the model, first, the emotional recognition of employees is done by a deep learning model, which we will introduce in the following section. Each output of the deep learning model is classified into one of the eight classes, such as happiness, contempt, anger, sadness, disgust, fear, surprise, and neutral. If an employee's emotion is recognized as happiness or neutral then she/he is in a good mood for continuing her/his task, otherwise, the manager decides to change her/his task for that time.

In the online scenario of the model, the employees' photos are taken by cameras which are installed in the employees' workplaces and are fed to the AI model every 30 minutes for the emotion recognition process. Like the first scenario, each output of the deep learning model is classified into one of the eight classes, and if the employee's emotion is recognized as happy or neutral then she/he is in a good mood for continuing her/his task, otherwise the manager decides to change her/his task if talking and

consulting with her/him is not fruitful. We gather clientele feedback at the time of discharge of patients to assess how our model works well for improving performance and quality at work.

3.2. Deep Learning Model Architecture

For the emotion recognition AI model, we utilized a deep learning method (Madadi, Seydi et al. 2021) to recognize the emotions of employees at work. In this method, there are a source domain $\mathrm{D}_s = \{(x_i^s, y_i^s) \forall \mathrm{i} \in [1: n_s]\}$ where (x_i^s, y_i^s) is tuple of source data and their labels, and n_s is the number of source data (labelled), and a target domain $\mathrm{D}_t = \{(x_j^t) \forall \mathrm{j} \in [1: n_t]\}$ where x_j^t is the target data, and n_t is the number of target data (unlabelled). We mention the source domain as the training data and the target domain as the testing data. The source domain (training data) and the target domain (testing data) have different probability distributions.

The model architecture comprises of three main components. The initial component is a convolutional neural network (CNN) that transforms high-pixel images to the low-pixel images. The second component is the global average pooling that extracts representations from the low-pixel images. Lastly, the model prediction is the third component. There are four convolution-pooling layers that extract diverse representations of the data. Conditional maximum mean discrepancy (CMMD) is employed for all the different representations. The architecture of the model is illustrated in Figure 3.

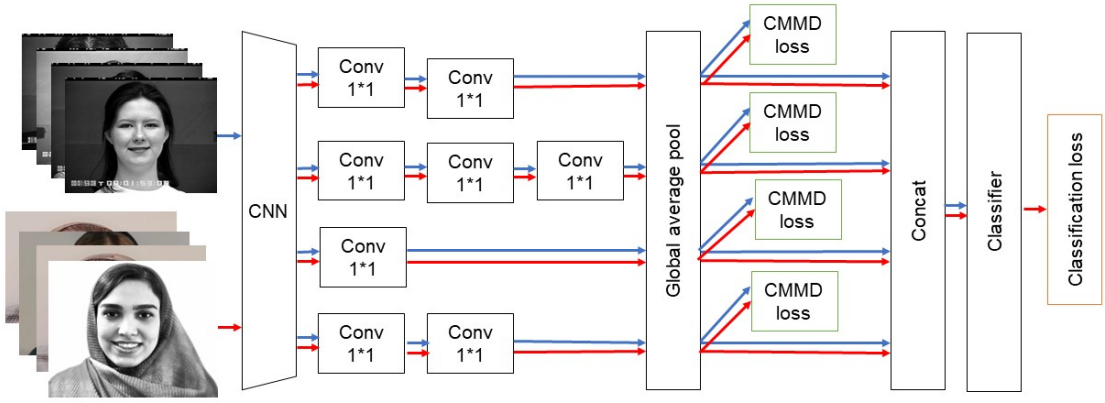

Figure 3. The architecture of deep learning model.

