Quiz

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Question 1. When carrying out inference by iterated particle filtering, the likelihood increases for the first 10 iterations or so, and then steadily decreases. Testing the inference procedure on simulated data, this does not happen and the likelihood increases steadily toward convergence. Which of the following is the best explanation for this?

(A) One or more random walk standard deviation is too large.

(B) One or more random walk standard deviations is too small.

(C) The model is misspecified, so it does not fit the data adequately.

(D) A combination of the parameters is weakly identified, leading to a ridge in the likelihood surface.

(E) Too few particles are being used.

Question 2. People sometimes confuse likelihood profiles with likelihood slices. Suppose you read a figure which claims to construct a profile confidence interval for a parameter ρ in a POMP model with four unknown parameters. Which of the following confirms that the plot is, or is not, a properly constructed profile confidence interval. The code producing the plot is available to you as an Rmarkdown file.

(A) The CI is constructed by obtaining the interval of rho values whose log likelihood is within 1.92 of the maximum on a smoothed curve of likelihood values plotted against ρ.

(B) The code involves evaluation of the likelihood but not maximization.

(C) The points along the ρ axis are not equally spaced.

(D) The smoothed line shown in the plot is close to quadratic.

(E) A and D together.

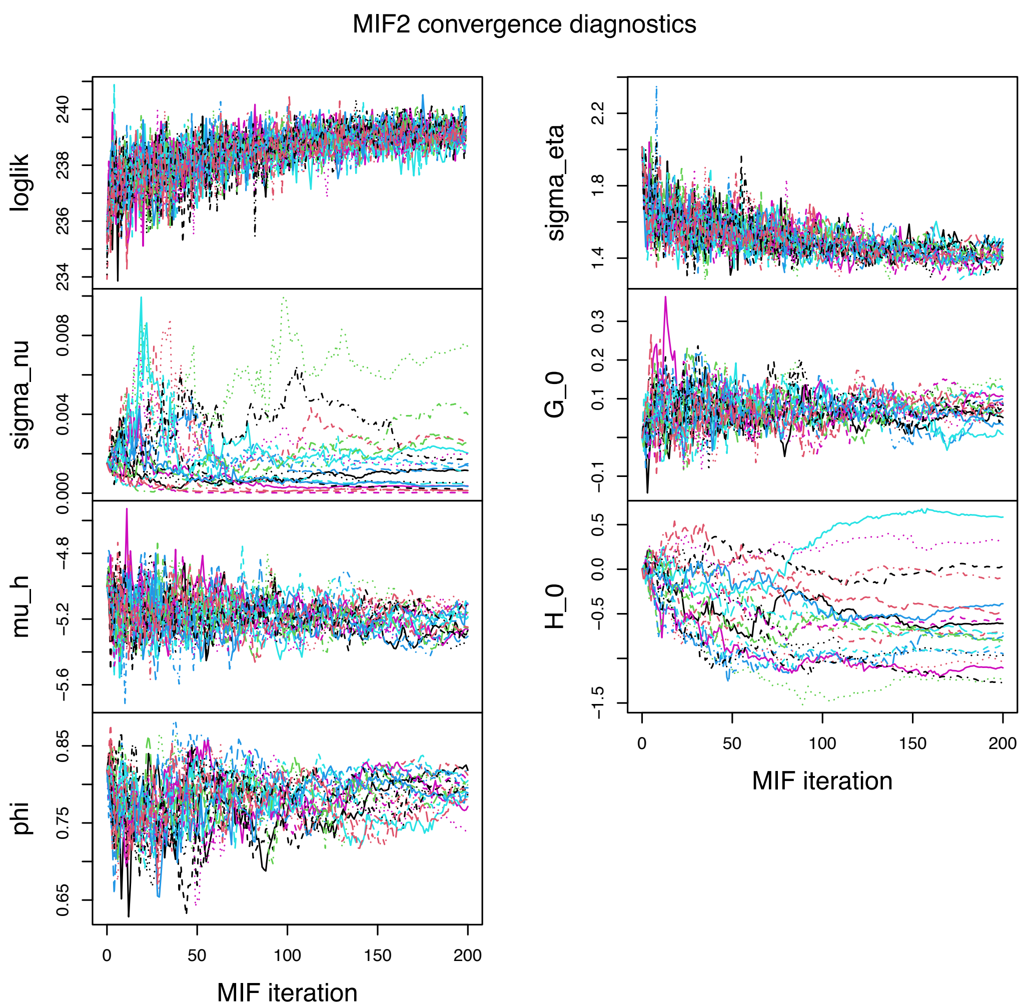
Question 3. Which of the following are true?

