Troubleshooting

Jūlija Pečerska

Squamish 2019

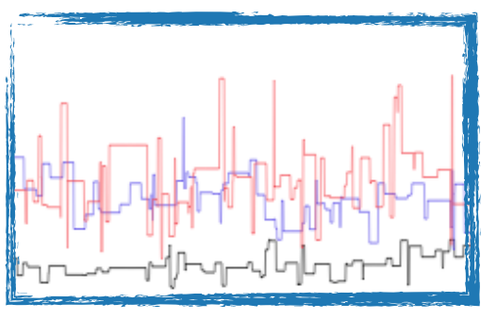
Possible scenarios

Beast analysis

Initialisation failed

Start likelihood: -Infinity after 1000 initialisation attempts
Fatal exception: Could not find a proper state to initialise. Perhaps try another seed.
P(posterior) = -Infinity (was -Infinity)

Nothing mixed



One parameter did not mix

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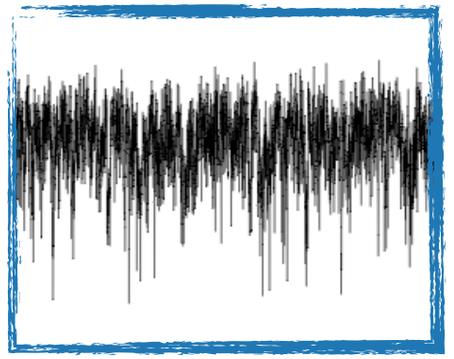

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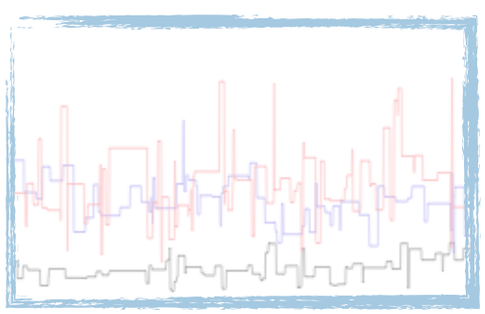

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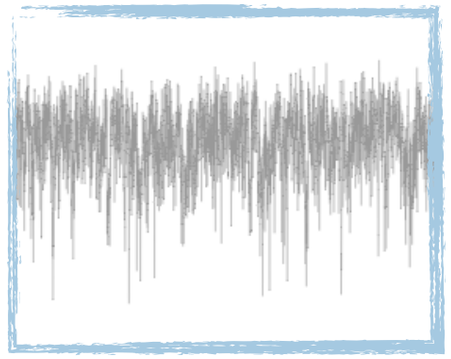

Failed initialisation

Start likelihood: -Infinity after 1000 initialisation attempts
Fatal exception: Could not find a proper state to initialise. Perhaps try another seed.

P(posterior) = -Infinity (was -Infinity)
 P(prior) = -Infinity (was -Infinity)
  P(BDMM) = -Infinity (was -Infinity)
    P(R0Prior) = -0.558684954107039 3 (was -0.558684954107039 3)
    P(rPrior) = -11.460421368664 74 (was -11.460421368664 74)
    P(rateMatrixPrior) = -0.140880254993814 85 (was -0.140880254993814 85)
    P(samplingProportionPrior) = -10.049507225748343 (was -10.049507225748343)
    P(becomeUninfectiousRatePrior) = -0.781124175131799 1 (was -0.781124175131799 1)
java.lang.RuntimeException: Could not find a proper state to initialise. Perhaps try another seed.
at beast.core.MCMC.run(Unknown Source)
at beast.app.BeastMCMC.run(Unknown Source)
at beast.app.beastapp.BeastMain.<init>(Unknown Source)
at beast.app.beastapp.BeastMain.main(Unknown Source)
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BEAST has terminated with an error. Please select QUIT from the menu.

Failed initialisation

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Fatal exception: **Could not find a proper state to initialise. Perhaps try another seed.**

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Parameter prior is -Infinity

Example: P(rateMatrixPrior) = -Infinity (was -Infinity)

Possible solutions:

✗ Change seed;

Random number generation

In reality — computer-generated pseudorandom!

