Monitoring and Safeguarding Employee Wellbeing through Advanced Analytics

An Engineering Project in Community Service

Phase- II Report

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in partial fulfillment of the requirements for the degree of

Bachlore of Engineering and Technology

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7th March, 2024

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Bonafide Certificate

Certified that this project report titled **"Monitoring and Safeguarding Employee Wellbeing through Advanced Analytics"** is the bonafide work of – (21BCE10249) Tanishka Mishra, (21BCE10294) Paras Verma, (21BCE10413) Hardik Kankane(21BCE11583) , Akash Parmar (21BCE10537) , Anondita Dutta, (21BCE10650) Apoorva Gupta, (21BCG10161) , Shrey Borana, (21BSA10123) Nikita Raut" who carried out the project work under my supervision.

This project report (Phase II) is submitted for the Project Viva-Voce examination held on 7th March,2024

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Index

1. INTRODUCTION

In today's quickly changing corporate world, employee well-being is recognised as a critical aspect in organisational success. Recognising the critical importance of employee satisfaction in total company performance, firms are increasingly implementing cutting-edge solutions. This research is primarily interested in exploring employee well-being, using advanced Artificial Intelligence (AI) and Machine Learning (ML) approaches to investigate the phenomena of "employee burnout." The goal of using AI and ML is to unearth significant insights that not only improve our understanding of this critical component, but also pave the way for informed initiatives to nurture a healthier and more productive work environment.
In essence, this project is a strategic reaction to the changing dynamics of the modern workplace, where employee well-being and technology innovation are intertwined. The dedication to employing advanced AI and ML approaches demonstrates a proactive approach to resolving burnout concerns, demonstrating a forward-thinking trajectory for organisations seeking long-term excellence in their workforce management strategies.

1.1 Motivation

Employee burnout is a state of physical, emotional, and mental weariness caused by extended stress and a heavy workload in the office. It frequently leads to lower productivity, disengagement, and bad consequences for mental health.
Employee burnout has a negative impact on individuals and organisations in today's corporate context. Burnout not only reduces productivity and job happiness, but also leads to high staff turnover rates, threatening organisational stability. Additionally, the consequences include increased healthcare expenses, emphasising the importance of taking preemptive actions. Recognising people as a company's most valuable asset necessitates understanding and addressing burnout. It is crucial for creating a workplace that promotes both employee well-being and productivity.In summary, anticipating employee burnout rates stems from a desire to increase employee well-being, improve organisational performance, and fulfil legal and ethical obligations to employees. It enables proactive actions to prevent burnout and provide a supportive work environment that promotes employee engagement and productivity.

1.1.1 The Role of AI and ML

Embracing the transformative capabilities of Artificial Intelligence (AI) and Machine Learning.(ML) unveils a strategic avenue to not only comprehend but actively prevent burnout. Through data-driven analyses, these

technologies empower us to discern intricate patterns and emerging trends related to burnout, offering a profound understanding of its root causes.

1.1.2 Predictive Models for Early Intervention

The integration of AI and ML facilitates the creation of predictive models capable of discerning early symptoms of burnout. This foresight equips organizations with a proactive approach, enabling targeted interventions to foster a resilient and well-being-centric culture within the workplace.

1.1.3 Significance of a Proactive Approach

This project's motivation lies in the recognition that a proactive stance towards employee burnout is not merely advantageous but indispensable in the contemporary professional landscape. By harnessing the analytical prowess of AI and ML, we aim to empower organizations to pre-emptively identify, understand, and mitigate factors contributing to burnout, ultimately fostering a workplace culture that prioritizes health, resilience, and sustained productivity.

1.2 Objective

1.2.1 Data Collection and Evaluation

In the pursuit of comprehensive insights into factors influencing employee well-being, the primary objective is to gather pertinent data from diverse and impactful sources. This includes not only performance metrics but also physiological examinations and external factors that play a role in determining prosperity. Leveraging advanced analytical techniques, the aim is to delve deep into the intricate components contributing to employee burnout.

1.2.2 Model Construction

Utilizing cutting-edge AI techniques, the project endeavours to construct predictive models specifically designed to identify and forecast breakdown risks. The uniqueness of these models lies in their ability to discern patterns and early indicators of potential burnout. This entails rigorous training on authentic datasets, ensuring the models' proficiency in recognizing nuanced trends related to employee well-being.