(A) A profile likelihood must lie *above* every slice.

(B) Confidence intervals can be read from likelihood slices.

(C) A poor man's profile must lie above the true profile.

(D) A poor man's profile must lie below the true profile.



Question 4. The iterated filtering convergence diagnostics plot shown above come from a student project. What is the best interpretation?

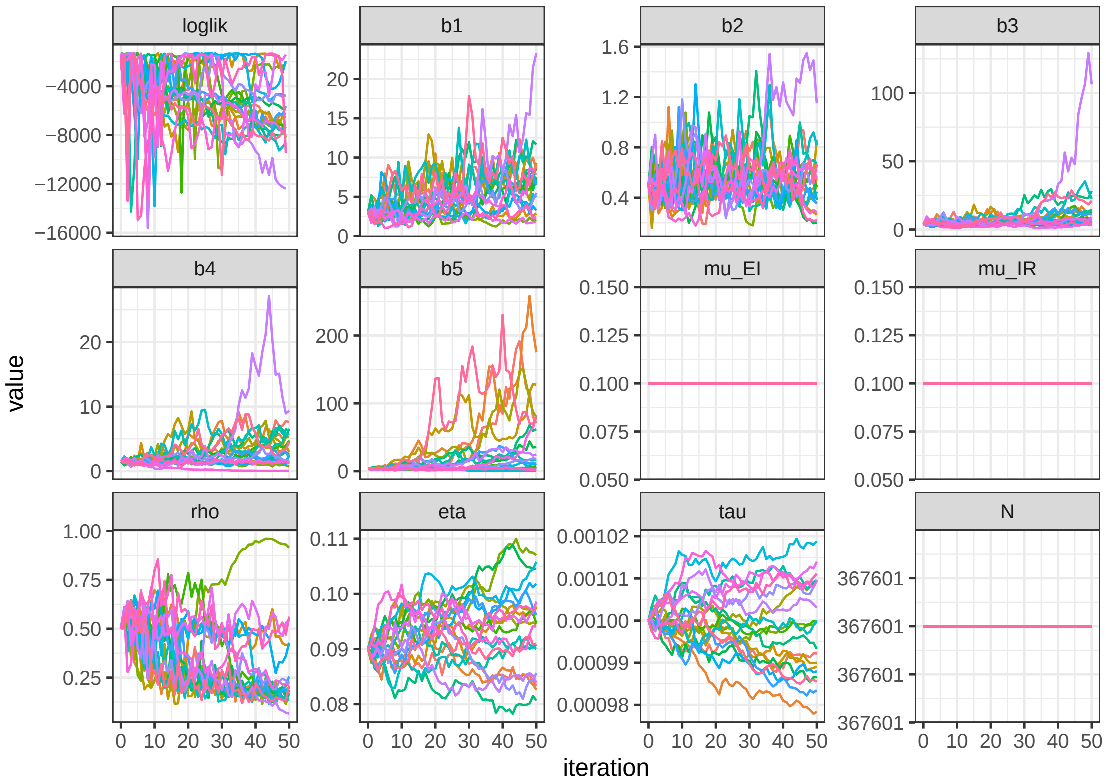
(A) Everything seems to be working fine. The likelihood is climbing. The replicated searches are giving consistent runs. The spread of convergence points for σ_ν and H_0 indicates weak identifability, which is a statistical fact worth noticing but not a weakness of the model.

