43075-01 Probabilistic Shape Modelling

Lecturers
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Introduction	5. April 2022
Discussion	12. April 2022

Exercise 4 — Building a statistical shape model

In the last exercise, we have built a Gaussian process model, which could roughly account for the shape variability of a femur bone. The goal of this exercise is to use this model to fit the shape of the femur bones in our database. Once we have a successfully fit our model to a given femur bone, we can compute a deformation field between the model and the fitted bone, and hence accurately quantify the differences. This allows us to apply statistics on our shapes and to compute a statistical shape model that accurately describes the shape variation.

4.1. Fitting the example femur bones

- Work through week 6 of the FutureLearn course and learn how to use non-rigid ICP to establish correspondence.
- Work through tutorial 11 of the Scalismo tutorials (`https://scalismo.org/docs/tutorials/tutorial11`) and use it as a basis to develop a fitting (or registration) algorithm.
- Fit the model to each example femur. Save the result.
  - Visualize the data. Do the registered surfaces look like the target surface? Is the mesh still regular or does it fold (press `W` in ScalismoUi to see a wireframe representation. Press `S` to switch back).
- Can you think of a way to use the landmarks to improve the results?

4.2. Building a statistical shape model

Follow tutorial 6 of the Scalismo tutorials (`https://scalismo.org/docs/tutorials/tutorial6`) and use the steps discussed there to learn a shape model from the data. Use the fitted meshes from the previous exercise to build a model.

4.3. Visual validation of your model

- Visualize the model. Draw random samples and explore the main shape variations (use the Sliders in ScalismoUI).
  - Do the random samples look like plausible shapes?
  - What are the dominant shape variations?