

# Gray Seals' Crania Landmarks Detection: 3D Digitizer Pen VS 3D Optical Scanner

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## Introduction

The gold standard for collecting 3D landmarks in geometric morphometric is Microscribe, a digitizer probe which collects 3D coordinates by tracing an object with the tip of a mechanical pointer arm.

This project aims at comparing Microscribe and the 3D Travelling Optical Scanner, developed by DTU Compute, in landmarks detection of gray seals crania. The Optical Scanner not only allows landmarks detection, but also allows production of 3D shape models of animals' crania, providing a greater amount of information available for users and institutions.

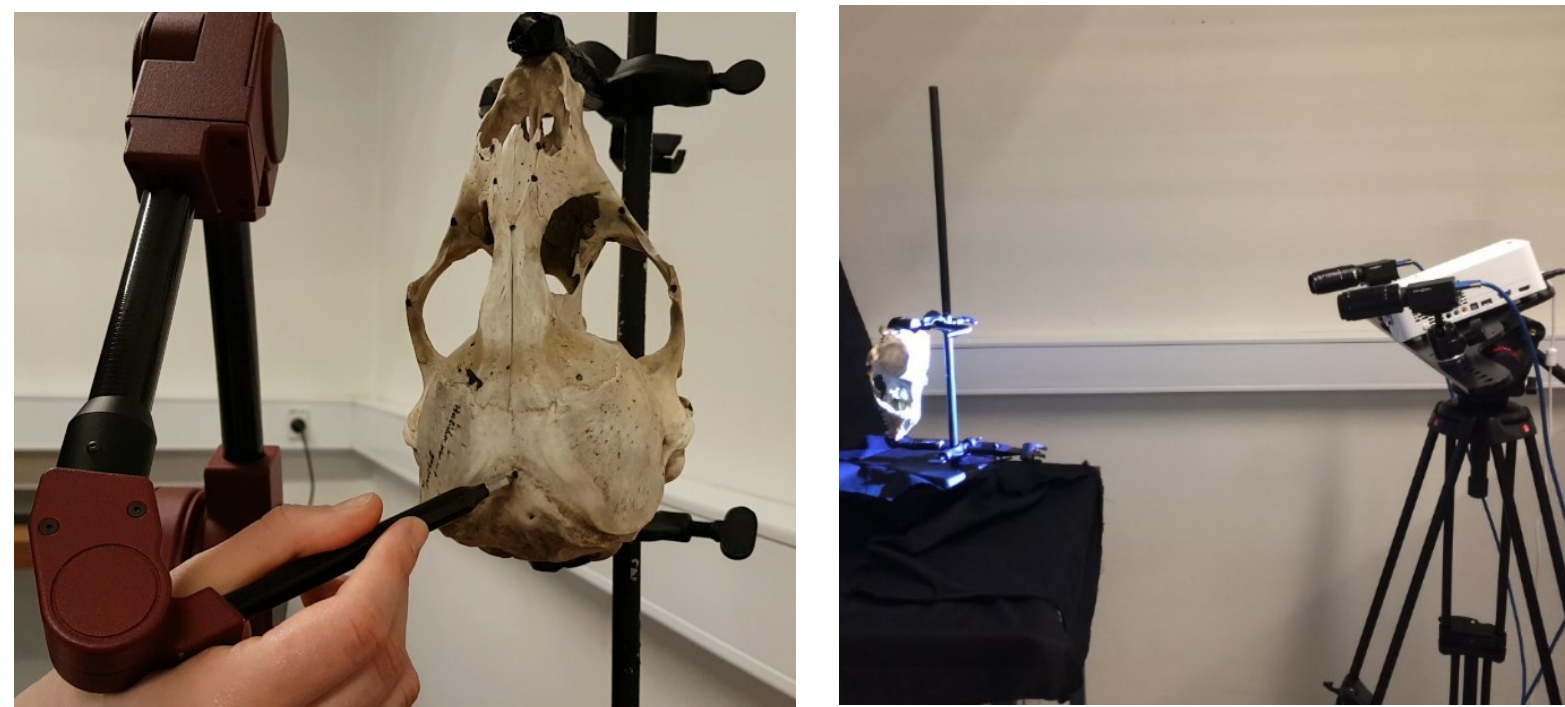
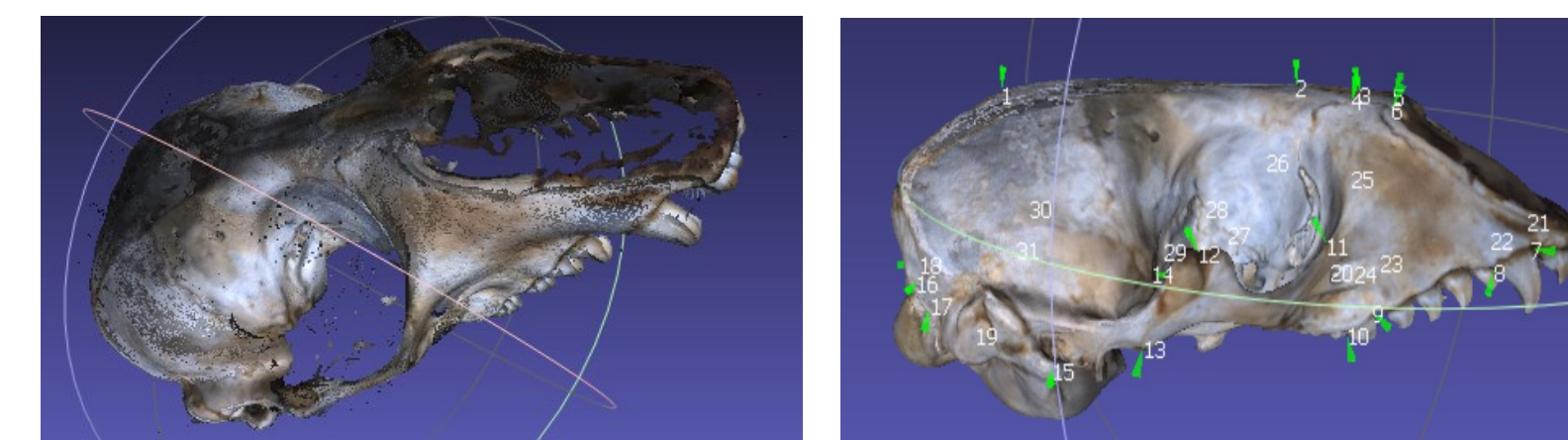


