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Predictive Stress Management for Employees Using Cloud Computing and Machine Learning

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ABSTRACT:
Currently, workplace stress is a prevalent occurrence among employees in organisations. Management must assess the mental state and physical capabilities of personnel prior to task assignment. The constantly evolving demands of the operational environment might elevate stress levels, particularly for individuals who continually operate under pressure. While pressure can enhance performance, excessive pressure may induce stress, adversely affecting the workforce. Workplace stress is an escalating issue within businesses, as it adversely impacts both employees' professional and familial lives. Work stress denotes the pressure or tension individuals experience in their lives. This is seen as a significant factor affecting organisational welfare and personnel health. It influences employee behaviour in organisations. It significantly influences employee motivation and satisfaction. Employee productivity and the overall productivity of the company are influenced by stress and motivation levels. Occupational stress induces a range of psychological issues, including anger, despair, anxiety, impatience, and tension. These factors significantly influence employee motivation.

Keywords— Cloud Computing (CC), Stress Management (SM), Deep Neural Network (DNN), Artificial Neural Network (ANN), Machine Learning (ML), Decision Tree (DT).

I. INTRODUCTION

In contrast to reactive approaches, this innovative approach to stress management is proactive and evidence-based. In this paper, we present a novel approach to stress management prediction modeling using cloud computing. Because of the increasing demands put on stress personnel, there is a pressing need to monitor and support their mental health. Our technology integrates data from multiple sources, including surveys, social media, EHRs, and wearable's, and stores it for study. Maintaining workforce stability and organizational effectiveness requires accurate predictions of staff turnover in high-stress sectors. Targeted actions to improve employee retention are made possible by the valuable predictive insights provided by ML applications [1]. To reduce the likelihood of employee turnover, it is crucial to address job pressures, enhance working environment, and encourage strong relationships among coworkers. Integrating advanced predictive models and thorough retention strategies will be critical for organizations to retain performance as high-stress sectors continue to grow. There is a correlation between the high stress levels in some industries and higher turnover rates, which in turn can have a detrimental impact on service delivery and operations. For instance, because of the tremendous expectations placed on medical experts, the healthcare sector often faces high turnover rates.

Employees in the banking sector, which is notorious for its high-pressure atmosphere, also leave in droves. Because of its widespread use and creative applications, cloud computing is quickly becoming an essential component of the education community [2]. Using TAM as a theoretical foundation, this research theorizes students' stress performance is enhanced by the adoption of cloud computing, focusing on their personal qualities and the stress management paradigm. With cloud computing, students may work together in a virtual classroom, exchange and access course materials, and communicate with one another and their instructors in real time all from anywhere with an internet connection [3]. Consequently, the academic achievement of students may be impacted by such activities. By utilizing a shared pool of configurable computing resources (such as networks, servers, storage, applications, and services), which can be quickly provisioned and released with minimal management effort or interaction with service providers, cloud computing allows users to conveniently access these resources on demand [4]. With its five core features, three service models, and four deployment options, this cloud model prioritizes availability. An economic advantage that reduces costs for current applications is the primary motivator for this broad adoption. Cost savings, scalability, and flexibility, access to pooled resources, and automatic updates and upgrades are all benefits that organizations can reap from cloud computing. However, cloud computing is not without its share of possible hazards and challenges, including but not limited to: security, performance, subscription model costs that are higher than on-premise implementation, integration difficulties with on-premise applications, limited customization options, and so on.

