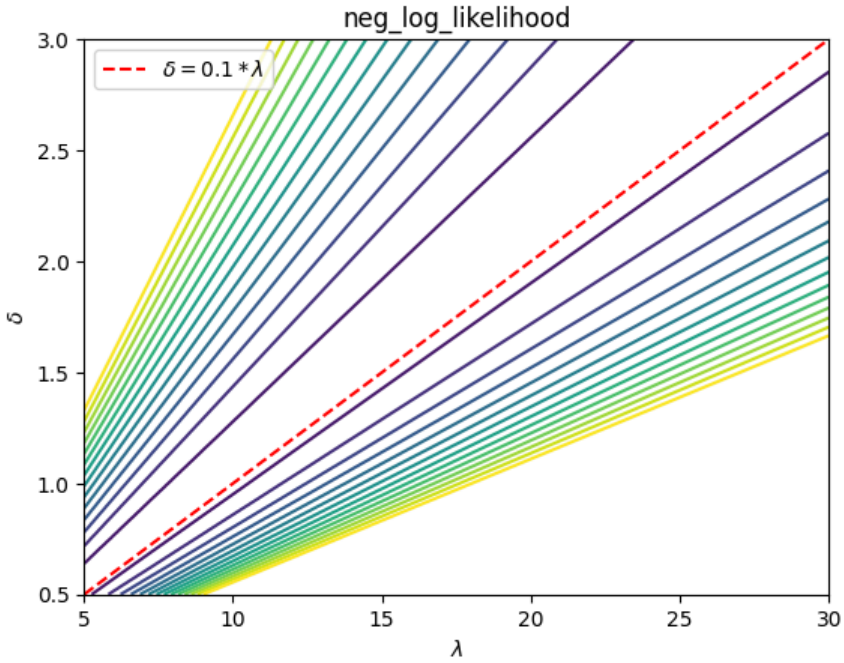
CaleyNovitskaia

HW1

b)

```
<matplotlib.legend.Legend at 0x1349f2eb0>
```

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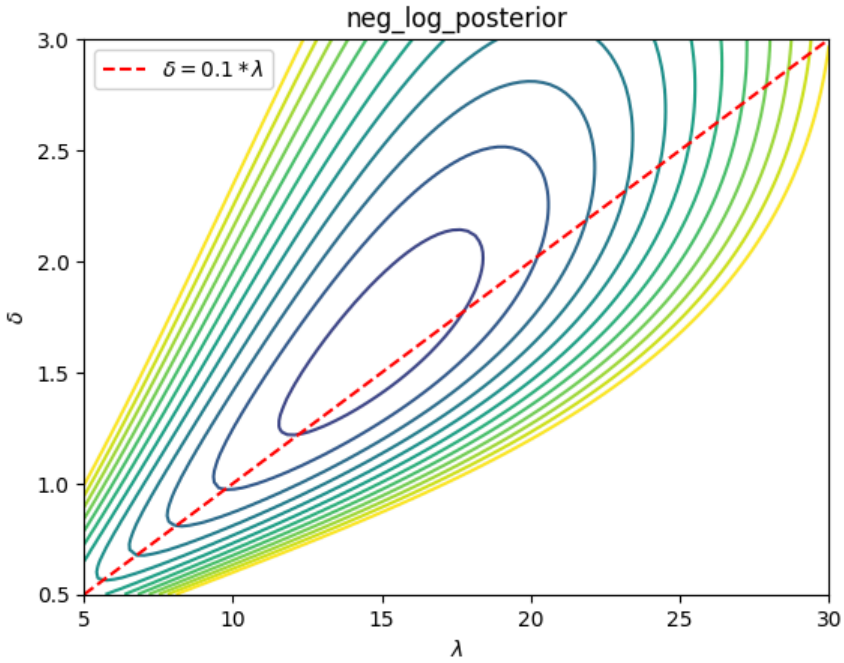


Discussion

What can you say about the region of minimum, or about the posedness of the problem?

1. For the negative log-likelihood:

- The region of minimum is flat and long.
- All contours follow the lines $\delta = C \cdot \lambda$, meaning the likelihood relies only on the ratio of the parameters.
- The solution is not unique as it might be determined by various sets of parameters (δ, λ) taken from the region of minimum. Therefore, this is an ill-posed problem.