3.2.1. Optimization

In the model, the optimization section involves a weighted sum of two cost functions. The initial cost function aims to reduce classification errors on the source set, while the second cost function strives to minimize the differences between the source and target data. To establish a connection between the source and target data, we use matrices X^s and X^t, which contain all training data of the source and target domains, respectively. Each row of X^s corresponds to an individual datum x_i^s. We also assume the existence of a general feature extractor, g, and d different specific feature extractors $\{s_i\}_{i=1}^d$. The total cost function can then be formulated as follows:

$$\min_{g,\{s_i\}_{i=1}^d} \frac{1}{n_s}\sum_{i=1}^{n_s} J\left(\left[s_1\left(g(x_i^s)\right);\ldots;s_n\left(g(x_i^s)\right)\right],y_i^s\right)+\lambda\sum_{i=1}^{n} D(s_i\left(g(X^s)\right),s_i\left(g(X^t)\right)) \quad (1)$$

The concatenated vector of various features is represented by $[s1;\ldots;sn]$. The cross-entropy loss, denoted by $J(.,.)$, measures the distance among label scores and their corresponding true labels, y. The activation function used for the the classifier layer is softmax. D represents the cost for reducing the difference among source and target distributions. The trade-off parameter in this equation is $\lambda > 0$.

3.2.2. Conditional Maximum Mean Discrepancy (CMMD)

The CMMD metric is commonly used to measure the difference between marginal distributions. The CMMD algorithm computes the difference between the class-specific probability distributions of $P(x_s|y_s = c)$ and $Q(x_t|y_t = c)$. Both the source domain's class labels and the target domain's pseudo class labels are represented by c, where c belongs to the set $\{1, \dots, C\}$. One possible use for the output of a deep neural network, which is represented as $\hat{y}_i^t = f(X_i^t)$, is to employ it as a pseudo label for the target data. During the optimization process, we aim to enhance the quality of the pseudo labels in the target domain through iterative improvements. By minimizing the CMMD metric in the equation below, we can narrow the gap among the marginal distributions of the source and target domains.

$$D_{CMMD}(\hat{X}^s, \hat{X}^t) = \frac{1}{C}\sum_{c=1}^{C} \left\| \frac{1}{n_s^{(c)}} \sum_{x_i^{s(c)} \epsilon \hat{X}^s} \phi\left(X_i^{s(c)}\right) - \frac{1}{n_t^{(c)}} \sum_{x_j^{t(c)} \epsilon \hat{X}^t} \phi\left(X_j^{t(c)}\right) \right\|_H^2 \quad (2)$$

In this equation, ϕ denotes the kernel function, and $\|.\|_H$ represents the norm in the Hilbert space.

4. Results

In this section, we explain implementation details, and datasets, then discuss our experimental results.

4.1. Implementation Details

The deep learning model was implemented by Python and Pytorch, and the convolutional and pooling layers were adjusted using the pre-existing ResNet models provided by Pytorch (He, Zhang et al. 2016). An optimization method called mini-batch stochastic gradient descent (SGD) with a momentum of 0.9 and a learning rate of $\eta_p = \frac{\eta_0}{(1+\alpha p)^\beta}$ was used. The value of p ranged from 0 to 1, and the values of $\eta_0 = 0.01$, $\alpha = 10$ and $\beta =$

0.75, respectively. To train the classifiers, the backpropagation with a batch size of 32 (minibatch) was utilized.

4.2. Datasets

In this work, we prepared the experimental analysis of the deep learning model on several general and proposed facial expression recognition datasets. The general facial datasets are including the extended Cohn-Kanade (CK+) (Lucey, Cohn et al. 2010), FER2013 (Goodfellow, Erhan et al. 2013), and Japanese Female Facial Expression (JAFFE) (Lyons, Akamatsu et al. 1998). We also prepared a new facial dataset from the health staff of one of the big hospitals in Iran. We named our generated dataset as Emam Reza Hospital Facial Expression (ERHFE).

CK+: The extended Cohn–Kanade (CK+) facial expression database (Lucey, Cohn et al. 2010) is a general dataset for emotion recognition. The CK+ dataset comprises 593 sequences from 123 individuals between the ages of 18 to 50, with diverse genders and backgrounds. Typically, previous studies use the final frame of these sequences for facial expression recognition using images. These images are classified into eight expression categories: happiness, contempt, anger, sadness, disgust, fear, surprise, and neutral.