1.2.3 Continuous Monitoring

The establishment of a continuous monitoring system is paramount for real-time evaluation of hand well-being. Through ongoing data inputs, this system is designed to provide an immediate assessment, enabling

HR professionals and managers to receive timely alerts and insights. This real-time approach facilitates innovative interventions, ensuring swift responses to emerging well-being concerns.

1.2.4 Personalized Interventions

Central to the project is the development of an individualized intervention framework, meticulously tailored based on identified risk factors. Through data analysis, specific risk factors will be identified, and interventions will be custom-designed to meet the unique needs of each employee. This approach aims to foster a collaborative and responsive working environment, acknowledging the diversity of employee needs and well-being.

1.2.5 Evaluation and Revisions

A continuous feedback loop is established for regular evaluations and revisions of both implemented interventions and the model itself. Feedback from employees and changes in organizational structure will be systematically incorporated into the refinement process. This iterative approach ensures the ongoing effectiveness and relevance of the interventions in a dynamic organizational context.

1.2.6 Overall Impact and Continuous Improvement

The project, rooted in artificial intelligence and machine learning, is designed for continuous improvement. The system evolves iteratively, adapting to changes in working conditions and organizational dynamics. This comprehensive and detailed approach aims not only to enhance employee resilience and motivation but also to contribute significantly to increased organizational success and overall employee satisfaction.

2. Existing Work / Literature Review

This initiative monitors employee well-being and uses sophisticated analytics to forecast staff burnout. The paper grounds its approach and supports its claims with research from other sources. The pertinent literature that was evaluated for this report is broken down as follows:

2.1 Statistics on employee burnout: A source that emphasizes the frequency of staff burnout is cited in the study. This source probably offers data on the proportion of workers that experience burnout, how it affects output, and possible repercussions for businesses. These sources include reports from mental health groups and surveys done by Indeed.

2.2 Using Machine Learning to Predict Employee Burnout: The study includes references that address how machine learning (ML) could be used to forecast employee burnout. These resources might investigate if employing data-driven strategies for spotting early indicators of burnout. Research publications or articles that address the use of ML algorithms in comparable situations, such as the prediction of burnout in healthcare workers, are some examples.

2.3 The advantages of proactive intervention: The significance of taking a proactive stance against staff burnout is emphasized in the study. The benefits of early intervention, such as lower healthcare expenses and increased employee wellbeing, are probably demonstrated by the listed sources. Studies examining the efficacy of prophylactic strategies against burnout are among the examples.

2.4 Present Research on Predicting Employee Burnout: The paper references previous research on predicting staff burnout. This is probably a reference to academic articles or code repositories that investigate related methods of machine learning model-based burnout prediction. One example is the report on Kaggle by Kerneler.

In general, the paper makes use of previous research to lay the groundwork for its methodology. It draws attention to how common burnout is, investigates how machine learning may be used for early identification, and underlines the advantages of proactive management techniques. The paper bolsters its credibility and proves its compatibility with ongoing research efforts in employee burnout prediction by citing pertinent literature.

3. Topic of the work

3.1 System Design / Architecture

3.1.1 Data Preprocessing: Raw data from the CSV file is put into a Pandas DataFrame, and features such as 'Date of Joining' are preprocessed to extract pertinent date components. One-hot encoding is used to encode categorical variables. Data cleaning steps include dealing with missing values and duplicates.

3.1.2 Model Development: Keras is used to create a feedforward neural network with input, hidden, and output units. For regression tasks, the model includes an appropriate optimizer and loss function. Dropout layers help to prevent overfitting.

3.1.3 Model Training and Evaluation: The model is trained on preprocessed data using training and validation splits. The test set is used to evaluate the model's performance once it is trained. Matplotlib is used to visualise loss metrics. Finally, predictions are compared against actual burnout rates to assess performance.

