

Accuracy Comparison of 3D Face Scans Obtained by Portable Stereophotogrammetry and Smartphone Applications

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Abstract

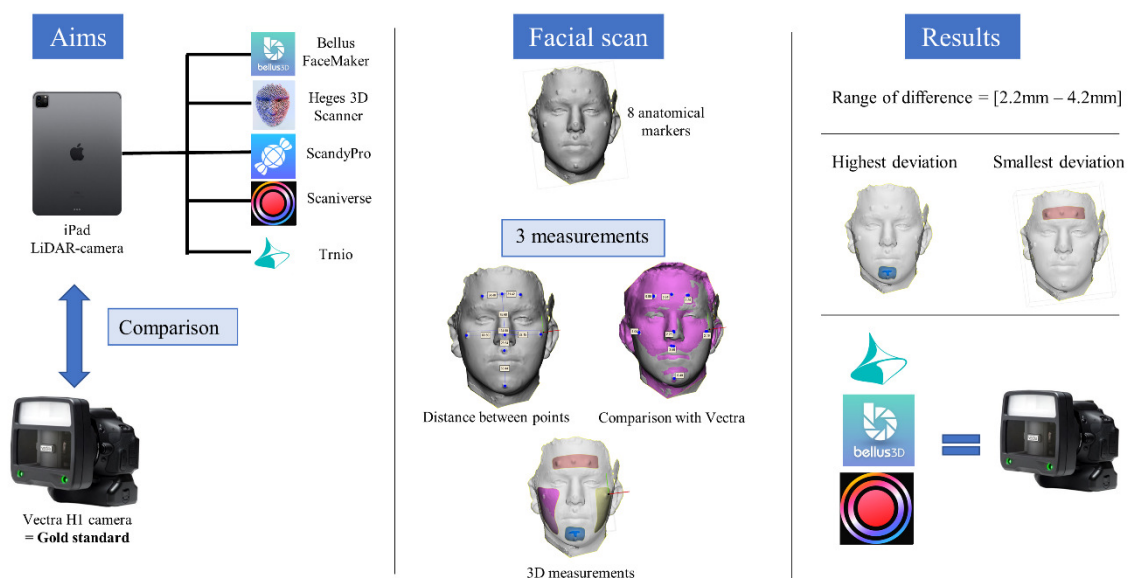
Purpose: To compare the accuracy of three-dimensional (3D) facial scans captured by smartphone applications with a clinically approved portable stereophotogrammetry device.

Methods: Morphometric markers were placed on 8 points on the face of fifty participants. Facial 3D scans were captured with a Light Detection and Ranging (LiDAR) camera on an iPad Pro using 5 smartphone applications and a stereophotogrammetric 3D Vectra H1 camera. These 5 smartphone applications are Heges 3D Scanner (Marek Simonik, Ostrava, Czech Republic), Bellus FaceMaker (Bellus 3D Inc, Campbell, USA), ScandyPro (Scandy, New Orleans, USA), Scaniverse (Toolbox AI, San Diego, USA) and Trnio (Trnio, Los Angeles). The standard triangle language (stl.) format of the smartphone facial scans were automatically surface-based spatially aligned on the 3D Vectra H1 stl. of the corresponding participant. Linear and 3D measurements were performed in 3-Matic software (Materialise, Leuven, Belgium).

Results: The largest linear differences were found between the morphometric points of the Heges 3D scanner (3.4 ± 1.5 mm) and ScanyPro (4.4 ± 2.1 mm), and Vectra H1, while the smallest deviations were seen for the Bellus FaceMaker (2.2 ± 1.2 mm) and Trnio (2.9 ± 1.5 mm). Identical findings were obtained for the 3D comparison. Within the forehead region, which was the region with the smallest deviation, the Bellus FaceMaker (-0.16 ± 0.47 mm³) and Trnio (-0.57 ± 0.76 mm³) give the best similarity. Largest differences were again found for the Heges 3D scanner (0.86 ± 0.83) and ScanyPro (1.02 ± 0.97).

Conclusion: From the five tested smartphone applications, three (Bellus FaceMaker, Trnio and ScandyPro) showed sufficient accuracy for facial scanning purposes.

Keywords: Three-Dimensional Imaging, smartphone apps, face, stereophotogrammetry, accuracy, 3D face model



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