II. LITERATURE SURVEY

Organizations may analyze complicated data sets, identify early symptoms of burnout, and prescribe targeted solutions with the help of ML which offers a powerful toolkit for predictive stress management. Data such as work schedules, communication patterns, productivity indicators, and sentiment analysis from employee feedback can be processed by ML algorithms [5]. This allows organizations to acquire actionable insights for workload optimization. Another benefit ML its ability to monitor and adapt in real-time, which helps to address potential stressors before they get worse [6]. The art of recognizing and addressing uncomfortable emotions, dissatisfaction, or disinterest in conversation. To better understand how stressed out employees are NLP methods can categories their attitudes. There are both immediate and long-term expenses associated with resignations, such as advertising for new hires and replacing departing workers with less

experienced ones [7].Found that businesses with high turnover rates experienced decreased morale and productivity due to the disruption DL approach of operations and the diminishment of team cohesion [8]. Forecasting employee turnover is especially important KNN methods for companies in high-pressure industries like healthcare, banking, and technology because of the special difficulties these fields encounter in attracting and maintaining top talent. For instance, achieved remarkable accuracy in predicting employee turnover using a combination of models such as SVC, GB, KNN and Gaussian NB [9]. Predicting employee stress management has never been easier than with the use of ML technology. Predicting employee turnover has never been easier than with the use of ML technology. Research into the IT and ITeS industry's employee turnover intention using the XGBoost algorithm [10]. With better accuracy, recall, precision, and F-score results than competing classification algorithms, the XGBoost algorithm proved its worth in this challenging industry. In a similar used the SVM algorithm to create a stress management predictive model [11]. Finding common occurrences among fault-free traces and labeling them as non-anomalous is achieved through the application of string analysis techniques, namely LCS [12]. To further examine non-deterministic variations, it employs a VMM to produce a fresh feature vector (the anomaly vector). The advent and rapid development of cutting-edge technologies like WSNs, the IoT, DL algorithms, cloud computing, and HPC have led to the emergence and rapid adoption of a new data-driven paradigm called DT . Through its life cycle, the DT produces an accurate digital replica of the physical thing; the two undergo continuous evolution in tandem. Cloud computing is a promising new area of study that could power SHM tasks due to its many benefits, such as low overhead, high performance and parallel processing, vast storage capacity, and network accessibility from anywhere in the world. The study by lastly, the CNN technique was implemented using python and Tensor Flow. The spectral datasets were analyzed and classified using these tools [13]. When compared to the CNN algorithm, the MLPC and ORC algorithms performed better when it came to classifying spectral data. Also, new ways to solve, measure, and comprehend data-intensive processes have been provided by ML, big data, and high performance computing [14]. It is possible to process large amounts of data with several dimensions in stress operating settings by combining cloud computing, big data in analysis, and ML. Data features and high-dimensionality data can be summarized and analyzed using cloud computing and ML techniques in precision stress management [15]. This improves decision quality, decreases information asymmetry, and increases benefits by providing faster and more accurate services to stress management. We presented a KNN algorithm-based ML model that uses recognized features to forecast the best times to migrate before making a copy. We made a new contribution to migration time prediction with our highly accurate and flexible model [16]. We conducted comprehensive studies and testing to validate our approach using data and a real-life KVM tested. Using our feature selection algorithm. To facilitate the seamless transfer of VMs between physical hosts without halting execution, live VM migration is essential in virtualized systems. In the realm of KVM-based pre-copy live migration has become quite popular because of its ability to reduce overall movement time and interruption. An approach to deal with service unavailability is LVM, which allows you to transfer VM between hosts without affecting any services that are currently operating [17]. The high frequency of regularly updated memory pages, or dirty pages, for pre-copy memory migration a popular LVM technique employed in cloud systems. The industry's extensive application demand for cloud computing, big data, and AI has led to a technological trend towards integration of each of these technologies, both domestically and internationally.

III. METHODOLOGY

Organisations are assemblies of individuals. The cultivation of human resources is a fundamental administrative obligation. Unprocessed human resources can contribute only little to the attainment of organisational objectives. Any development strategy should focus on the sustained

welfare of humanity. Currently, the influence of stress on employee well-being has become increasingly significant. It may be considered a novel aspect of Human Resource Development. An efficient HRD is distinguished by its commitment to enhancing staff productivity and its sincere dedication to improving employee well-being. An effective tool to assess or evaluate an employee's well-being is a stress audit. Given that stress impacts everyone at some point, an HRD, should prioritise assessing and implementing measures to mitigate stress. Stress is defined as the body's generic reaction to diverse pressures imposed upon it.