FER2013: The Facial Expression Recognition 2013 (FER2013) database (Goodfellow, Erhan et al. 2013) contains 35,887 photos of 48 × 48 resolution. The faces are labelled as happiness, contempt, anger, sadness, disgust, fear, surprise, and neutral. Compared to the other datasets, FER has more shifts in the images, including partial faces, facial occlusion, eyeglasses, and low-contrast images.

JAFFE: This dataset (Lyons, Akamatsu et al. 1998) consists of 213 photos that showcase seven distinct facial expressions presented by 10 Japanese female models. These images have also been annotated with the average semantic ratings for each facial expression by a total of 60 annotators.

ERHFE: Emam Reza Hospital Facial Expression (ERHFE) is our collected dataset that contains 80 facial images from 10 health staff from one of the big hospitals in Iran. We annotated these images in eight expression classes: happiness, contempt, anger, sadness, disgust, fear, surprise, and neutral.

4.3. Experimental Results

In this section, we evaluate the accuracy of the deep learning model on our generated dataset, ERHFE, and then assess the role of emotion recognition in human resource management which has a great impact not only on the optimal work output but also on the relations between the personnel and clientele and the whole team of the managed group.

We considered the combination of CK+, FER2013, and JAFFE as the source domain (with labels) and RHFE (without labels) as the target domain. Then, we presented the performance of the deep learning model on the RHFE dataset. The classification accuracy result on the RHFE dataset is obtained classification accuracy of ~92% after 100 epochs (Figure 4).

