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AI AND PSYCHOLOGICAL WELL-BEING: A MACHINE LEARNING PERSPECTIVE ON MENTAL STRESS AMONG WORKING WOMEN

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ABSTRACT

Mental stress among working women is a growing concern, impacting productivity, well-being, and overall quality of life. Artificial Intelligence (AI) and Machine Learning (ML) have emerged as powerful tools for detecting and analyzing mental stress through various physiological and behavioral indicators. This paper critically evaluates machine learning paradigms in stress identification, explores data-driven approaches, and discusses their effectiveness in understanding psychological well-being among working women.

Key words: Artificial Intelligence (AI)Machine Learning (ML)Mental Stress DetectionWorking WomenPsychological Well-being

I. INTRODUCTION

Mental stress is a prevalent issue among working women due to factors such as workload, workplace discrimination, family responsibilities, and societal expectations. Traditional stress detection methods rely on self-reported surveys and clinical diagnoses, which can be subjective and time-consuming. AI-driven models, leveraging physiological data (heart rate variability, EEG signals) and behavioral data (speech patterns, facial expressions, social media activity), offer a more efficient and objective approach to stress detection. This paper provides a critical evaluation of machine learning techniques in recognizing and predicting mental stress among working women. The rapid integration of artificial intelligence (AI) in various aspects of human life has significantly reshaped the way people perceive and manage psychological well-being. Among the most vulnerable groups to mental stress are working women, who often juggle multiple responsibilities, including professional obligations, household duties, and caregiving roles. The rising demands of modern work culture, gender biases, workplace discrimination, and societal expectations have exacerbated stress levels among working women, leading to various psychological and physiological consequences. The emergence of machine learning (ML) and AI-driven technologies has opened new possibilities for identifying, predicting, and mitigating mental stress in this demographic. AI-based tools, such as sentiment analysis, stress detection algorithms, and mental health chatbots, are now being leveraged to assess and improve psychological well-being. By analyzing behavioral patterns, physiological data, and linguistic cues, ML models can provide early detection of stress symptoms, allowing timely interventions and personalized mental health support.

The role of AI in addressing mental health challenges has become increasingly relevant in recent years, particularly with the rise of remote work, digitalization, and the growing awareness of mental well-being. Machine learning models trained on large datasets can detect stress patterns through physiological markers like heart rate variability, sleep disturbances, and voice modulation, or through text-based sentiment analysis from emails and social media interactions. Moreover, wearable technology integrated with AI algorithms enables real-time stress monitoring, providing insights into stress triggers and coping mechanisms. Such advancements can empower working women by offering them personalized mental health recommendations, mindfulness exercises, and cognitive behavioral therapy (CBT) techniques through AI-powered applications.

Despite these advancements, ethical concerns and challenges persist regarding AI's role in psychological well-being. Privacy issues, data security, and potential biases in AI models can impact the accuracy and reliability of mental health assessments. Additionally, AI should complement rather than

replace human psychological support, ensuring that individuals receive empathetic and contextually relevant care. Addressing these challenges requires collaborative efforts between data scientists, psychologists, healthcare professionals, and policymakers to create AI-driven mental health solutions that are both effective and ethical.

This paper explores the intersection of AI, machine learning, and mental stress among working women, focusing on how AI-driven approaches can revolutionize stress detection and management. By delving into the latest advancements in AI-powered mental health interventions, this study aims to highlight the potential of machine learning in enhancing psychological well-being while addressing the challenges associated with AI adoption in mental health care. The findings will contribute to a deeper understanding of how AI can be harnessed to support working women in managing mental stress, ultimately fostering a healthier and more inclusive work environment.

II. MACHINE LEARNING APPROACHES FOR STRESS DETECTION

Supervised Learning Models

Supervised learning models such as Support Vector Machines (SVM), Random Forest (RF), and Neural Networks have been extensively used for stress classification based on labeled datasets. These models analyze physiological signals like electrodermal activity (EDA), heart rate variability (HRV), and voice modulation to detect stress levels.

Unsupervised Learning Models

Unsupervised learning, particularly clustering algorithms like K-Means and DBSCAN, helps in identifying hidden patterns in stress-related data without predefined labels. These models are useful in detecting underlying stress trends in different work environments.

Deep Learning and Neural Networks

Deep learning models, including Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), have shown significant success in stress recognition through facial expression analysis, speech emotion recognition, and text sentiment analysis from social media posts. These models provide a more nuanced understanding of stress patterns among working women.

III. DATA SOURCES FOR STRESS DETECTION

1. **Physiological Data** – Collected via wearable devices (e.g., smartwatches, EEG sensors) to track real-time stress indicators.
2. **Behavioral Data** – Includes speech analysis, keystroke dynamics, and facial expressions to infer stress levels.
3. **Textual Data** – Social media posts, workplace emails, and sentiment analysis of written communication help in stress prediction.
4. **Survey-Based Data** – Self-reported psychological assessments provide a baseline for AI models.

IV. CHALLENGES AND ETHICAL CONSIDERATIONS

Data Privacy and Security

AI models rely on sensitive personal data, raising concerns about privacy and security. Implementing strong encryption methods and obtaining user consent is crucial.

Bias and Fairness in AI Models

AI models must be trained on diverse datasets to prevent biases that could affect the accuracy of stress predictions for different demographic groups.

Interpretability of AI Models

Understanding AI decision-making in stress detection remains a challenge. Explainable AI (XAI) methods are essential for transparency and trust.

V. CONCLUSION

Machine learning provides a promising avenue for detecting and managing mental stress among working women. By leveraging AI-driven approaches, it is possible to move beyond traditional self-reported stress assessments to more objective and real-time monitoring systems. However, ethical challenges, data privacy, and bias in AI models must be addressed to ensure fairness and reliability. Future advancements should focus on developing holistic, user-centric AI solutions that enhance psychological well-being in professional settings.

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