43075-01 Probabilistic Shape Modelling

Lecturers
Dr. Marcel Lüthi ⟨marcel.luethi@unibas.ch⟩

Introduction   12. April 2022
Discussion   19. April 2022

Exercise 5 — Quantitative validation and finalizing the first part of the report.

In the last exercise we have built a model of the femur and validated it qualitatively, by looking at sample shapes. We have also visualized the main modes of variations. In this exercise we will perform a more quantitative evaluation, which will indicate how well our model can represent new femur shapes, which were not part of the training data.

5.1 Measurements

In a previous exercise sheet, we have plotted the length and width measurements of random samples and compared them to the measurements obtained on real data. Repeat this experiment with the statistical model. How well do random samples represent the distribution?

5.2. Cross-validation

In this exercise, we are investigating whether our model is expressive enough to represent novel femur bones that were not used to build the model. This can be achieved using cross-validation. The idea is that we build a statistical shape model from only a part of the data (such as for example all but one bone) and use that model to explain the left-out shape. If the left-out shape can be represented well, we have reason to believe that the model is expressive and can generalize to other unseen shapes. If not, we need to improve the model.
Perform this experiment with several left-out bones and report your result. To measure the distance between two bones, you can use the scalismo functionality `avgDistance` and `hausdorffDistance`, which you can find in the object `scalismo.mesh.MeshMetrics`.

Hint: Use the data that is in correspondence for this analysis. This allows you to use the method `project` of the class `PointDistributionModel` to obtain the best reconstruction of the left-out mesh in terms of the model. There is no need to run another ICP registration.

5.3. Report writing

Continue writing the report. Include results of the qualitative and quantitative evaluation that you performed in this and the previous exercise. Discuss your results and draw your own conclusion regarding the quality of the model.

5.4. *Optional*: Hand in a draft of your report

If you like, you can hand in your draft of the first part of the report. If you choose to hand it in, send it until 19.4 per E-mail to ⟨marcel.luethi@unibas.ch⟩ you will get feedback on Tuesday, 26.4.

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