VI International Conference on Mathematics and its Applications in Science and Engineering
(ICMASE 2025)

ICMASE 2025

CLUSTERING OCCUPATIONAL SAFETY PROFESSIONALS' PERCEPTIONS ON EMERGING TECHNOLOGIES: A DATA-DRIVEN SEGMENTATION APPROACH

Aldina Correia[1,2,*], Hélia Fariae[2], José Queirós[1,2,]

[1] *CIICESI,*
[2] *ESTG, Instituto Politécnico do Porto, 4610-156 Felgueiras, Portugal*

ABSTRACT

The integration of emerging technologies—such as Artificial Intelligence (AI), Internet of Things (IoT), and wearable devices into Occupational Health and Safety (OHS) systems is transforming workplace risk management. However, adoption varies considerably depending on practitioners' perceptions and organizational contexts. This study applies unsupervised machine learning techniques to segment OHS professionals based on their perceptions of benefits and challenges associated with these technologies. Using a dataset from a national survey of Portuguese OHS technicians, we employ dimensionality reduction (PCA and t-SNE) followed by clustering algorithms (k-means and DBSCAN) to discover latent clusters among respondents. The analysis reveals different groups, including "technology enthusiasts", "cautious adopters" and "resistant sceptics", each with specific concerns such as data privacy, training needs, or ethical implications. These findings suggest that a one-size-fits-all strategy is insufficient for implementing safety technologies and highlight the value of perception-based segmentation for targeted interventions. Our work provides a methodological contribution to digital transformation efforts in OHS and practical guidance for policymakers and security managers who aim to tailor adoption strategies to specific professional profiles.

***K*eywords** occupational health and safety · clustering · unsupervised learning · perceptions · emerging technologies · t-SNE · k-means · segmentation · Portugal

References

[1] Correia, A., Faria, H. and Queirós, J. Challenges and Benefits of Emerging Technologies in Occupational Health and Safety. Springer Lecture Notes in Computer Science. (to appear)

[2] Akyıldız, C. (2023). Integration of digitalization into occupational health and safety and its applicability: a literature review. The European Research Journal, 9(6), 1509-1519.

[3] Bathan, J., and Joy, C. A. (2023). Modeling the mediating effects of occupational safety and health management between organization culture and business performance among employees of construction companies. International Journal of Open-Access, Interdisciplinary & New Educational Discoveries of ETCOR Educational Research Center, **2**(4), 131-156.

[4] Boring, R. L., Neville, K., Spielman, Z. A., Kelley, D. B., & Gawron, V. J. (2022). Safety Frameworks for Emerging Technologies. Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 66(1), 1391–1395. https://doi.org/10.1177/1071181322661006

[*] *Aldina Correia, E-mail: aic@estg.ipp.pt*
This work was supported by national funds through FCT—Fundação para a Ciência e Tecnologia through project UIDB/04728/2020.