Editorial

The Importance of Reproducibility in Dental Age Estimation, Challenges and Strategies to Enhance Reproducibility

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Dental age estimation (DAE) is a hot topic in forensic odontology. As the name implies, it's all about figuring out a person's age based on changes in their teeth over time. While it sounds simple, the actual process involves careful variable observation and complex statistics.

Like many fields, DAE has come a long way. Back in the day, the process was straightforward: pick a dental variable related to age, observe it, and then use some kind of model, along with its error rate, to estimate age, or even just apply a mean and standard deviation at a certain stage of development. Different researchers might tackle different questions, but they're all chasing the same goal: finding the most accurate or reliable way to predict someone's age.

Lately, this quest for accuracy—though statistically speaking, it's more about precision—has taken a big leap forward with the use of machine learning[1]. From image recognition to creating deep learning models, these techniques have been making waves in DAE research over the past couple of years. But there's a twist: as exciting as these new methods are, there's been a rising concern about the reproducibility of machine learning research results.[2]

This issue isn't unique to machine learning; it also affects traditional DAE methods. However, it can be mitigated with clear, step-by-step descriptions in the methodology, supplemented by easy-to-read figures or tables, and examples demonstrating how a particular method works. This is especially crucial when introducing a new methodology. Journals that publish DAE research can (and, more importantly, should) request a short manual from authors as supplementary material. This manual should include a step-by-step guide—ideally free from excessive technical and statistical jargon—on how to apply the method.

There are multiple layers to the reproducibility problem when researchers use machine learning, from randomization to the various learning parameters that can be tuned. For example, the most common methodology for sample testing and training data splitting is k-fold cross-validation. Although papers often report the number of folds (or k), the samples within each fold are still randomized, which can lower the reproducibility of results. While achieving 100% reproducibility may be impossible, we should strive for the highest possible reproducibility. This can be achieved in several ways, such as using open-source software, sharing code on platforms like GitHub, or simply reporting the random seed used in the statistical software.

We believe that reporting research is not only about sharing our latest achievements in addressing specific hypotheses but also about educating each other on the methods and approaches we use. By focusing on transparency and reproducibility, we can ensure that our findings are not only robust but also a valuable resource for the entire forensic community.

In conclusion, as DAE continues to evolve with the integration of advanced technologies like machine learning, it's crucial to address the challenges of reproducibility head-on. By doing so, we can foster a more open and reliable scientific environment, where findings are not just exciting but also dependable and replicable. This commitment to rigorous research practices will ultimately enhance the credibility and impact of our work in forensic odontology.

References

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