

2024_49_DoLS_JR: Dating and analysing the complete tree of life

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The tree of life is a fundamental object revealing the evolutionary history of all life on earth and finding practical uses in ecology, evolution and conservation. The complete tree describes the common ancestry between over two million species of life, all species known to science.

The open tree of life project has provided the scientific community with a synthetic complete tree, but only a small proportion of points on that tree have dates attached to them, and there is a lot of uncertainty around the dating of the tree where multiple sources may be conflicting.

This project will seek to estimate dates for every common ancestor on the complete tree of life and capture the uncertainty of those dates with a 'distribution' of trees. The main challenges around this task will be algorithmic, how can we efficiently interpolate between known dates on a tree structure this large? How can we efficiently store the resulting data and perform analyses on it?

After achieving this initial goal, the student will be able to take the project in any one of a number of directions depending on their personal interest and motivation. Examples include characterising the tree with a range of evolutionary metrics, investigating diversification patterns on the tree, or identifying candidate 'living fossils' based on tree shape. We also anticipate potential for the complete dated tree to be used in science outreach, for example by making the data available for use by the 'OneZoom' tree of life explorer project.

Synthesising the tree with extinction risk data would enable a huge expansion in the use of metrics used to prioritise species for practical conservation attention, and of biodiversity loss indicator metrics. To date, such analyses have only been conducted on relatively small portions of the tree of life compared to what will be possible through this work. This project will seek to do some conservation prioritisation with the tree resulting from the project, which will benefit the project CASE partner.

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