$X_{n+1} = (aX_n + c) \bmod c$, where:

- X is the sequence of pseudo-random values
- m, $0 < m$: modulus
- a, $0 < a < m$: multiplier
- c, $0 \leq c < m$: increment
- X_0, $0 \leq X_0 < m$: the seed or start value

Parameter prior is -Infinity

Example: P(rateMatrixPrior) = -Infinity (was -Infinity)

Possible solutions:

✓ Increase initialisation attempt number;

✓ Adjust initial conditions;

✓ Check for silly/incompatible priors;

✓ Check for prior interaction.

Model prior is -Infinity

Example: P(BDMM) = -Infinity (was -Infinity)

Possible solutions:

- ✓ Check for model misspecification;
- ✓ Check for underflow;
- ✓ Talk to the developers of the particular model.

Possible scenarios

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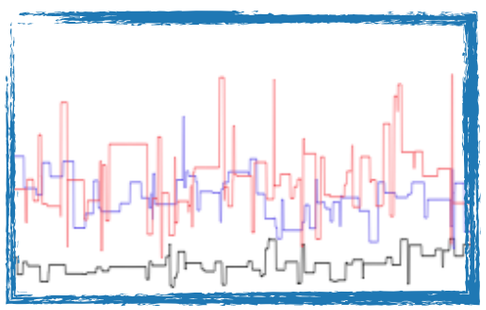

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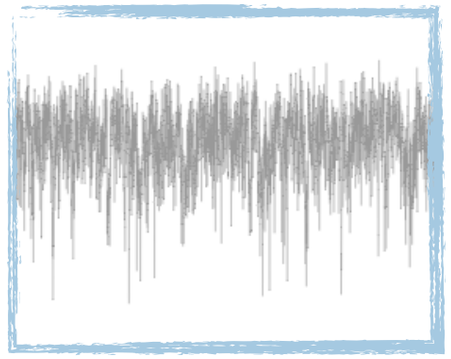

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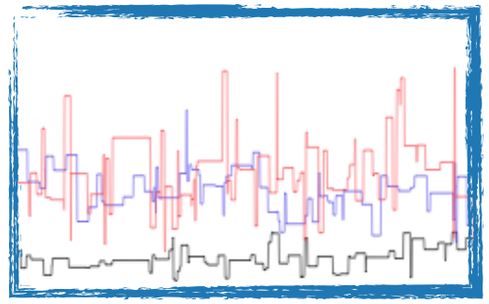


Possible solutions:

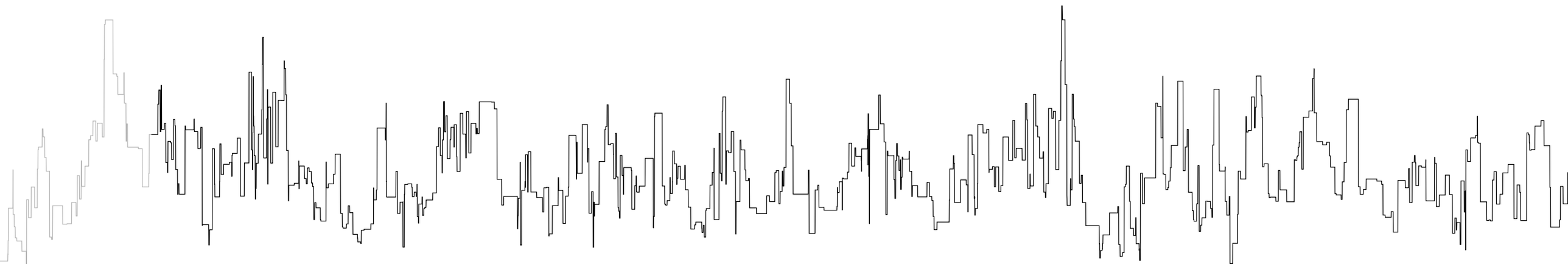
✓ Increase chain length;

✓ Run multiple independent chains;

✓ Increase sampling frequency (if ACT permits);

✓ Check parameter identifiability;

✓ Check for model misspecification.