A. Attitude and Behaviour of Stress on Employee:

Changes in the internal and external environment will inevitably influence our attitudes and behaviour. It is typical from a learning perspective that undergoing specific changes will inevitably alter our behaviour, which in turn will influence employee organisational conduct, work culture, behaviour, and discipline [18]. Effectively managing the acquisition process and the personnel of the acquired organisation can mitigate the adverse effects associated with the acquisition. It can also assist an organisation in recovering and resuming operations in a shorter timeframe. Organisations must adopt appropriate methodologies and strategies during the acquisition process, with particular emphasis on the successful management of the workers from the acquired entity.

B. Turnover Rate of Employee:

Employee turnover rates may be elevated due to mergers and acquisitions, as employees may feel dissatisfied with their work or salary in the new organisation. Employees may begin seeking new employment, which will undoubtedly elevate turnover rates, adversely affecting the bank or any other organisation.

C. Absenteesim:

A substantial number of researches have been undertaken on human relations issues inside firms, although absenteeism among employees arises owing to specific job-related concerns [19]. When an employee is compelled to alter their job profile, it may become a significant factor prompting them to evade stress through absenteeism. Consequently, these concerns must be addressed with utmost seriousness as they directly impact the company's production [20].

D. Grievances:

Mergers and acquisitions cannot achieve their full potential value without constructive employee input. New employees' issues must be addressed meticulously to facilitate their integration into the organization's work culture [21]. From the perspective of organisational objectives, it is crucial to recognise that only a satisfied employee can effectively satisfy the client. Customer happiness is essential in the highly competitive current corporate environment.

E. Performance and Health on Effects of Stress:

Emotional intelligence showed a weak correlation with health condition. The proposed model examined the correlation between job-related stress and health outcomes [22]. Increased levels of stress correlate with deteriorating health, resulting in heightened sleeplessness, somatic complaints, anxiety, and depressive symptoms.

Factors connected to work stress, such as excessive workload, insufficient rewards, and workplace unpredictability, are most closely correlated with health status [23]. The effects of stress on an individual's mental and physical health are well-documented. Stress can manifest in various forms. A variety of somatic and psychological disorders, including tension allergies, back pain, colds, headaches, and influenza, tension, irritability, anxiety, insomnia, and melancholy, may result in health-deteriorating coping mechanisms, such as heightened intake of cigarettes, alcohol, and

narcotics. Prolonged exposure to stress can result in severe repercussions, including heart disease,cancer,strokes, respiratory disorders, hypertension, arthritis, and ulcers. Nevertheless, not all persons have such issues when confronted with stress.

Stress does not exert a uniform effect on all individuals. Individuals exhibit variability in their responses to stressful events. Some individuals get discomposed with minimal provocation, and others appear unfazed even in very stressful situations. It is in this context that Emotional Intelligence (EQ) assists us in responding effectively to various stressors. Emotional intelligence assists in managing stressful circumstances. Stress management mostly relies on achieving emotional equilibrium between a prospective stressor and your response to it.

F. Traning in the Model:

1) ARTIFICIAL NEURAL NETWORK:

ANN are interconnected systems inspired by the biological structure of neurones found in animal brains. The most common structure of an artificial neural network consists of three layers: input, hidden, and output. A network of connections between the input layer and the hidden layer, together with many weights and corresponding biases, can describe an ANN. Artificial neurones, which are interconnected nodes in artificial neural networks, emulate the neurones present in the biological brain. Analogous to the manner in which synapses in biological neurones transmit impulses, the interconnected nodes perform a similar function.

