

Online Phylogenetics Inference

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Online Phylogenetics

1. Phylogenetic Inference
2. Tree space

Phylogenetic Inference

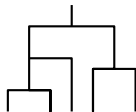
Requests:

- ▶ Adding taxon
- ▶ Give tree

Distance Methods

$$\begin{pmatrix} 0 & d_{1,2} & d_{1,3} & d_{1,4} & d_{1,5} \\ d_{1,2} & 0 & d_{2,3} & d_{2,4} & d_{2,5} \\ d_{1,3} & d_{2,3} & 0 & d_{3,4} & d_{3,5} \\ d_{1,4} & d_{2,4} & d_{3,4} & 0 & d_{4,5} \\ d_{1,5} & d_{2,5} & d_{3,5} & d_{4,5} & 0 \end{pmatrix}$$

\Rightarrow



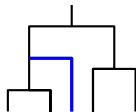
Distance Methods

Stability Analysis

Distance Methods

Stability Analysis

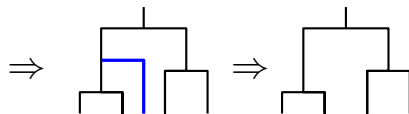
$$\begin{pmatrix} 0 & d_{1,2} & d_{1,3} & d_{1,4} & d_{1,5} \\ d_{1,2} & 0 & d_{2,3} & d_{2,4} & d_{2,5} \\ d_{1,3} & d_{2,3} & 0 & d_{3,4} & d_{3,5} \\ d_{1,4} & d_{2,4} & d_{3,4} & 0 & d_{4,5} \\ d_{1,5} & d_{2,5} & d_{3,5} & d_{4,5} & 0 \end{pmatrix}$$



Distance Methods

Stability Analysis

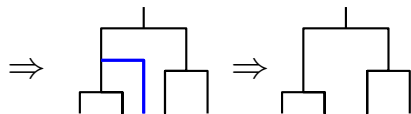
$$\begin{pmatrix} 0 & d_{1,2} & d_{1,3} & d_{1,4} & d_{1,5} \\ d_{1,2} & 0 & d_{2,3} & d_{2,4} & d_{2,5} \\ d_{1,3} & d_{2,3} & 0 & d_{3,4} & d_{3,5} \\ d_{1,4} & d_{2,4} & d_{3,4} & 0 & d_{4,5} \\ d_{1,5} & d_{2,5} & d_{3,5} & d_{4,5} & 0 \end{pmatrix}$$



Distance Methods

Stability Analysis

$$\begin{pmatrix} 0 & d_{1,2} & d_{1,3} & d_{1,4} & d_{1,5} \\ d_{1,2} & 0 & d_{2,3} & d_{2,4} & d_{2,5} \\ d_{1,3} & d_{2,3} & 0 & d_{3,4} & d_{3,5} \\ d_{1,4} & d_{2,4} & d_{3,4} & 0 & d_{4,5} \\ d_{1,5} & d_{2,5} & d_{3,5} & d_{4,5} & 0 \end{pmatrix}$$



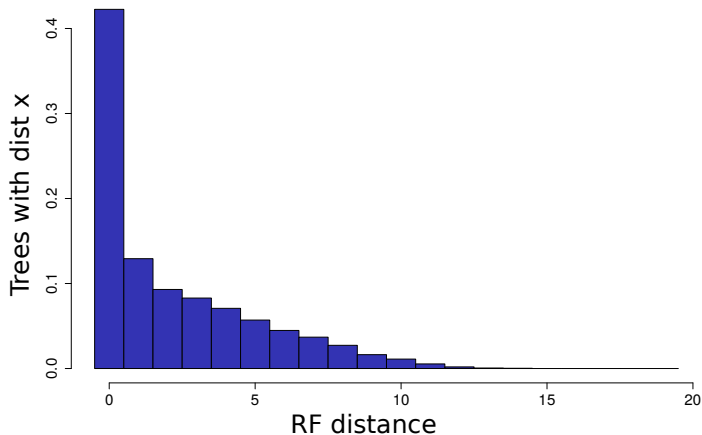
$$\begin{pmatrix} 0 & d_{1,2} & d_{1,3} & d_{1,4} \\ d_{1,2} & 0 & d_{2,3} & d_{2,4} \\ d_{1,3} & d_{2,3} & 0 & d_{3,4} \\ d_{1,4} & d_{2,4} & d_{3,4} & 0 \end{pmatrix}$$



Distance Methods

Neighbour Joining

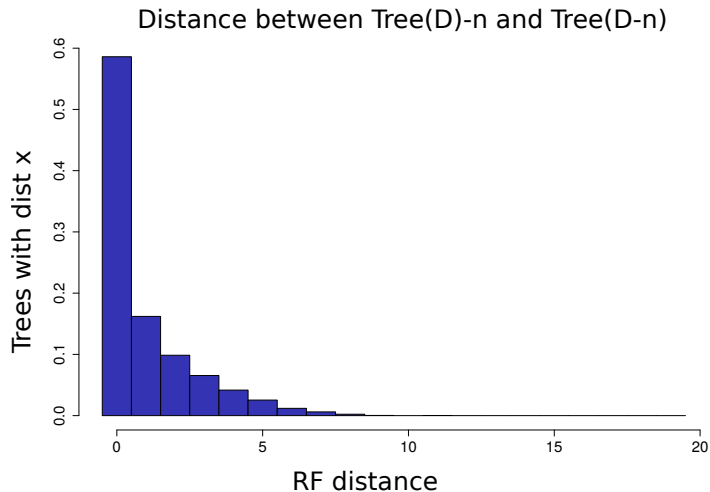
Distance between Tree(D)-n and Tree(D-n)