(B) The consistently climbing likelihood is promising, but the failure of σ_ν and H_0 to converge needs attention. Additional searching is needed, experimenting with **larger** values of the random walk perturbation standard deviation for these parameters to make sure the parameter space is properly searched.

(C) The consistently climbing likelihood is promising, but the failure of σ_ν and H_0 to converge needs attention. Additional searching is needed, experimenting with **smaller** values of the random walk perturbation standard deviation for these parameters to make sure the parameter space is properly searched.

(D) The consistently climbing likelihood is promising, but the failure of σ_ν and H_0 to converge needs attention. This indicates weak identifiability which cannot be solved by improving the searching algorithm. Instead, we should change the model, or fix one or more parameters at scientifically plausible values, to resolve the identifiability issue before proceeding.

(E) Although the log likelihood seems to be climbing during the search, until the convergence problems with σ_ν and H_0 have been addressed we should not be confident about the successful optimization of the likelihood function or the other parameter estimates.



Question 5. The iterated filtering convergence diagnostics plot shown above come from a student project, calculated using 10^3 particles. What is the best interpretation?

(A) Everything seems to be working fine. There is a clear consensus from the different searches concerning the highest likelihood that can be found. Therefore, the search is doing a good job of maximization. Occasional searches get lost, such as the purple line with a low likelihood, but that is not a problem.

(B) The seaches obtain likelihood values spread over thousands of log units. We would like to see consistent convergence within a few log units. We should use more particles and/or more iterations to achieve this.

(C) The seaches obtain likelihood values spread over thousands of log units. We would like to see consistent convergence within a few log units. We should compare the best likelihoods obtained with simple statistical models, such as an auto-regressive moving average model, to look for evidence of model misspecification.

(D) The seaches obtain likelihood values spread over thousands of log units. We would like to see consistent convergence within a few log units. We should look at the effective sample size plot for the best fit we have found yet, to see whether there are problems with the particle filtering.

(E) All of B, D and D.

Question 6. In the following call to `mif2`, which of the statements below are true? You may assume that `obj` is a pomp object with parameters `alpha`, `Beta`, `gamma`, and `delta`.

```
obj %>%
  mif2(
    Nmif=100,
    partrans=parameter_trans(log=c("Beta","alpha","delta")),
    paramnames=c("Beta","alpha","delta"),
    rw.sd=rw.sd(Beta=0.05,alpha=ivp(0.02),gamma=0.05),
    cooling.fraction.50=0.1
  ) -> obj
```

(A) 50 IF2 iterations will be performed.

(B) `Beta` and `alpha` are estimated on the log scale.

(C) `gamma` is not estimated.

(D) `delta` is not estimated.

(E) The magnitude of the perturbation on `Beta` at the end of the run will be $0.05 \times 0.1^{100} = 5 \times 10^{-102}$.

(F) The magnitude of the perturbation on `gamma` at the end of the run will be $0.05 \times 0.1^{100/50} = 5 \times 10^{-4}$.

(G) `alpha` is an initial-value parameter; it will be perturbed only at the beginning of the time series.

(H) After the call, `obj` is an object of class 'mif2d_pomp'.

Question 7. Assume that `obj` is the result of the call in Question 6. Which of the statements below best describes what happens as a result of the following call?

```
obj %>%
  mif2(
    rw.sd=rw.sd(Beta=0.05,alpha=ivp(0.02)),
    cooling.fraction.50=0.2
  )
```

(A) 100 more IF2 iterations will be performed.

(B) The settings of the previous calculation are re-used, with the exception of `rw.sd` and `cooling.fraction.50`.

(C) The starting point of the new calculation is the end point of the old one.

(D) `Beta` and `alpha` are estimated on the log scale.

(E) `gamma` is not estimated.

(F) `delta` is not estimated.

(G) The cooling occurs more quickly than in the previous call.