A45 Automated Anthropometric Measurements of Long Bones Using Point Cloud Data

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After attending this presentation, attendees will understand the current and future potential for traditional osteometry to be enriched by the application of software capable of producing automated osteometric measurements, thus reducing the risk of intra- and inter-observer error.

This presentation will impact the forensic science community by demonstrating that 3D point clouds created from both dry bones and medical Computed Tomography (CT) scans can be modeled and automatically measured. This proof of principle strongly indicates that future development in this field will allow the majority of traditional anthropometric measurements to be made with software programs either fully or semi-automatic, without the need of manual intervention. These measurements will be repeatable, reproducible, and can overcome the lack of universal measurement standards within forensic anthropology, which makes it specifically relevant for the forensic aspect of anthropology.

Osteometry is widely used and accepted in the forensic, archaeological, and anthropological world. This is to establish a biological profile, which typically includes sex, age, stature, and ethnicity of an individual by using regression formulas that require measurements of various bones and bone regions. The accuracy of these measurements is partially determined by how much experience the practitioners have, as well as where each practitioner chooses to take measurements, as there are no clearly defined or universally accepted best practices.[1-3]

With current technology, it is possible to create detailed 3D models of bones and perform measurements on them. Previous studies show that measuring 3D models, produced with CT scanners or hand-held laser scanners, are equally as accurate as when physically measuring on a dry or fresh bone.[4,5]

Two studies were performed, one with 31 dry femora from the St. Brides Church Crypt collection in London, England, and one using 40 femora from CT scans provided by the Institute of Forensic Medicine at the University of Zurich, Switzerland. The maximum length was obtained from the dry bones with an osteometric board and manually from 3D models of the CT scans in MeshLab. The maximum length of the point clouds was then obtained automatically within custom software. Due to the pioneering nature of these studies, multiple methodologies for data handling and analysis were developed and tested in order to determine their feasibility prior to the creation of the custom software.

The results of these studies show clear correlations, which provide evidence that measurements taken automatically by software are as good as those taken manually, and thus has the potential to be used for biological profiles. This would have the advantage of allowing practicing forensic anthropologists to present easily reproduced and quantifiable results.

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3D Models, Automated Measurements, Virtual Skeletal Analysis