2) DEEP LEARNING ALGORITHM:

A neural network of three or more layers is referred to as a DNN. A subset of machine learning that utilises deep neural networks is referred to as DL. These neural networks aim to replicate the functioning of the human brain, although they fall short of achieving parity. This enables the neural network to assimilate vast quantities of data. The incorporation of additional concealed layers in deep learning enhances accuracy. Deep Learning has developed a robust framework for executing intellectually stimulating tasks. Deep learning underlies numerous AI applications and services, augmenting automation by performing cognitive and physical tasks independently. Deep learning is the foundation that supports both current and emerging applications in smart cities, smart grids, and smart homes. Among several deep learning models are RNN and deep belief networks.

3) SUPPORT VECTOR MACHINE:

The SVM, a widely utilised method in machine learning, employs unsupervised learning and models to classify or regress discrete or continuous datasets, as applicable. A non-probabilistic binary linear classifier is generated by an SVM learning algorithm by assigning training cases to one or more predetermined categories. Three lines delineate the three courses into their corresponding groupings.SVM is an advantageous choice for identifying problematic power sections owing to its numerous significant benefits. The properties of SVM surpass the training data for networks with a substantial number of DG. SVM is a suitable instrument for the training process in this context due to its superior performance with high-dimensional data. SVM incurs a lower computational cost compared to KNN because to its superior memory efficiency.

4) K-NEAREST NEIGHBOR:

The instance-based learning method, KNN, has demonstrated efficacy in tasks related to fault detection, localisation, and classification. The KNN algorithm is one of the most straightforward machine learning approaches. The class selected by an object's k nearest neighbours is established through a majority vote among those neighbours. K is a positive, frequently minuscule integer. The item is assigned the class of its nearest neighbour when k = 1. Selecting k as an odd number

in double-class classification problems is beneficial, as it mitigates complications arising from tied votes. A system employing redundant statistical features derived from wavelet packet transform, utilising an advanced KNN-based fault detection method.

5) DECISION TREE ALGORITHM:

A DT is a specific type of machine learning technique characterised by an inverted tree or pyramid structure. It is utilised to address issues related to categorisation and regression. The design resembles a tree, with each non-leaf node representing an input feature. The branching arcs of the internal node are determined by an input feature. The target or output feature values are assigned to these arcs. A DT visually represents the necessary decisions, potential outcomes, and various combinations of decisions and events.

IV. RESULTS AND DISCUSSION

Stress management is garnering increasing attention, particularly in relation to the workplace. With the intensification of competition in the economy due to globalisation, liberalisation, and privatisation, seller's markets have been supplanted by competitive ones; thus, there are no longer any stress-free jobs. Every individual in the workplace encounters various frustrations, tensions, and anxieties associated with their assigned tasks or the overall work environment. Rising urbanisation, industrialisation, and expanding operational scales induce stress and strain. Individuals suffer stress when they perceive a loss of control over their living circumstances.