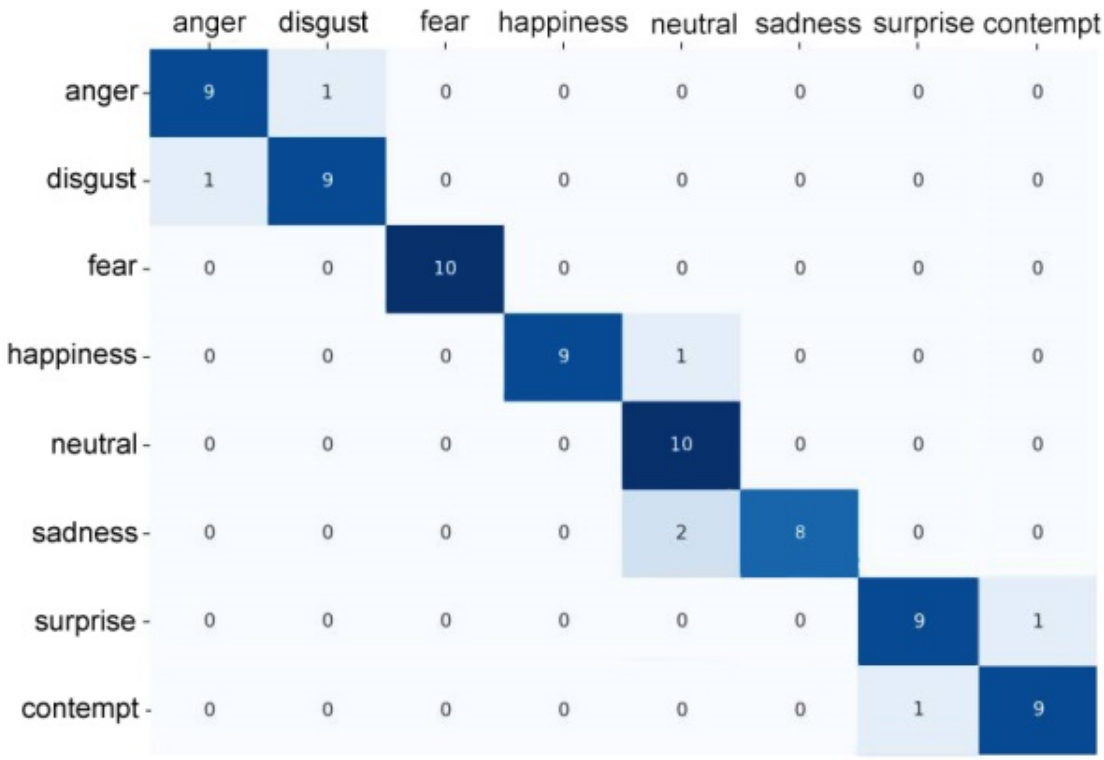

Figure 4. Confusion matrix of deep learning model on RHFE dataset.

To assess how our model works well for improving performance and quality at work, we surveyed clientele's feedback for four weeks and compared the performance with the time when we had not performed our model at work. The results showed that clientele satisfaction and performance increased due to the proposed model (see Table 1). The result shows that the total performance increases to 0.96 by using the proposed model. Further, Figure 5 shows the bar plot where the x-axis is according to time for four weeks and the y-axis is according to performance based on clientele's feedback. The results indicate that performance increases by performing the proposed model.

Table 1. Performance results with/without using the proposed model based on clientele's feedback.

	Performance in each week	**Total performance**

Clientele's feedback in	Week 1	Week 2	Week 3	Week 4	
With using the proposed model	0.95	0.96	0.94	0.98	0.96
Without using the proposed model	0.73	0.85	0.75	0.79	0.78

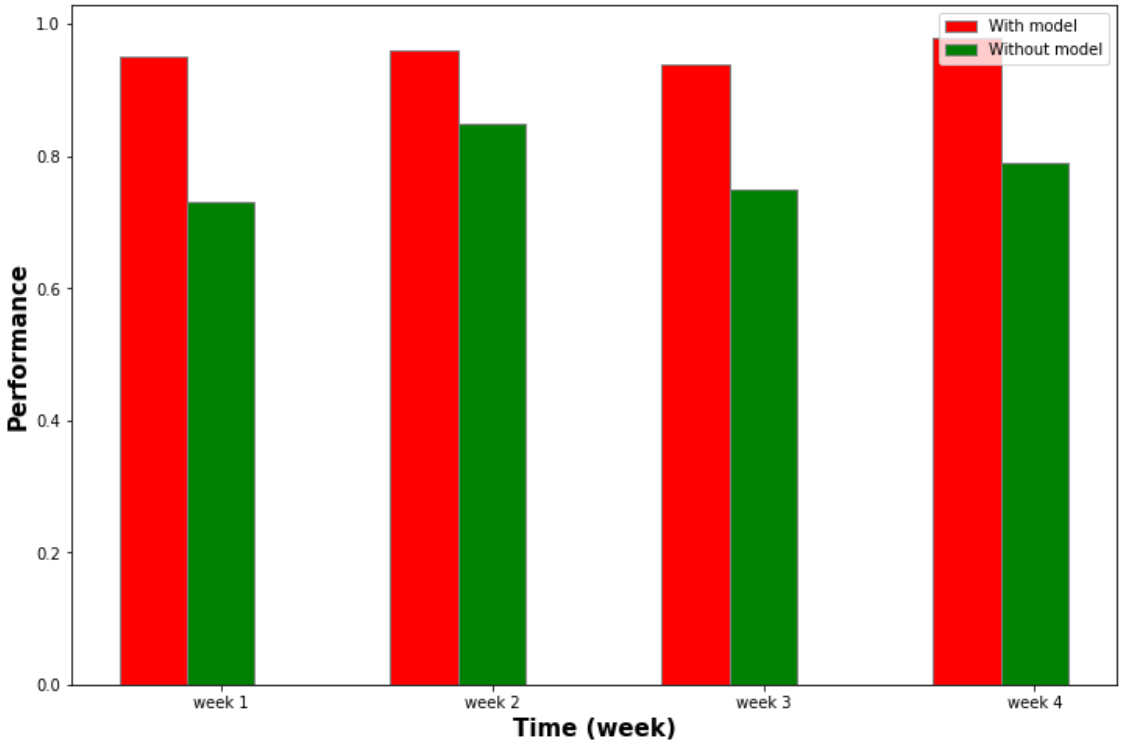

Figure 5. Performance based on clientele's feedback for four weeks.