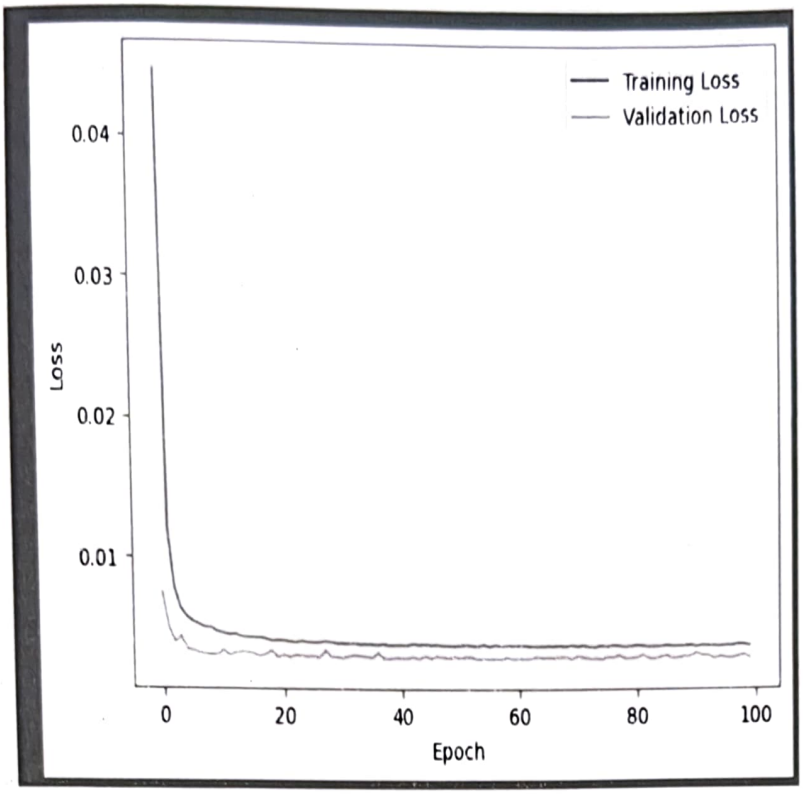
3.2 Working Principle

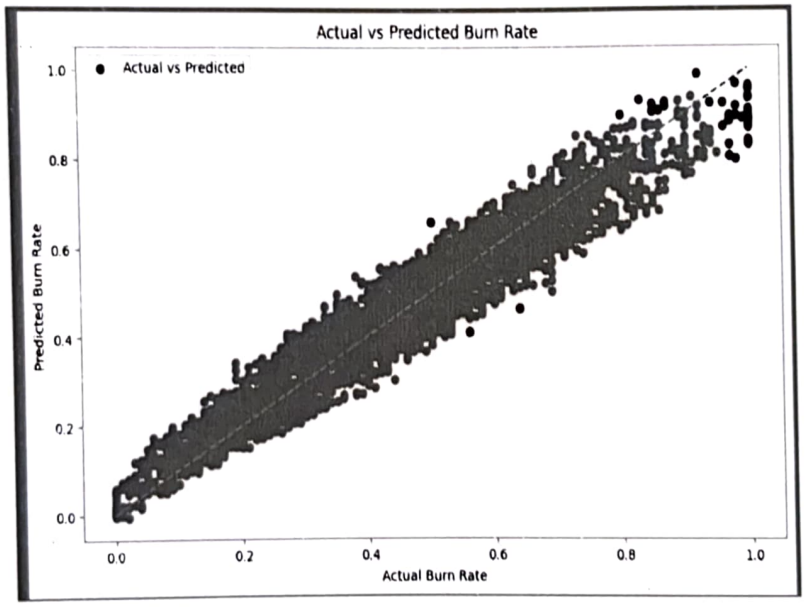
This code attempts to forecast employee burnout rates based on a variety of factors such as gender, firm type, work-from-home arrangement, designation, resource allocation, and dates of joining. It begins by preparing the data, which includes transforming categorical variables to numerical ones and addressing missing values. The date of joining is separated into several aspects, including year, month, week, day, and day of the week. The preprocessed data is then divided into training and test sets. TensorFlow's Keras API is used to build a neural network with input, hidden, and output layers. The model is trained using the training data, with the goal of minimising mean squared error loss.

3.3 Results and Discussion

This code seeks to forecast employee burnout rates by analysing a dataset that includes gender, organisation type, WFH setup, designation, resource allocation, and date of joining. After preparing the data by converting categorical variables to numerical format and extracting features from the joining date, the data is divided into training and testing sets.

To avoid overfitting, a Sequential neural network model is built with three thick layers and dropout regularisation. The model is trained with the mean squared error loss function and the Adam optimizer. The training progress is tracked using validation loss and visualised with matplotlib. Finally, the model's performance is assessed on the test set, with predictions displayed versus actual burnout rates.


