43075-01 Probabilistic Shape Modelling

Lecturers
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Exercise 3 — Sampling

Introduction   21. April 2020.
Deadline   **05. Mai 2020**

Project preparation

In this exercise you will work on the first part of the model fitting project. Download the project for exercise 3 from the Adam workspace and open it in the IDE.

1. Using MCMC in Scalismo

Work through the tutorials "Model fitting using MCMC"
`https://scalismo.org/tutorials/tutorial14.html`
`https://scalismo.org/tutorials/tutorial15.html`.
Note that you can find the source code for this projects in the folder `src/main/scala/tutorialcode/` ready for you to experiment.

Make sure you understand what is happening and write down any questions you have.

2. Fitting a shape model to given landmark points

In the folder `data` you will find an active shape model of the liver, which you can use for fitting. You will also find validation data, which you can use for experimentation.
   Implement a MCMC fitting algorithm, which fits the model to the given landmark points. Write your code into the class `exercise3.LiverFitting`. Note that the class already does all the loading of the data. Also, you will have all the evaluators and proposals used in the tutorial already at your disposal.
   Your task is to implement all methods marked with `???`.
   Think about the following questions:

- Check the position of the individual landmarks. Think about how well each landmark can be located. Can you reflect that in the uncertainty?

- Should you make use of GP-Regression to incorporate the landmarks or is it preferable to use a `CorrespondenceEvaluator`?

- Is it sufficient to have one chain or does it make sense to have several chains in a row?

- If you choose to have several chains, which sample from the previous chain do you use to initialize the next chain?

- Create a trace plot and histograms using the methods you can find in the class `utils.DiagnosticPlots`.

  - Interpret the plots. What can you see?
  - What happens when you choose fewer landmarks? What happens when you increase the uncertainty of the landmark positions?

- How can you adapt the `CorrespondenceEvaluator` from the tutorial such that it can work with points for which you don't know the correspondence?

  - Click some points on the boundary that don't have correspondence and integrate them into the fitting. Does it help with fitting the model?