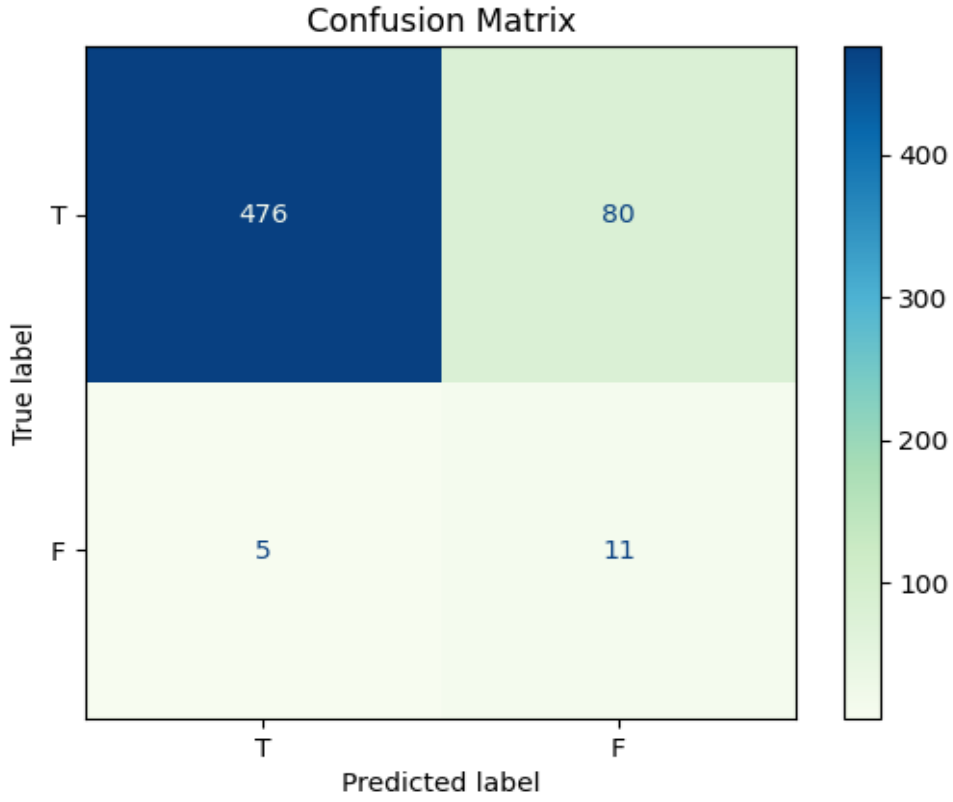

Fig. 1. Confusion Matrix for Proposed Model

The matrix reveals minimal misclassifications, suggesting that the model performed satisfactorily. The model demonstrates a well-balanced accuracy in identifying both categories, as evidenced by the diagonal elements (476 and 11) that signify correct predictions.

TABLE I. PROPOSED MODEL TABLE

Models	Accuracy	Precision	Recall	F1-Score
DT	91.32	89.56	87.32	91.39
ANN	95.30	93.21	91.54	95.47
DNN	**98.73**	**96.38**	**94.85**	**98.79**
KNN	94.87	92.99	90.19	94.91
SVM	90.15	88.42	86.49	90.25

Table 1 encapsulates the performance indicators for all five models. Examples of these models include DT, ANN, SVM, KNN, and DNN. DNN surpasses its competitors in several metrics, including Accuracy, Precision, Recall, and F1-Score. The results demonstrate that support vector machines are very proficient in jobs necessitating precision and predictability.

