Real Time RULA Posture Corrector

Annu Kumari[1], Bhavya Narnoli[1]

Abstract

This study pioneers the development of an automated posture assessment system, utilizing a deep learning algorithm based on the Rapid Upper Limb Assessment (RULA) methodology. The objective is to estimate real-time RULA scores, including wrist posture, as well as calculates score from images capturing various sitting postures. The innovation extends to an interactive website, not only providing instantaneous RULA scores but also incorporating alerting sounds for posture correction which serves as a gentle reminder to users, to guide them towards optimal sitting postures. It also integrates short yoga routines for breaks, fostering a holistic approach to posture correction and overall well-being in sedentary settings. This comprehensive system aligns with the growing need for proactive posture management, contributing to improved workplace health and productivity.

Keywords: RULA, alerting signal, WMSD, posture detection

1. Introduction

The sedentary nature of modern work environments has given rise to a range of health concerns, particularly those related to musculoskeletal strain and poor posture. WMSDs have contributed to almost 400,000 injuries, costing industries over $20 billion per year.(Nayak and Kim 2021). RULA is an observational survey method developed to assess postures of the neck, trunk, upper arm, lower arm, and wrists. Traditionally, methods of evaluating postural risk are based on observational techniques that require an ergonomic analyst to observe the work in real-time or from recorded video to manually segment the relevant body parts and evaluate the risk associated with the posture. Due to human error, however, these techniques produce results with low consistency and repeatability, both of which can be reduced or eliminated by using advanced technologies

2. Background and Motivation

In contemporary workplaces, prioritizing worker health and safety is imperative, given the escalating prevalence of Work-Related Musculoskeletal Disorders (WMSDs). WMSDs contributed to 4.1 million early deaths in 2015, marking a 46% increase since 2000 (Sebbag et al, 2019). Recognizing the role of bad posture and repetitive movements in these issues, the demand for automated systems for objective assessments has intensified.

Manual assessments of posture and muscle-related problems are not only labor-intensive but also slow to scale. Automated systems offer a transformative solution, providing reliable and scalable assessments. This not only saves time but aligns with the practicalities of large-scale implementation, particularly crucial in sectors like Information Technology (IT) where prolonged desk work is common.

In the IT sector, where prolonged desk-bound work is prevalent, automated upper limb assessments become critical. Bad posture and repetitive movements in this sector can lead to WMSDs, impacting both employee health and organizational productivity. The adoption of automated systems aligns directly with the overarching goals of organizations, especially in IT, to ensure safe work environments and comply with regulatory frameworks.

3. Materials and Methods

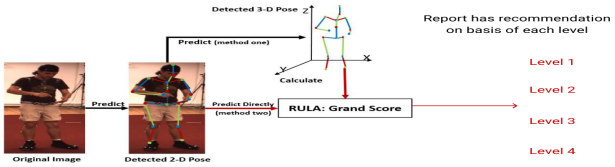
Existing works in the fields of computer vision, posture assessment tools, and ergonomic risk assessment methods were used to identify the missing gaps by utilising them on the sample. Consequently, to enhance the usability and effectiveness user feedback collection process was initiated. Semi-structured interviews were conducted with a diverse group of participants, including Ph.D. professionals, IT experts, a general physician at IIIT Delhi, and a doctor who played a key role in facilitating an iterative development process. Through this collaborative effort, valuable insights were gathered, leading to iterative improvements in the prototype.

4. Inferences

Score	Level of MSD Risk
1-2	neglibible risk, no action required
3-4	low risk, change may be needed
5-6	medium risk, further investigation, change soon
6+	very high risk, implement change now

Challenges of prolonged sitting help in reducing the negative impacts of sedentary behavior on the human body to optimize human well-being and overall system performance.
Reminder to take breaks and maintaining conscious posture aligns at aiming at promoting better posture and reducing musculoskeletal strain for comfortable and efficient work environments to support natural posture and movements of the human body.
Early detection of backbone shift and proactive measures for prevention aligns with ensuring the well-being and safety of individuals in their work environment to remain safe body-wise.
Through postural analysis and tracking health indicators aligns with fostering a healthy and supportive work environment that considers both physical and mental well-being for holistic well-being of individuals in their workspaces.