Training Loss
Validation Loss
0.04
0.03
0.02
0.01
Loss
0
20
40
60
80
100
Epoch


Actual vs Predicted Burn Rate
Actual vs Predicted
1.0
0.8
0.6
0.4
0.2
0.0
Predicted Burn Rate
0.0
0.2
0.4
0.6
0.8
1.0
Actual Burn Rate

3.4 Limitations

The offered code displays a basic regression model that use a neural network to estimate burn rates based on various employee characteristics. However, there are numerous restrictions that can be solved to improve. For starters, the model architecture is simple, which may limit its ability to capture complicated patterns. Incorporating deeper layers or more complicated architectures may improve performance. Furthermore, the dataset preparation is simplistic, neglecting potential feature engineering opportunities or managing categorical variables more efficiently. Furthermore, there has been little research into hyperparameters or regularisation techniques that could help prevent overfitting. Finally, judging model performance exclusively on mean squared error risked overlooking nuances. Using other measures such as MAE or RMSE can provide a more complete picture of model performance.

3.5 Individual Contribution by members

1. Hardik Kankane 21BCE10413

In the collaborative project "Employee Wellbeing Monitoring and Assurance Using Advanced Analytics", my role in fine-tuning the models and creating synthetic datasets became crucial. I carefully parameterized the training and validation models, ensuring their effectiveness. Diving into the human side, I simulated real-world scenarios in our datasets, managing changing relationships and incorporating just the right amount of complexity. This experience not only sharpened my technical skills, but also instilled a deep appreciation for the human nuances of employee wellness through advanced analytics.

2. Paras Verma 21BCE10294

In the collaborative project "Employee Wellbeing Monitoring and Assurance Using Advanced Analytics," In collaboration with my Team mate Tanishka, I conducted thorough research into machine learning models and their accuracies, ultimately opting to implement neural networks. Tanishka's expertise significantly influenced our decision, leading to successful model optimization and remarkable results. Our teamwork fostered dynamic idea exchange and problemsolving, highlighting the effectiveness of collaboration in achieving project objectives.

3. Tanishka Mishra 21BCE10249

In the collaborative project "Employee Wellbeing Monitoring and Assurance Using Advanced Analytics", my role was to look after the suitable ML model through which we are going to implement the prediction. The dataset undergoes several preprocessing procedures, including the conversion of the 'Date of Joining' column into individual

year, month, week, day, and day of the week features. This helps the programme to identify probable trends in employee tenure. The neural network model architecture consists of three densely linked layers with dropout regularisation to prevent overfitting. I tried to train this model with the Adam optimizer and the mean squared error loss function. I used training and validation loss curves to evaluate model performance, and predictions are compared to actual burn rates using scatter plots, providing insights into the model's predictive skills and potential areas for development.

4. **Akash Parmar 21BCE11583**

My key contribution to the collaborative endeavour dubbed "Employee Wellbeing Monitoring and Assurance Using Advanced Analytics" focused on fine-tuning models and creating synthetic datasets. I meticulously tuned the training and validation models to achieve peak performance. I delved into the human dimension by simulating actual real-world scenarios within our datasets, expertly managing evolving relationships and introducing the proper level of complexity. This immersion training not only sharpened my technical skills, but also gave me a thorough understanding of the nuances of employee wellbeing via the lens of sophisticated analytics.

5. Apoorva Gupta21BCE10650

In the collaborative project "Employee Wellbeing Monitoring and Assurance Using AdvancedAnalytics," I played a pivotal role in testing numerous algorithms on a sizable dataset provided by Hardik. This involved rigorous testing and analysis, ensuring the efficiency and effectiveness of the chosen algorithms. My focus on frontend development added a layer of user-centric perspective, contributing to the overall success of the project. This experience not only enhanced my technical skills but also highlighted the importance of bridging technical excellence with usercentric design in real-world applications.

6. Anondita Dutta 21BCE10537

In the project 'Monitoring and Safeguarding Employee Wellbeing through Advanced Analytics,' I played a pivotal role in exploring various machine learning models. Alongside the chosen model, I researched and evaluated alternative approaches, contributing to the project's comprehensive analysis and decision-making process. My contributions were aimed at ensuring our project not only adopted a robust model for immediate needs but also considered adaptability and scalability for future enhancements.

3. CONCLUSION

This code sample uses a neural network regression model to forecast employee burn rates based on a variety of factors. The dataset is preprocessed to remove missing values, transform categorical variables to dummy variables, and extract date features from the 'Date of Joining' column.Following preprocessing, the data is divided into training and testing sets and standardised to ensure consistency across characteristics. The neural network model architecture is made up of three dense layers with dropout regularisation to prevent overfitting.During training, the model uses the Adam optimizer to optimise the mean squared error loss function. The training history is recorded to track the model's convergence.

