COI Convergence Plots

This document contains plots and statistics for evaluating the convergence of COI MrBayes runs performed in this paper. Assessment of convergence used the web address http://danwarren.net/plot-comparisons.html written by the authors of the package RWTY.

It seems that both COI runs have converged. The approximate sampling Estimated Sample Size (ESS) and topology ESS are both above 200 (standard rule of thumb). The tree topology trace shows well-mixed chains and a clear optimum, cumulative split frequencies seem to have become fairly stable, sliding window split frequencies show large jumps, but a clear search of the tree space and both runs seem to have converged on similar posterior probabilities, as shown by the split frequency comparisons. The average standard deviation of split frequencies (ASDSF) is below 0.01 and shows a decrease to a plateau, as expected. Tree space plots show both runs searching similar areas of tree space and well-mixed chains. The topological autocorrelation plots also appear to have reached a plateau for each run.

Analysis code

```r
library(rwty)

## Loading required package: ape
## Loading required package: ggplot2
library(ape)

# Pull in the trees (only need to indicate a folder)
my.trees <- load.multi("COI", format='mb')

## [1] "COI_con_cds_modified.nex.run1.t"
## [1] "Reading trees..."
## [1] "1000 generations per tree..."
## [1] "Trees are unrooted..."
## [1] "Reading parameter values from COI_con_cds_modified.nex.run1.p"
## [1] "COI_con_cds_modified.nex.run2.t"
## [1] "Reading trees..."
## [1] "1000 generations per tree..."
## [1] "Trees are unrooted..."
## [1] "Reading parameter values from COI_con_cds_modified.nex.run2.p"

# Set burn in
burnin_val <- 2500

# Analysis of trees using **RWTY**
my.trees.rwty <- analyze.rwty(my.trees, burnin=burnin_val, fill.color='LnL')

## [1] "Creating trace for LnL"
## [1] "Creating trace for LnPr"
## [1] "Creating trace for TL"
## [1] "Creating trace for r.A...C."
## [1] "Creating trace for r.A...G."
## [1] "Creating trace for r.A...T."
## [1] "Creating trace for r.C...G."
## [1] "Creating trace for r.C...T."
## [1] "Creating trace for r.G...T."
## Creating trace for pi.A.
## Creating trace for pi.C.
## Creating trace for pi.G.
## Creating trace for pi.T.
## Creating trace for alpha
## Creating trace for m.i.
## Creating trace for tree topologies
## Calculating approximate ESS with sampling intervals from 1 to 100
## Creating topological autocorrelation plot
## Creating sliding window split frequency plot for 20 clades
## Creating sliding window ACSF plot
## Creating cumulative split frequency plot for 20 clades
## Creating cumulative ACSF plot
## Creating treespace plots

## Warning: `panel.margin` is deprecated. Please use `panel.spacing` property instead

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## Creating ASDSF plot
## Creating split frequency matrix and ASDSF clustering plots

# Approximate ESS for topologies

topological.approx.ess(my.trees, burnin=burnin_val)

## Calculating approximate ESS with sampling intervals from 1 to 100

## operator approx.ess chain
## 1 = 1043.96 COI_con_cds_modified.nex.run1.t
## 2 = 1068.84 COI_con_cds_modified.nex.run2.t
Plots

Estimated Sample Size

\texttt{makeplot.pseudo.ess(my.trees, burnin = 2500)}

## [1] "Creating pseudo ESS plot"
## [1] "Calculating pseudo ESS for 7501 trees and 20 replicates, please be patient"
## [1] "Calculating pseudo ESS for 7501 trees and 20 replicates, please be patient"

## `$pseudo.ess.plot`

![Pseudo ESS with 20 replicates](image)
my.trees.rwty$LnL.trace[[1]]

LnL trace

COI_con_cds_modified.nex.run1.t (ESS=1536)

LnL

COI_con_cds_modified.nex.run2.t (ESS=1100)

my.trees.rwty$LnL.trace[[2]]

LnL trace

COI_con_cds_modified.nex.run1.t (ESS=1536)

count

COI_con_cds_modified.nex.run2.t (ESS=1100)
Topology trace plots

my.trees.rwty$topology.trace.plot[[1]]

Tree topology trace

COI_con_cds_modified.nex.run1.t (Approximate ESS = 1139)

my.trees.rwty$topology.trace.plot[[2]]

Tree topology trace

COI_con_cds_modified.nex.run1.t (Approximate ESS = 1139)

COI_con_cds_modified.nex.run2.t (Approximate ESS = 975)
Split frequency plots

my.trees.rwty$spltfreqs.cumulative.plot

Cumulative Split Frequencies for 20 clades

my.trees.rwty$spltfreqs.sliding.plot

Sliding Window Split Frequencies for 20 clades
**Split frequency comparisons**

- **con_cds_modified.nex.r**
  - $r = 0.99$
  - ASDSF = 0.002

**Average Standard Deviation of Split Frequencies**

- Standard Deviation of Split Frequencies
- Generation

- $4 \times 10^6$ to $1 \times 10^7$
Tree space plots

my.trees.rwty$treespace.heatmap

Tree space heatmap for 100 trees

my.trees.rwty$treespace.points.plot

Tree space for 100 trees
Autocorrelation plots

Topological autocorrelation plot

Mean Path Difference between Pairs of Trees

Sampling Interval between Trees