

4th progress report

February 2, 2016

1 Introduction

A first shareable version of the R code is included with this report. The code (described on last report) was implemented with:

- A `phyl()` function, which simulate a tree with rates generated by any of the three models described on next section of this report.
- An iterative method which estimate MLE values for a set of simulated trees.

Moreover, the code generates the tree on Newick format as well for visual and topological analysis purposes.

2 Approach & questions

2.1 Rates

We implement the model described on the previous reports, which considers the speciation and extinction rates as functions of traits depending on time $\lambda_i = f(traits)$ and $\mu_i = f(traits)$.

On this report we include two more models besides the loglinear, so we have the following three models:

loglinear (Model 1):

$$\lambda_i = e^{\theta_0 + \theta_1 a_i}$$
$$\mu_i = e^{\varphi_0 + \varphi_1 a_i}$$

linear (Model 2):

$$\lambda_i = \theta_0 + \theta_1 a_i$$
$$\mu_i = \varphi_0 + \varphi_1 a_i$$

logistic (Model 3):

$$\lambda_i = \frac{\theta_0}{1 + e^{-\theta_1 a_i}}$$

2.2 Questions:

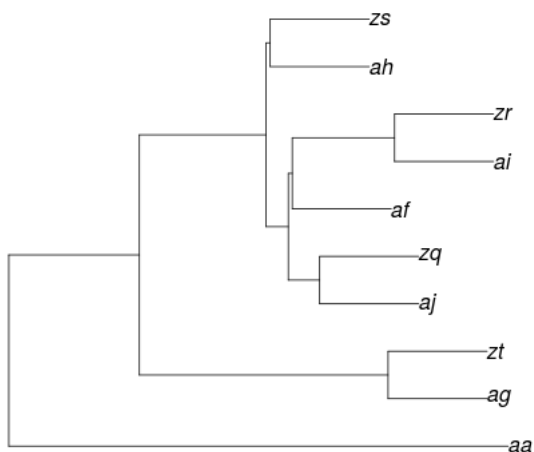
- Does the loglinear, linear and logistic models makes any biological sense?, It is ok to have same $f()$ for both, λ and μ ?
- Would be a non-parametric approach a better alternative of those models?
- Why would we prefer this framework instead of the differential approach of Nee et al. ?

3 Implementation

3.1 Simulation

We use the `phyl()` function to simulate trees, an exaple of a 10-iteration phylogenetic tree would be:

```
s1 = phyl(nT=10, model = "loglinear")
```



We simulated 1000 different trees with same parametes and we estimated it using MLE. A summary of the estimated values for each model is described included bellow. In general we have similar results given in the last report.

	n	real value	mean	median	min	max
1	1000	3.00	3.00	2.98	0.62	5.81
2	1000	4.00	5.03	3.95	-591.87	2410.71
3	1000	1.00	1.56	0.87	-13.42	347.45
4	1000	2.00	-1.03	1.63	-4045.67	2003.04

Table 1: Model 1

	n	real value	mean	median	min	max
1	1000.00	3.00	2.83	2.85	-15.46	17.76
2	1000.00	4.00	13.43	3.87	-4131.72	3329.81
3	1000.00	1.00	1.02	0.94	-15.02	18.60
4	1000.00	2.00	-5.88	1.60	-7333.90	3473.38

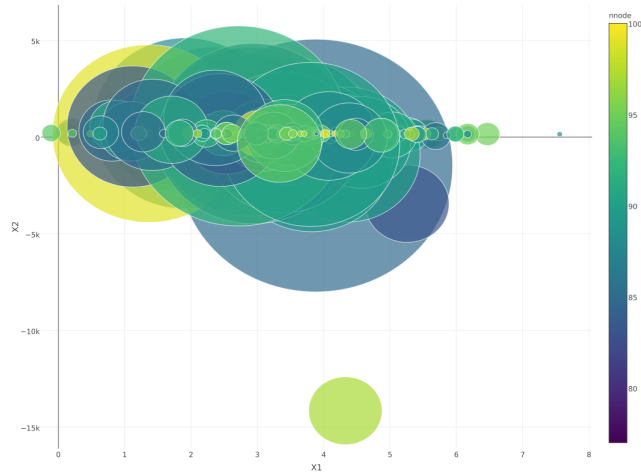
Table 2: Model 2

	n	real value	mean	median	min	max
1	1000.00	3.00	4.55	3.34	1.39	63.37
2	1000.00	4.00	10.09	2.02	-1118.53	2702.20
3	1000.00	1.00	2.64	1.07	0.34	180.18
4	1000.00	2.00	-0.75	1.46	-3027.31	2999.15

Table 3: Model 3

3.2 Analysis

Some visual analysis tools are also provided with the code, we used them to find relationships between "bad" estimations and both, numerical and topological data.



After comparison we found no relationship between particular characteristics of the trees and non accurate estimations.