Following training, the model is evaluated on a test set to determine its performance. The loss metric is calculated and displayed to evaluate the model's accuracy. A scatter map compares the projected and actual burn rates, providing insight into the model's prediction capability.

Overall, the code use a regression model to forecast staff burn rates, utilising neural networks and appropriate preprocessing approaches. It evaluates the model's performance using evaluation metrics and visualisations and serves as a platform for future research and refinement, if necessary.

4. References:

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4. https://iaeme.com/MasterAdmin/Journal_uploads/IJMHRM/VOLUME_13_ISSUE_2/I JMHRM_13_02_003.pdf
5. https://www.kaggle.com/code/kerneler/starter-healthcareworkersburnout-d76d4259a/input

5. Biodata:

1.AKASH PARMAR

I am Akash Parmar, currently in my third year of pursuing in Computer Science. My academic journey has been marked by a passion for technology and a relentless pursuit of knowledge in the field . With proficiency in a diverse set of skills, I specialize in MERN (MongoDB, Express.js, React.js, Node.js) Full Stack development, where I have gained hands-on experience in building dynamic web applications. Additionally, my expertise extends to Data Structures and Algorithms (DSA), an essential aspect of software development, and I am proficient in C++, a versatile programming language widely used in the industry . As a student deeply invested in the realm of computer science, I am enthusiastic about exploring new opportunities and challenges to further develop my skills and contribute meaningfully to the tech community. Whether it's crafting innovative solutions to real-world problems or collaborating with peers to push the boundaries of technology, I am driven by a desire to make a positive impact through my work.

2.HARDIK KANKANE

Hello, I'm Hardik Kankane, currently pursuing B.Tech in Computer Science. Specializing in Linux application development and Bash scripting, I excel in creating seamless, efficient solutions within the Unix Operating System. My proficiency extends to Django and cloud technologies, allowing me to deliver robust applications. With a keen focus on clean code, I prioritize simplicity and functionality in every project. My commitment to Linux environments ensures a solid foundation for innovation, emphasizing a seamless development process. Excited to contribute to cutting-edge projects, I bring a comprehensive skill set that harmonizes technical depth with practical application, striving for excellence in the dynamic field of technology.

3. PARAS VERMA

I am Paras Verma, currently embarking on a rewarding academic journey in pursuit of a Bachelor of Technology degree with a specialization in front-end development. Furthermore, I am deeply invested in the captivating field of UI/UX design. My professional aspirations lie in the meticulous construction of user interfaces that not only possess a visually compelling aesthetic but also prioritize the creation of intuitive and seamless user experiences. Beyond the realm of visual appeal, my skillset extends to the powerful programming languages of C++ and Python . I possess a strong proficiency in both, allowing me to meticulously dissect complex technological problems into manageable components.

4.TANISHKA MISHRA

I'm Tanishka Mishra, currently pursuing my B.Tech in Computer Science and Engineering. My love for coding runs deep, especially when it comes to delving into the complexities of the MERN stack and ML. Moreover, I am committed to lifelong learning and skill enhancement, always on the lookout for opportunities to broaden my expertise across different sources and platforms. I am very fond of implementing these techniques in the real world. Apart from these, I have a different side of me which loves to travel and hang out at different places with my friends and play Video Games.

5.APOORVA GUPTA

I am Apoorva Gupta, currently embarking on a rewarding academic journey in pursuit of a Bachelor of Technology degree with a specialization in front-end development. Furthermore, I am deeply invested in the captivating field of UI/UX design. My professional aspirations lie in the meticulous construction of user interfaces that not only possess a visually compelling aesthetic but also prioritize the creation of intuitive and seamless user experiences. Beyond the realm of visual appeal, my skillset extends to the powerful programming languages of Python and MySQL. I possess a strong proficiency in both, allowing me to meticulously dissect complex technological problems into manageable components.

6.ANONDITA DUTTA

I am Anondita Dutta, currently pursuing my B.Tech in Computer Science and Engineering. My
academic interests lie in the fields of Data Analytics/Science and Cybersecurity The intricate dance of numbers and the rigorous process of securing data fascinate me, driving my passion for these fields.