Figure 1: (from the left) Microscribe and 3D Optical Scanner (DTU Compute)

## Method



The point clouds acquired with the 3D Optical Scanner (4 positions per cranium) were elaborated and merged using MeshLab. After that, 31 landmarks were detected on the 3D crania's models using the Pick Points tool of MeshLab. Then, after aligning Microscribe and MeshLab landmarks, the distance between the two measurements for each landmark was measured. Finally, a simplified statistical analysis was conducted on the distances.

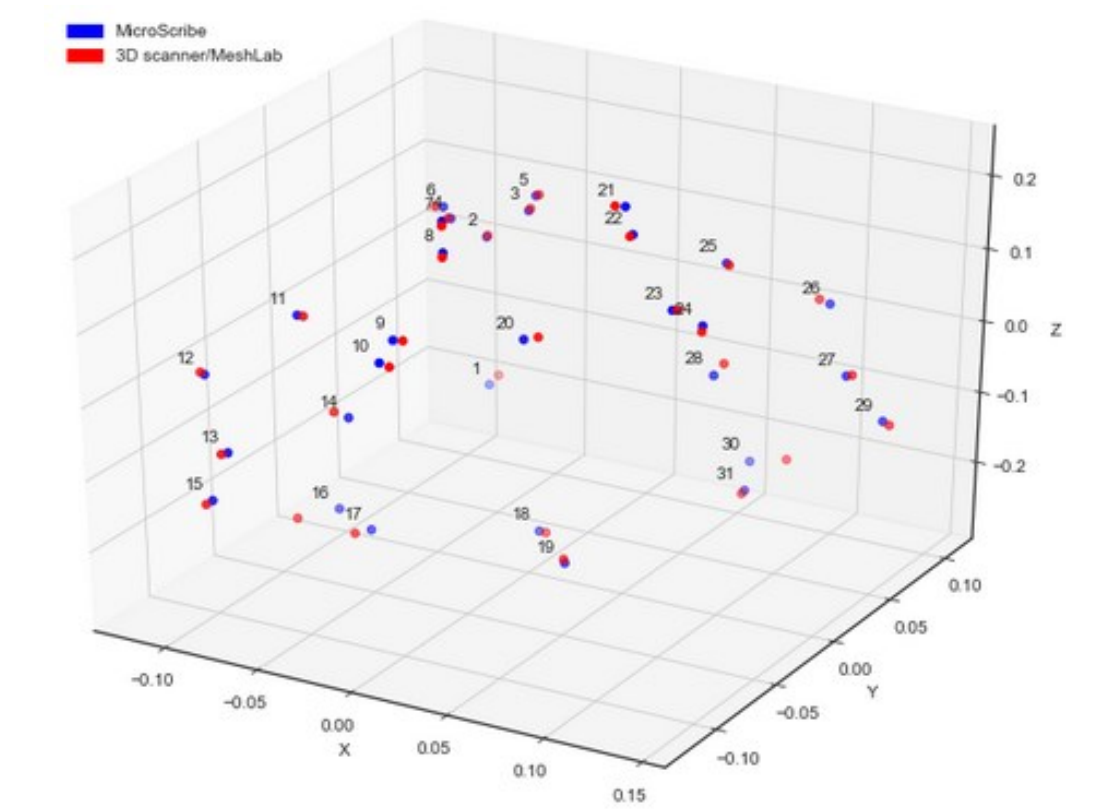
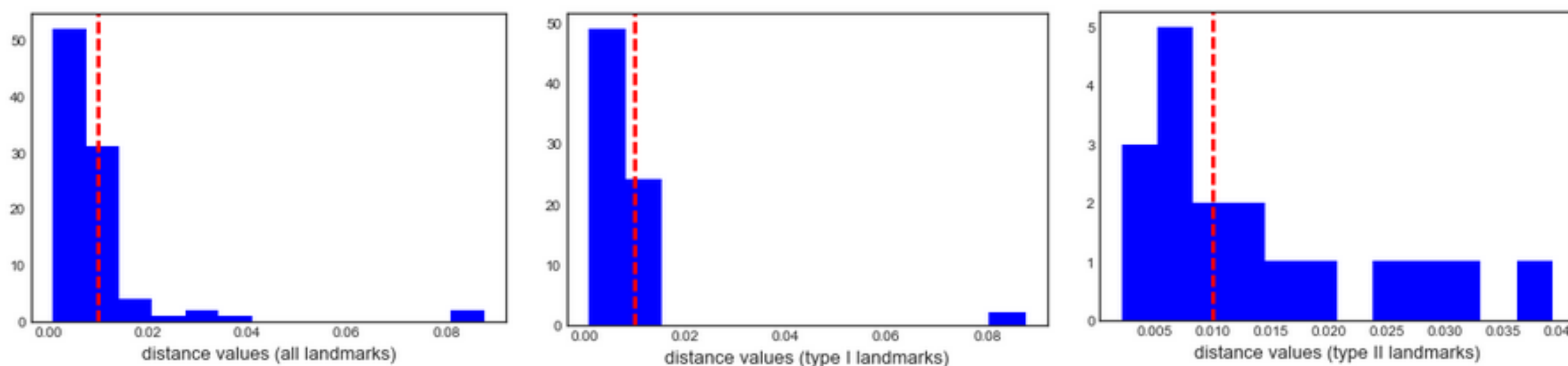
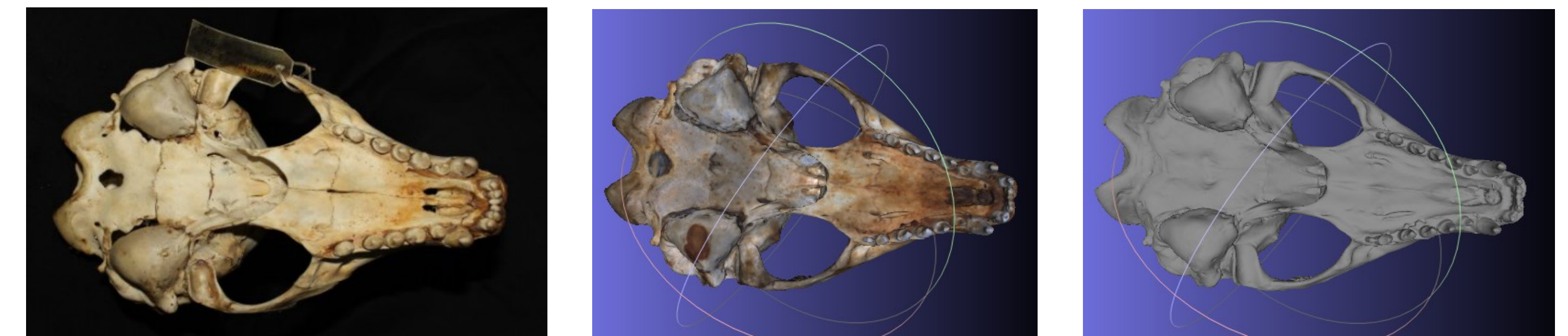


Figure 2: (from the left) raw data imported in MeshLab; landmarks detection using PickPoints tool in MeshLab; Microscribe and MeshLab landmarks

## Preliminary Results



Microscribe precision is 0.01 mm; this value has been chosen as reference to be compared with distances between landmarks (red dotted line in figures). 77% of distances were lower than 0.01mm (figure on the left). Moreover, landmarks were classified into type I and type II, according to their morphological characteristics. Type I are easily detectable and present with better accuracy than the previous case (central fig.), whereas type II landmarks present with greater unaccuracy, as expected from literature (fig. on the right).



The 3D Optical Scanner provides the 3D model of the object of interest, resulting in a great benefit for several applications. From the left: a digital camera picture of a seal's cranium; MeshLab Poisson Surface Reconstruction of raw data acquired by the 3D Optical Scanner, version with acquired colours; MeshLab Poisson Surface Reconstruction of raw data, version without colours used for landmark detection.

## Conclusion

Preliminary results show that MeshLab landmarks are as precise as Microscribe landmarks by 77%. Future statistical analyses should repeat measurements on same crania, in order to assess operator error, and be more deeply elaborated. Classification into type I and type II will help in better determining MeshLab/3D Optical Scanner performance. Unfortunately, literature does not provide reference values for gray seals' crania. Nevertheless, the 3D Optical Scanner has proved of great utility in landmark detection and in providing the 3D model of the object of interest.