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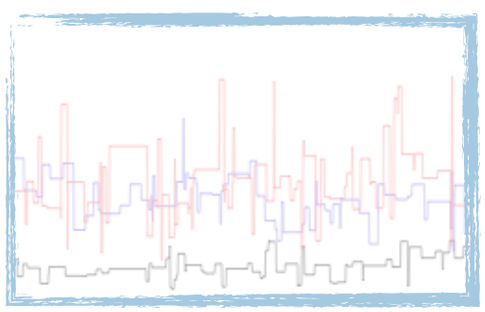

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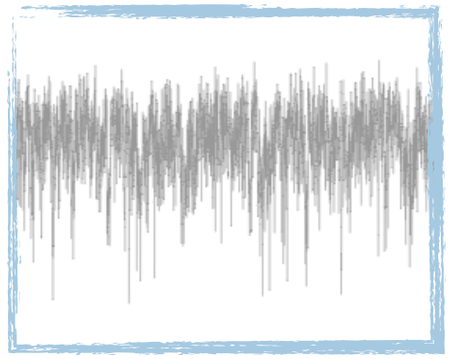

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Possible solutions:

- ✓ Tweak operators:
  - ✓ Increase operator weight for low ESS parameters;
  - ✓ Use UpDown operator for correlated parameters;
- ✓ Run longer (or combine several independent chains).

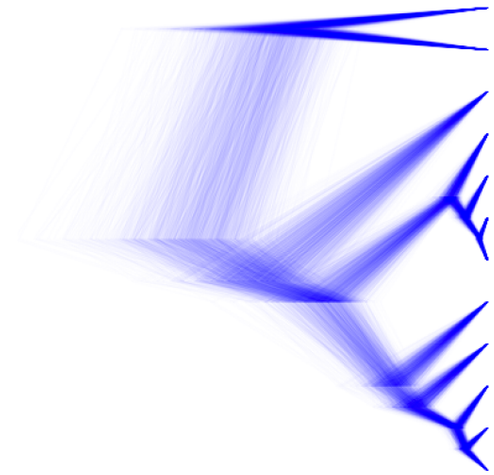
Only posterior not mixed

Possible reasons:

- Tree prior cares too much about a parameter the data says nothing about;

- Can always make a statistic that does not mix.

Tree space mixing



Bad news:

At the moment can not directly examine the ESS;

Good news:

Good mixing of continuous parameters and likelihoods is indicative;

Can use AWTY.

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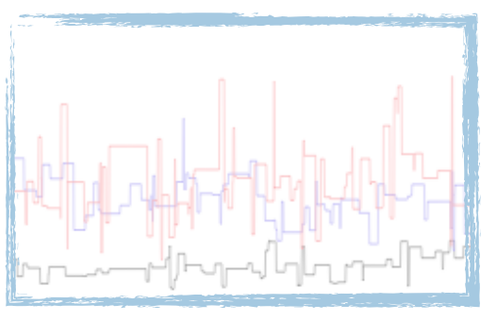

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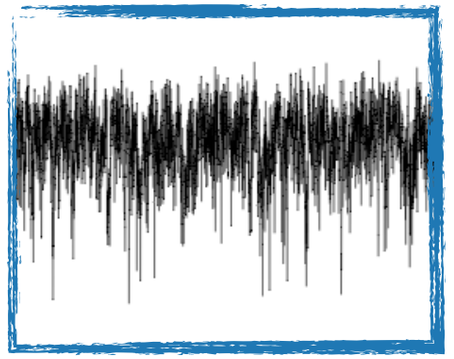

Everything mixed

Sanity check:

- Sampling from prior.

Good news:

Bayesian analysis always gives an answer!

Bad news:

The answer is how uncertain we are.

Troubleshooting time!