We used the patient satisfaction questionnaire that is used in Emam Reza Hospital, one of the largest general hospitals of the Social Security Organization. The questionnaire was collected in person or by sending a link. And the respondents have been asked to express their opinions and suggestions. When personnel are in the good mood, they will behave properly, which has led to an increase in the good performance of the staff and will ultimately increase the satisfaction of the patients.

According to the survey findings, the model has a positive impact on human resource management and enhances personnel performance. It is suitable for modern and critical organizations, such as hospitals and health centers.

5. Discussion

The workforce is a crucial asset for any organization, as it contributes significantly to gaining a competitive edge. In order to manage it effectively, a proficient human resource management system is essential. It requires a robust set of human resource management operations to support the system.

Considering the different emotional states of the employees, including enjoy and happiness, sadness and stress, anxiety and anger, and dividing tasks in the organization according to their moods, increases the efficiency of the personnel, the satisfaction of the customers, and the success of the organization.

We are currently experiencing the "digital age" as a result of the advancements in artificial intelligence, automation, and machine learning. These technologies have the potential to revolutionize the way human resource management works, improving its overall effectiveness. Through the use of AI and ML systems, organizations can streamline their processes and work more efficiently. Ultimately, the success of any organization depends on how effectively people and technology are integrated to achieve their goals.

The emotions and mental conditions of service providers are very important in reaching the goals of the organization. Today's world is a world of developments, technology, and new technologies that can have a deep impact on organizations. The needs of customers have changed, and the organization must respond appropriately to them in order to survive in a competitive environment, and this shows the importance of innovation and the use of technologies, including artificial intelligence and machine learning. In this regard, the generation of new ideas, the use of technologies, and attention to the feelings and needs of service providers and receivers, by organizational managers, is of particular importance.

By identifying and comprehending emotions, public healthcare administrations can develop programs and strategies to mitigate negative effects in the workplace. Adopting a positive leadership style can improve employee well-being and, in turn, enhance the quality of service provided.

Creating a work environment that fosters transparency and prevents emotional exhaustion resulting from poor social interaction between managers and healthcare providers can greatly benefit healthcare organizations. This includes making well-informed medical decisions, enhancing teamwork, and promoting well-being among healthcare workers.

6. Recommendation For Future Research

We used face emotion recognition in this paper. It is suggested that other methods of detecting emotions can be used

7. Declaration of Interest Statement

No potential conflict of interest was reported by the author(s).

8. References

Ahmad, I. S., S. Zhang, S. Saminu, L. Wang, A. E. K. Isselmou, Z. Cai, I. Javaid, S. Kamhi and U. Kulsum (2021). "Deep learning based on CNN for emotion recognition using EEG signal."

Ahmad, I. S., S. Zhang, S. Saminu, L. Wang, A. E. K. Isselmou, Z. Cai, I. Javaid, S. Kamhi and U. Kulsum (2021). "Deep Learning Based on CNN for Emotion Recognition Using EEG Signal." WSEAS Trans. Signal Process **17**: 28-40.

Barrett, L. F. (2021). "AI weighs in on debate about universal facial expressions." Nature **589**(7841): 202-204.

Belhaj, R. and M. Tkiouat (2013). "A Markov model for human resources supply forecast dividing the HR system into subgroups."

Brooks, N. A., A. Puri, S. Garg, S. Nag, J. Corbo, A. E. Turabi, N. Kaka, R. W. Zemmel, P. K. Hegarty and A. M. Kamat (2021). "The association of Coronavirus Disease-19 mortality and prior bacille Calmette-Guerin vaccination: a robust ecological analysis using unsupervised machine learning." Scientific reports **11**(1): 774.

