**Info**

Peter suggested two illustrations I could provide.

1. Some example automatic landmarkings of some example mandibles
2. Compare an average mandible, derived using meshmonk for correspondence compared to one using a less good registration method.

**Automatic Landmarking**

The training mandible is an average of 100 male and female adolescent mandibles extracted from CBCT. These were randomly chosen from a larger database of ~600. The numbers of males to females and numbers of each age may not be equal. I put the points on using a Mevislab network.

The average was created by repeatedly registering each of the 100 mandibles with the average derived from the previous iteration. This process was initialised with a single mandible from the database that had been downsampled and remeshed to make the distribution of points as even as possible and so that the number of points was sensible (17415) (The meshes initially were 100 000+ points).

The registration settings have not been tuned in any very systematic way. But we have found settings that seem to work well in about 90% of cases.

The three test mandibles were randomly chosen from the bigger database, and were not in the 100 used to build to template.

The landmark locations are plotted over the original targets (hence why they look a bit jagged)

The landmarks I used are these.

|  |  |  |
| --- | --- | --- |
| Landmark Name | Abbreviation | Description |
| Pogonion | POG | Most anteroinferior point on the mental symphysis |
| Infradentale | INFR | Most central point on the mandibular alveolus |
| Mental foramen | MEN\_R/MEN\_L | Anteromedial edge of the mental foramen |
| Gonion | GON\_R/GON\_L | Junction of ramus and inferior border of mandibular body |
| Lateral mandibular condyle | LAT\_R/LAT\_L | Most superolateral point on mandibular condyle |
| Coronoid process | COR\_R/COR\_L | Most superior point on the coronoid process |

Table X: Mandibular landmark definitions. Definitions derived from Williams and Richtsmeier ([2003](#_ENREF_1)).

**Comparing averages**

I have created two averages, each from the same 100 mandibles (above) using the same process of repeatedly registering each image with the average from the iteration before. Both averages were created using three iterations of this process.

As a first approximation I have actually used meshmonk for both. One employing the rigid ICP then pyramid registration and the other employing only the rigid ICP. For the rigid ICP I took the corresponding points estimated on the last iteration as the result (equivalent to the floatingPoints in the non-rigid registration).

Williams, F. L. E., & Richtsmeier, J. T. (2003). Comparison of mandibular landmarks from computed tomography and 3D digitizer data. *Clinical Anatomy, 16*(6), 494-500.