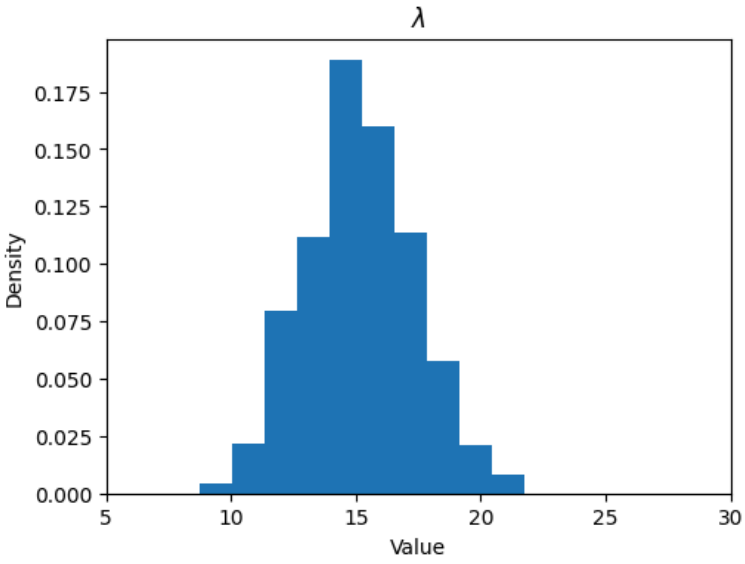
2. For the negative log-posterior:

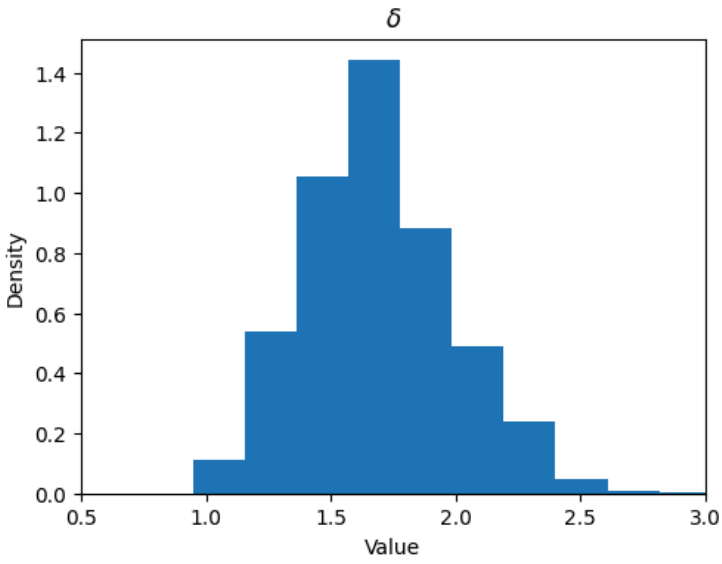
- A plot indicates the existence of a well-defined minimum region surrounded by contours forming closed curves.
- Priors help to limit the space of optimal parameters and convert the ill-posed problem to a better-posed one.

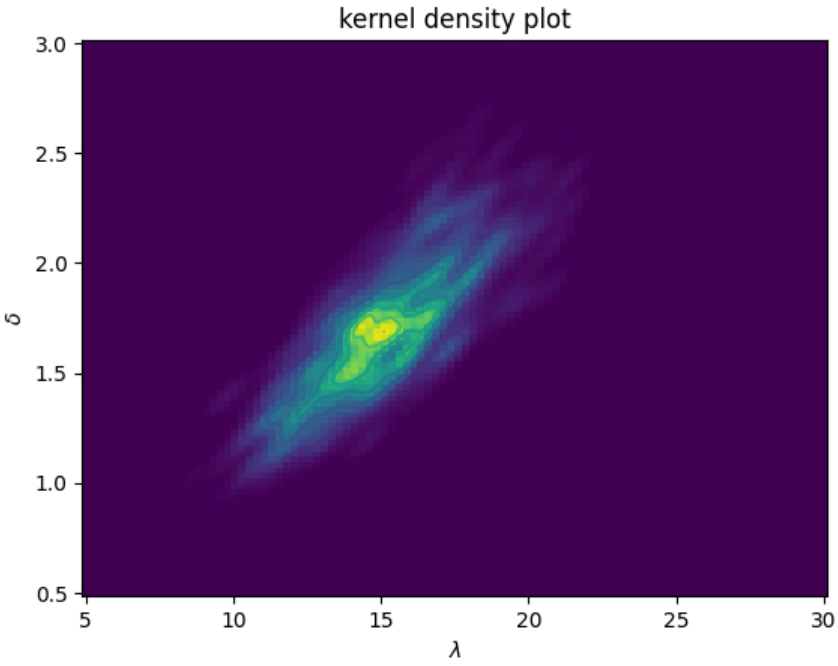
HW2

b)