Budhwar, P., A. Malik, M. T. De Silva and P. Thevisuthan (2022). "Artificial intelligence–challenges and opportunities for international HRM: a review and research agenda." The InTernaTIonal Journal of human resource managemenT **33**(6): 1065-1097.

Cabrera, R. M., M. L. Ganchozo, R. S. O. Rene, R. W. R. Bujaico, H. H. Samaniego and J. F. R. Bujaico (2022). "Impact Of Machine Learning In Human Resource Management: Towards The Modernization Of Leadership." Journal of Positive School Psychology **6**(2s): 290-299.

Dwivedi, Y. K., L. Hughes, E. Ismagilova, G. Aarts, C. Coombs, T. Crick, Y. Duan, R. Dwivedi, J. Edwards and A. Eirug (2021). "Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy." International Journal of Information Management **57**: 101994.

Fallucchi, F., M. Coladangelo, R. Giuliano and E. William De Luca (2020). "Predicting Employee Attrition Using Machine Learning Techniques." Computers **9**(4): 86.

Gallagher, S. and S. Varga (2014). "Social constraints on the direct perception of emotions and intentions." Topoi **33**: 185-199.

Garg, S., S. Sinha, A. K. Kar and M. Mani (2022). "A review of machine learning applications in human resource management." International Journal of Productivity and Performance Management **71**(5): 1590-1610.

Goodfellow, I. J., D. Erhan, P. L. Carrier, A. Courville, M. Mirza, B. Hamner, W. Cukierski, Y. Tang, D. Thaler and D.-H. Lee (2013). Challenges in representation learning: A report on three machine learning contests. International conference on neural information processing, Springer.

He, K., X. Zhang, S. Ren and J. Sun (2016). Deep residual learning for image recognition. Proceedings of the IEEE conference on computer vision and pattern recognition.

Huang, Y.-S. and M. H. Alhlffee (2023). "Improving Face Recognition by Integrating Decision Forest into GAN." Applied Artificial Intelligence **37**(1): 2175108.

Jain, D. K., P. Shamsolmoali and P. Sehdev (2019). "Extended deep neural network for facial emotion recognition." Pattern Recognition Letters **120**: 69-74.

Jarrahi, M. H. (2018). "Artificial intelligence and the future of work: Human-AI symbiosis in organizational decision making." Business horizons **61**(4): 577-586.

Jović, M., E. Tijan, D. Brčić and A. Pucihar (2022). "Digitalization in Maritime Transport and Seaports: Bibliometric, Content and Thematic Analysis." Journal of Marine Science and Engineering **10**(4): 486.