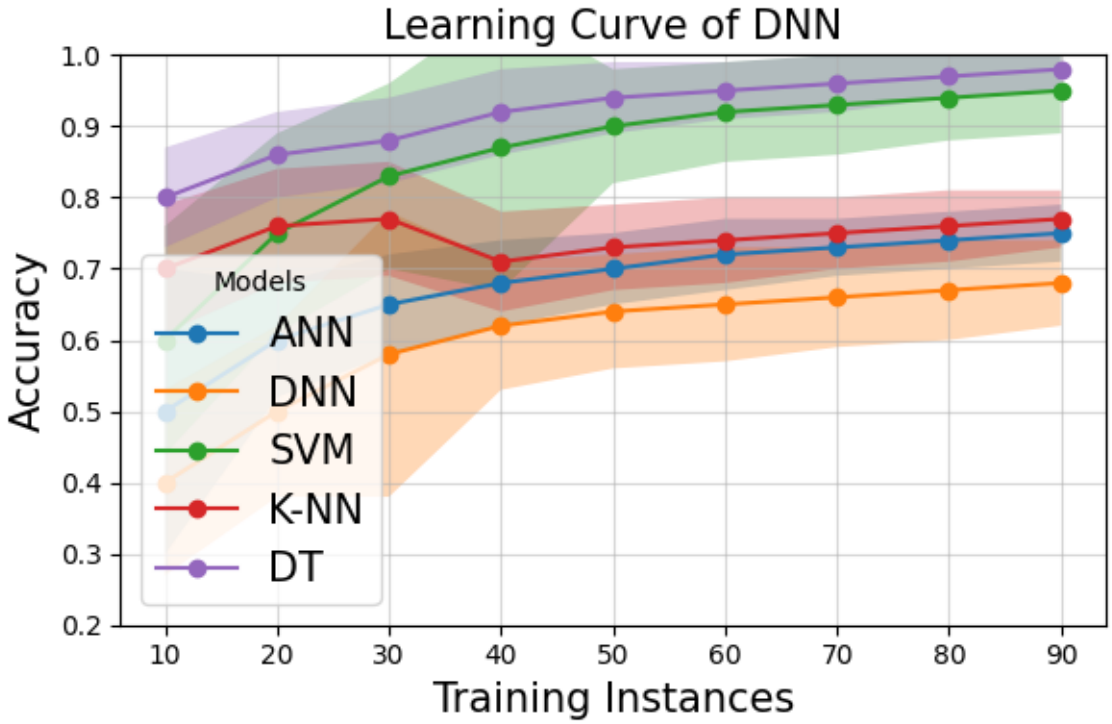

Fig. 2. Curve for Learning

Fig. 3.

Figure 2 illustrates the test and training scores of DNN models based on a distinct sample count. Utilising 10-fold cross-validation, it was determined that the average training accuracy values for ANN, SVM, KNN, DT were 0.98, 0.91, 0.95, 0.94, and 0.90, respectively.

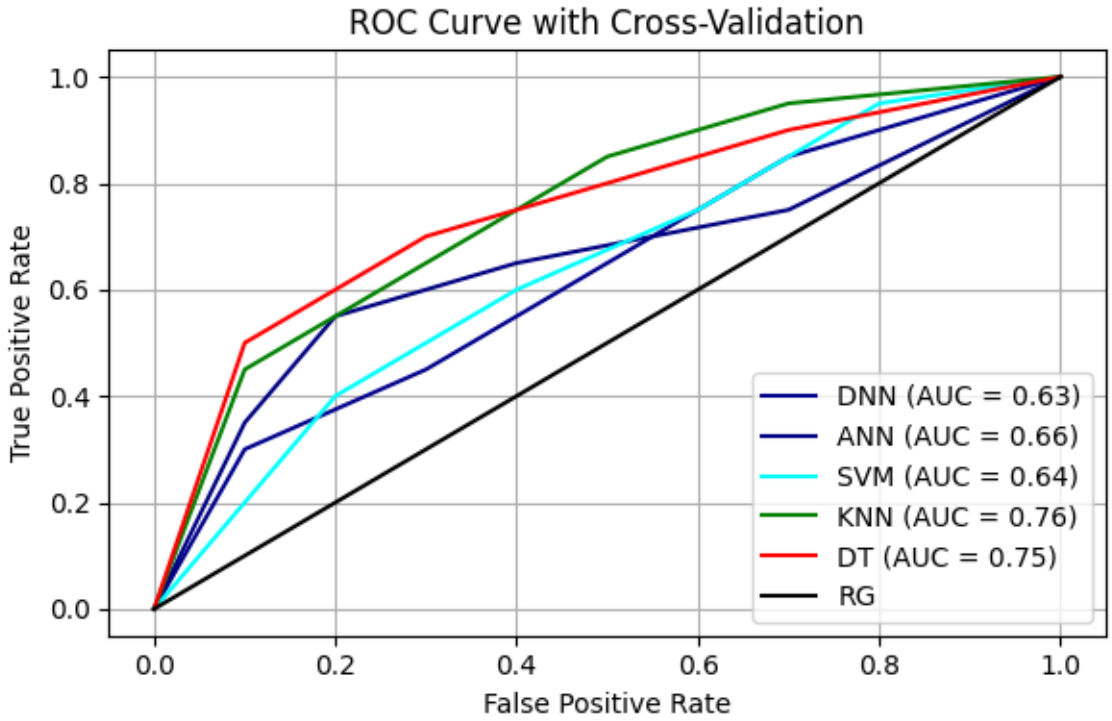

Fig. 4. Training and Validation Loss of the proposed model

Figure 3 illustrates the receiver operating characteristic (ROC) curve utilised for the comparison of DNN models. AUC values exceeding 60 for all models indicate a well-balanced binary classification