1. $\theta = (30, 3)$

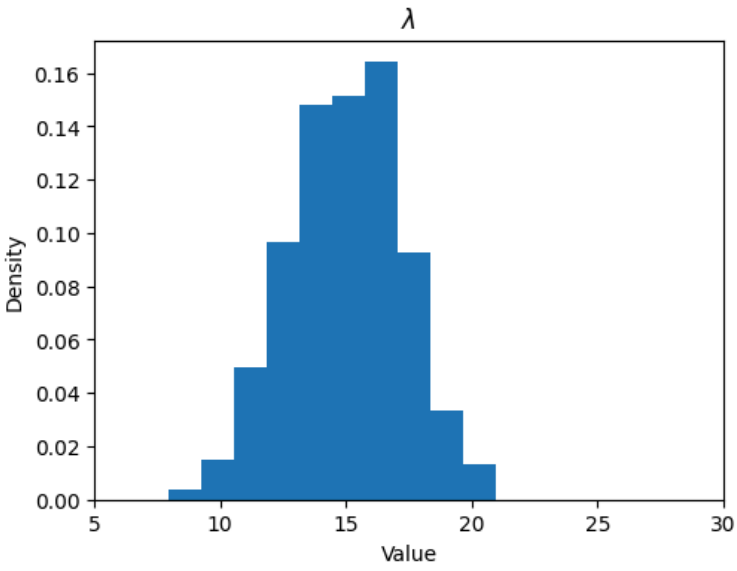


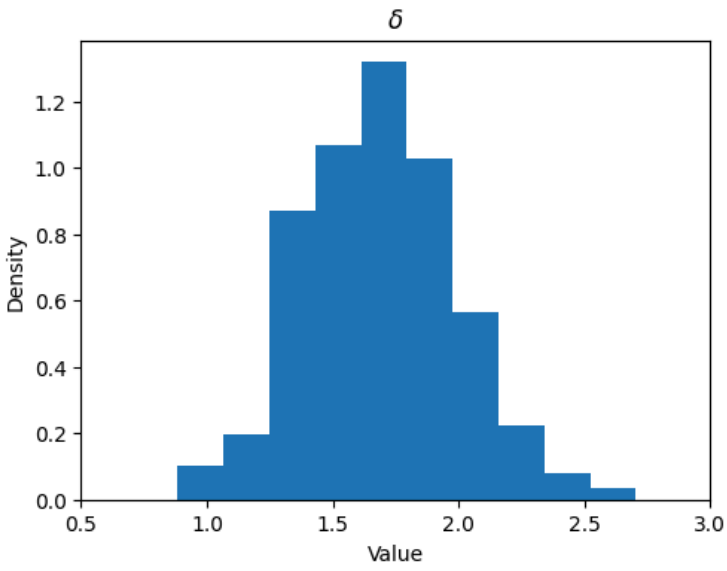


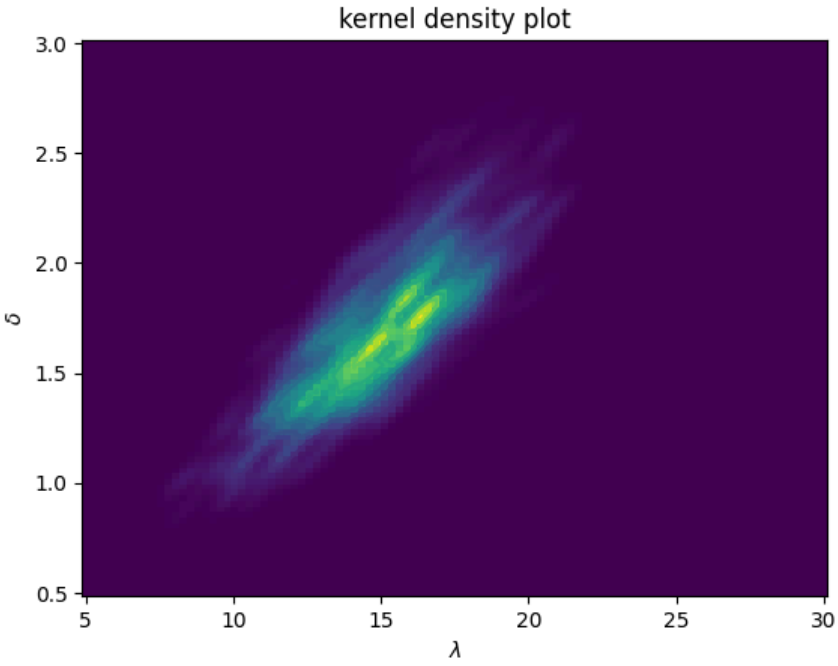


2. θ randomized

```
Initial parameters after randomization: lambda=18.770  and theta=2.270
```







Discussion

1. Randomize your initial parameters. Do you get the same posterior parameter distributions?

- The distributions of sampled parameters are similar but not the same after randomization.

2. Why, or why not?

- The similarity occurs because the negative log posterior has a well-defined optimum region, after 'burn-in' in both initializations the sampler converges to parameters associated with the high-probability region (or optimum region for the negative log posterior). As the result, the parameters will more likely be sampled from this region on the last iterations.
- Additionally, as the algorithm relies only on the current state to propose the next one, initialization should not affect the results of parameter sampling once the sampler reach the parameter area connected to vicinity of optimum. (Specifically for our case with one well-defined optimum region).
- The difference might be caused by the randomness of sampling, and the finite number of steps. Probably, for more iterations the difference will be subtle.

3. How are the parameter distributions related to **task 1**?

- The parameter distributions match the posterior contours, that indicates that the parameters are mostly sampled from the area with the high posterior.