Ko, B. C. (2018). "A brief review of facial emotion recognition based on visual information." sensors **18**(2): 401.
Kolbjørnsrud, V., R. Amico and R. J. Thomas (2016). "How artificial intelligence will redefine management." Harvard Business Review **2**(1): 3-10.
Kulkarni, S. B. and X. Che (2019). "Intelligent software tools for recruiting." Journal of International Technology and Information Management **28**(2): 2-16.
Kulkarni, S. S., N. P. Reddy and S. Hariharan (2009). "Facial expression (mood) recognition from facial images using committee neural networks." Biomedical engineering online **8**(1): 1-12.
Li, X., Z. Mai, L. Yang and J. Zhang (2020). "Human resource management practices, emotional exhaustion, and organizational commitment–with the example of the hotel industry." Journal of China Tourism Research **16**(3): 472-486.
Lucey, P., J. F. Cohn, T. Kanade, J. Saragih, Z. Ambadar and I. Matthews (2010). The extended cohn-kanade dataset (ck+): A complete dataset for action unit and emotion-specified expression. 2010 ieee computer society conference on computer vision and pattern recognition-workshops, IEEE.
Lyons, M. J., S. Akamatsu, M. Kamachi, J. Gyoba and J. Budynek (1998). The Japanese female facial expression (JAFFE) database. Proceedings of third international conference on automatic face and gesture recognition.
Madadi, Y., V. Seydi, J. Sun, E. Chaum and S. Yousefi (2021). Stacking Ensemble Learning in Deep Domain Adaptation for Ophthalmic Image Classification. International Workshop on Ophthalmic Medical Image Analysis, Springer.
Mehendale, N. (2020). "Facial emotion recognition using convolutional neural networks (FERC)." SN Applied Sciences **2**(3): 446.
Musa, A., K. Vishi and B. Rexha (2021). "Attack analysis of face recognition authentication systems using fast gradient sign method." Applied artificial intelligence **35**(15): 1346-1360.
Nawaz, N. (2020). "Artificial intelligence applications for face recognition in recruitment process." Journal of Management Information and Decision Sciences **23**: 499-509.
Pap, J., C. Mako, M. Illessy, N. Kis and A. Mosavi (2022). "Modeling Organizational Performance with Machine Learning." Journal of Open Innovation: Technology, Market, and Complexity **8**(4): 177.
Priya, K. R. and A. K. Sinha (2022). "Underpinnings of social contributions: conceptualizing behavioral patterns among socially contributive leaders in India." Social Responsibility Journal **18**(2): 221-239.
Ramadevi, D., A. Gunasekaran, M. Roy, B. K. Rai and S. Senthilkumar (2016). "Human resource management in a healthcare environment: framework and case study." Industrial and Commercial Training **48**(8): 387-393.
Ritz, E., F. Donisi, E. Elshan and R. Rietsche (2023). Artificial Socialization? How Artificial Intelligence Applications Can Shape A New Era of Employee Onboarding Practices. Hawaii International Conference on System Sciences (HICSS).
Rouhani, S. and S. Zamenian (2021). "An architectural framework for healthcare dashboards design." Journal of Healthcare Engineering **2021**: 1-12.
Sahu, S., E. Kithani, M. Motwani, S. Motwani and A. Ahuja (2021). Stress Detection of Office Employees Using Sentiment Analysis. Emerging Technologies in Data Mining and Information Security: Proceedings of IEMIS 2020, Volume 2, Springer.
Sandelowski, M., J. Barroso and C. I. Voils (2007). "Using qualitative metasummary to synthesize qualitative and quantitative descriptive findings." Research in nursing & health **30**(1): 99-111.

Sivathanu, B. and R. Pillai (2018). "Smart HR 4.0–how industry 4.0 is disrupting HR." Human Resource Management International Digest **26**(4): 7-11.
Tran, Q. M., V. T. Pham, D. T. T. Nga and P. The Bao (2022). "Evaluating the Efficacy of Small Face Recognition by Convolutional Neural Networks with Interpolation Based on Auto-adjusted Parameters and Transfer Learning." Applied Artificial Intelligence **36**(1): 2012982.
Urkude, S. V., V. R. Urkude and C. S. Kumar (2021). "Comparative Analysis on Machine Learning Techniques: A case study on Amazon Product."
Van Tilburg, W. A. and E. R. Igou (2017). "Boredom begs to differ: Differentiation from other negative emotions." Emotion **17**(2): 309.
Yabanci, O. (2019). "From human resource management to intelligent human resource management: a conceptual perspective." Human-Intelligent Systems Integration **1**(2-4): 101-109.
Yawalkar, M. V. V. (2019). "a Study of Artificial Intelligence and its role in Human Resource Management." International Journal of Research and Analytical Reviews (IJRAR) **6**(1): 20-24.
Yuan, S., Q. Qi, E. Dai and Y. Liang (2022). "Human resource planning and configuration based on machine learning." Computational Intelligence and Neuroscience **2022**.
Zheng, X., F. Ping, Y. Pu, Y. Wang, C. E. Montenegro-Marin and O. I. Khalaf (2021). "Recognize and regulate the importance of work-place emotions based on organizational adaptive emotion control." Aggression and Violent Behavior: 101557.