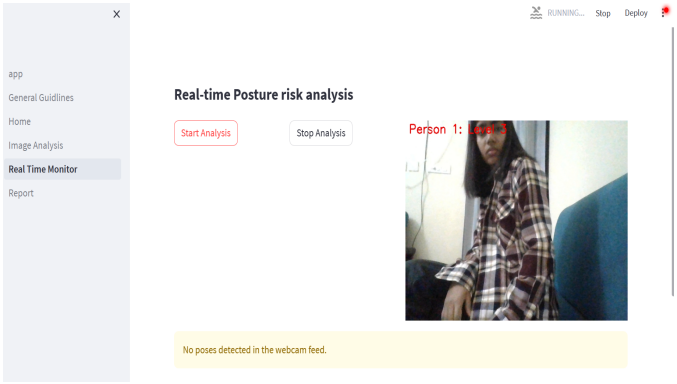
5. Result



5.1. Posture Evaluation and Guidance

To further combat the negative effects of prolonged sitting, our system incorporates several features to promote proper posture and reduce the risks associated with sedentary behavior.

5.2. Alert Signal for Posture Correction

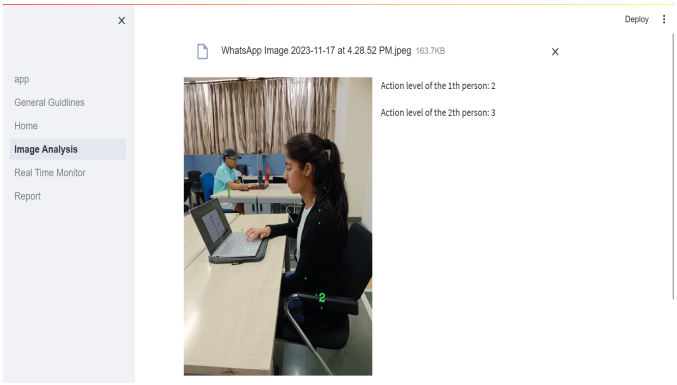


Monitoring the user's posture provides an alert audio signal when the posture score falls below a certain threshold, indicating that corrective action is needed. This alert serves as a timely reminder to adjust posture and prevent potential discomfort or injury.

5.3. In-Depth Posture Analysis and Recommendations

Users can access a detailed report section on the website, where they can find in-depth analysis of their posture and specific recommendations for improvement. This comprehensive feedback provides valuable insights into posture habits and guides users towards adopting healthier sitting postures.

5.4. Posture Evaluation via Image Upload



In addition to real-time posture monitoring, system allows users to evaluate their posture by uploading an image of themselves sitting. This feature provides a convenient and accessible way to assess posture and identify areas for improvement.

5.5. General Guidelines for Healthy Sitting

The website also includes a dedicated page with general guidelines for healthy sitting and working. These guidelines provide practical tips and recommendations to promote proper posture and reduce the negative effects of prolonged sitting.

6. Conclusion

Prolonged sitting poses significant health risks, including musculoskeletal disorders, obesity, metabolic syndrome, cardiovascular disease, diabetes, and certain types of cancer. To address these challenges, the system offers a comprehensive approach that combines real-time posture monitoring, in-depth posture analysis, general guidelines, and posture evaluation via image upload. This multifaceted approach empowers users to adopt healthier sitting habits, mitigate the risks associated with prolonged sitting, and promote overall well-being.

7. Discussion

The system could be enhanced by integrating activity tracking, providing personalized posture goals and feedback, incorporating gamification elements for engagement, and partnering with workplaces to promote healthy sitting habits. Additionally, educational resources, collaboration with healthcare professionals, wearable device integration, machine learning-based posture recognition, real-time posture correction guidance, and personalized exercise recommendations could further augment the system's effectiveness in addressing prolonged sitting and promoting overall well-being.

Acknowledgements

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