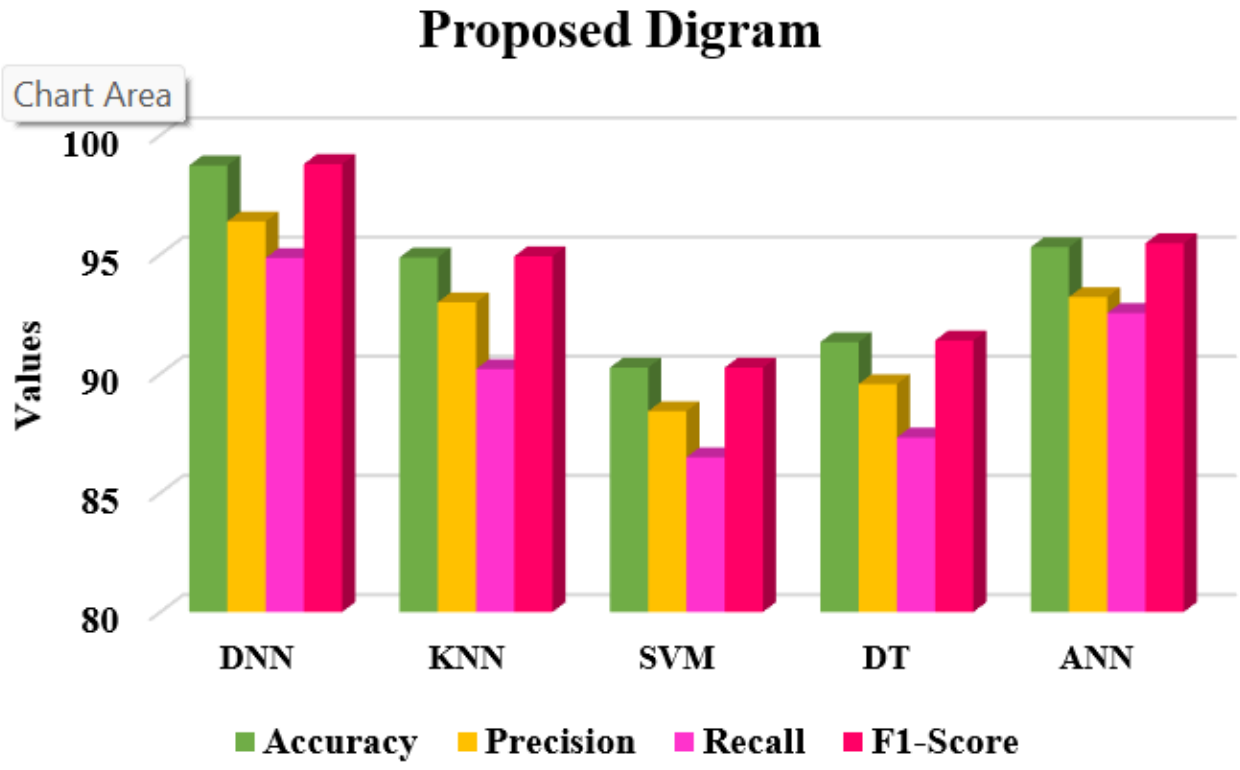

Fig. 5. The Proposed Model

This bar chart shows the results of a model evaluation utilising DT, ANN, SVM, and KNN and DNN on three data split configurations: Accuracy, Precision, Recall, and F1 Score. The algorithms are shown on the x-axis, and performance measurements are shown as percentages on the y-axis.

V. CONCLUSION AND FUTURE DIRECTIONS

Global interventions to mitigate workplace stress are essential, and disability management has been recognised as a crucial mechanism for implementing pertinent policies and practices. The workers' lack of confidence in their organization's ability to effectively manage workplace stress, as indicated in this study, highlights the necessity for enhancements in the disability management policies and practices aimed at reducing the occurrence and effects of workplace stress.

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