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Editorial

Artificial Intelligence Applications in Digital Anthropometry [1]

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Abstract

Anthropometric measurements are frequently used to assess changes in body composition in different populations. Despite being a cheap, in-field, and relatively valid technique, the COVID-19 pandemic has impulse research on digital anthropometry across the globe. Machine learning, as the convergence of artificial intelligence and data mining, has the potential to improve data collection and analysis in the applications of kinanthropometry. Far from replacing conventional methods, digital anthropometry is a powerful opportunity to increase accuracy, validity, practicality, and the use of self-monitoring procedures under professional supervision. However, further research and scientific literacy among practitioners are warranted.

[1] Presented as a keynote at the 'I Congreso Iberoamericano de Antropometría Aplicada' organized by the 'Red Iberoamericana de Investigadores en Antropometría Aplicada'.

Keywords
Artificial intelligence; machine learning; estimation techniques

Artificial intelligence (AI) represents the intelligence performed by machines that mimic the cognitive functions of human beings [1]. On the other hand, data mining (DM) is the semi-automatic or automatic analysis by which patterns and information are extracted, analyzed, and visualized from large data sets [2]. In turn, machine learning (ML) is at the convergence between AI and MD, which allows automata to learn from data, adapt and improve by performing different tasks such as predictions, classifications, and regressions [2]. The learning process is the key difference when comparing ML and DM.

Among several methods, kinanthropometry offers to exercise and health practitioners a standardized procedure for acquiring anatomical surface measurements that might be used to track changes in body composition. This represents a cheap, in-field, and relatively valid technique commonly used in several instances across the lifespan. However, the main drawbacks encompass i) the high inter-technician variability if the International Standards for Anthropometric Assessment established by the International Society for the Advancement of Kinanthropometry (ISAK) are ignored; and ii) the time-consuming procedure necessary to take all measurements by duplicate or triplicate when assessing the ISAK restricted (21 variables) and full (43 variables) profiles.

ML has the potential to improve data collection and analysis in kinanthropometry. This should call the attention of practitioners, considering that anthropometric data can be used to create morphological profiles or body composition estimation models beyond conventional statistical analyses. For example, unsupervised ML methods allow the inherent structure of unlabeled data to be discovered. Since the clustering method is applied to find homogeneous subgroups of observations, the algorithms have been used to profile phenotypes in sports science [3-5]. It is worth mentioning that the selection of the most appropriate clustering algorithm will depend on the distribution of the data and the phenotype/biological phenomenon to be analyzed (field knowledge) [6].

On the other hand, considering the predictive power of supervised ML methods, methodologies have been developed to estimate basic measures and girths by processing subpixels (silhouettes) [7, 8], searching for convex hull defects (convex Hull) [9] or by using support vector machines or convolutional neural networks with collected data [10]. In this sense, estimating adiposity through digital anthropometry seems promising with valid and reliable results [11], although more research is needed.

As a result of the significant disruption that was caused by the COVID-19 pandemic, digital anthropometry has become an active line of research. The community of practitioners and kinanthropometry researchers is invited to undertake a scientific literacy process in this field to acquire the necessary programming and data science skills to enable correct analysis with ML algorithms (or at least understand the essentials). It is highly likely, in the future, practitioners will use hybrid procedures (human-machine-based methods) to collect anthropometric data. Skinfolds are those measures that might be maintained in future kinanthropometry protocols unless portable ultrasound devices (e.g., BodyMetrix™ BX2000) reduce their price to increase accessibility which may replace the manual procedures due to high reliability, validity, and agreement against dual-

energy X-ray absorptiometry (DXA) [12]. After a possible transition into digital anthropometry, basic measures (stature, sitting height, and arm span), girths, breadths, and lengths can be evaluated with high accuracy and reliability using AI methods. Finally, unsupervised ML algorithms would benefit sports practitioners when the aim is to obtain anthropometric profiles, as has been demonstrated by our research group [3-5].

The lack of knowledge and standardization makes digital anthropometry a promising area for research and innovation. Our Research Division at the Dynamical Business and Science Society—DBSS International SAS will continue working on the ANTHROCYBER initiative as a multi-centric research project to design and validate digital anthropometry methodologies in various countries of Euro-America. Those interested in collaborating with this initiative may contact the author for details.

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Author Contributions

The author did all the research work of this study.

Competing Interests

D.A.B. is a certified Level Three Anthropometrist (Instructor) by the International Society for the Advancement of Kinanthropometry (ISAK), has conducted academic-sponsored research on anthropometry and has received honoraria for selling anthropometric equipment and speaking about anthropometry at international conferences/private courses. Additionally, he is an active member of the 'Red Iberoamericana de Investigadores en Antropometría Aplicada—RIBA2'.

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