Title of the thesis: APPLICATION OF DEEP LEARNING AND COMPUTER VISION TECHNIQUES FOR POSTURAL CLASSIFICATION OF FOREST OPERATIONS USING THE OWAS METHOD

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In forest operations, occupational ergonomics is concerned with the well-being of workers, contributing at a full implementation of the sustainable forest operations concept. In manual, motor-manual, and partly mechanized forest operations, the use of intensive manual labor is still dominating across many parts of the world. Such operations expose the workers to heavy biomechanical loads and unsuitable working postures which, in turn, on the medium and log term have serious consequences for their health and well-being.

Postural analysis encompasses a series of methods and represents a corner stone in occupational ergonomics. It contributes to a better understanding on how the posture is affected by personal, environmental, and job-related contexts. However, one of the drawbacks of the currently used methods in postural assessment is the intensity at which resources and trained personnel are required to process, analyze, and interpret the data, limiting our understanding to conclusions drawn on small datasets.

In this context, computer vision and deep learning promise a full automation of the process, enabling us to make more informed decisions. The thesis approaches this idea, of using media files such as images to test the degree at which state-of-the art algorithms can solve the problem of postural classification, an attempt that is strongly anchored in a well-developed systematic review. Then, one of the crucial contributions to the field is the annotated dataset itself, covering more than 20,000 fully annotated images as inputs for tuning and testing various algorithms. Third, various deep-learning algorithms are tuned, trained, validated, and tested with competitive results in terms of postural classification for a 252-class problem. Fourth, a data partition is then used to check whether the image augmentation by generating key body points can further increase the classification performance, which is proven by the thesis at a significant classification performance increment rate. Since advanced codding does not come handy for most researchers, a visual programming software interface and transfer learning are used to see if the classification performance can be competitive, using a different dataset. While the results were promising, there were also limitations in classification performance when using image embedding and transfer learning. Finally, human labelers are tested against computer classification in postural analysis, with the aim to evaluate the reliability of the methods and their time-efficiency. The findings indicate that, computer-based classification tasks came forward with a high time

efficiency and a competitive accuracy while removing the subjectivity in classification as opposed to human raters.

Overall, the thesis brings relevant and significant contributions to the field of postural analysis in forest operations, overpassing well the state of the art in the dedicated scientific research on the topic; however, by the methods used and results obtained, the thesis reaches a broader audience in the field of postural assessment and ergonomics since it provides a well developed dataset, tuned and tested algorithms, code snippets and methodological procedures that may help adapting the whole process to other sectors and/or businesses.

Therefore, I conclude that the thesis has a very high scientific and practical merit, as it aligns with the concept of resource saving and big data analytics in forestry, and may serve as a great starting point for further developments on the topic.

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