$m = 10000$ trees on $n = 20$ taxa

Distance Methods

UPGMA



$m = 10000$ trees on $n = 20$ taxa

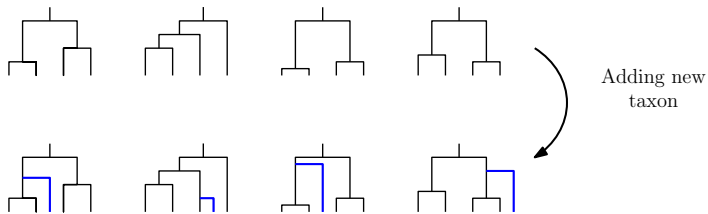
Bayesian Inference

$$\pi(\text{tree}|\text{data}) = \frac{\pi(\text{data}|\text{tree})\pi(\text{tree})}{\pi(\text{data})}$$



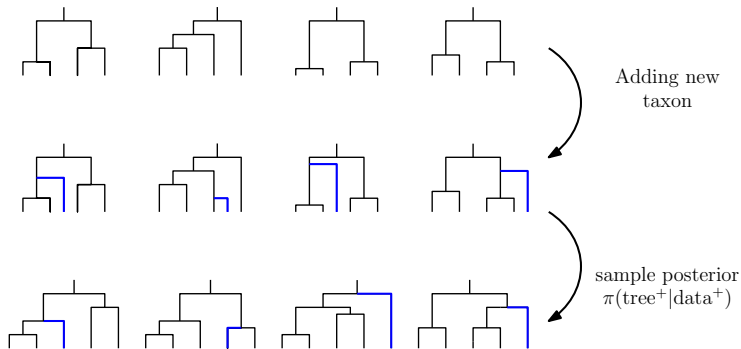
Bayesian Inference

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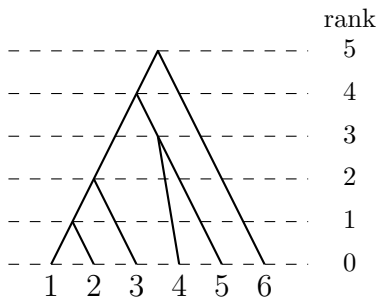
Bayesian Inference

$$\pi(\text{tree}|\text{data}) = \frac{\pi(\text{data}|\text{tree})\pi(\text{tree})}{\pi(\text{data})}$$



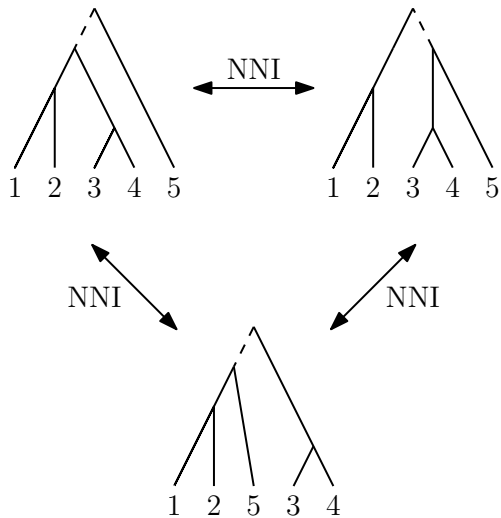
RNNI

Ranked Trees



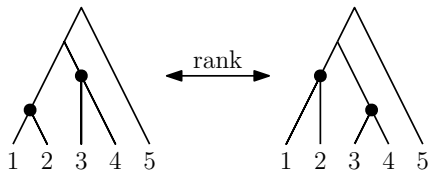
RNNI

NNI neighbours



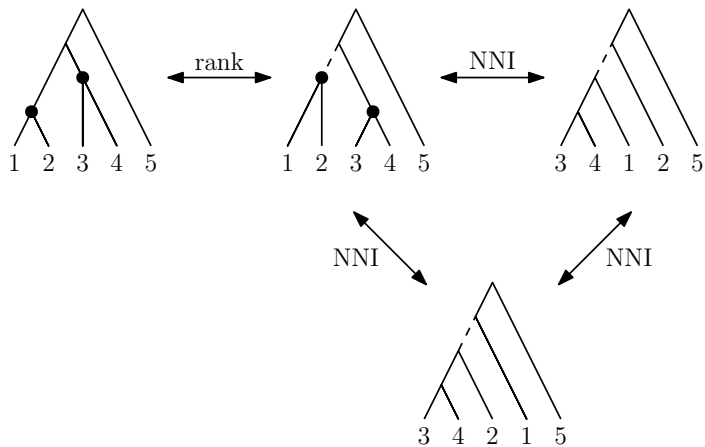
RNNI

Rank move

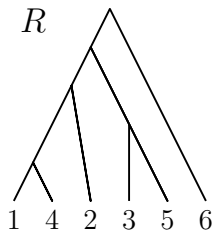
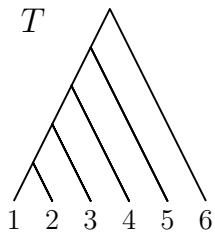


RNNI

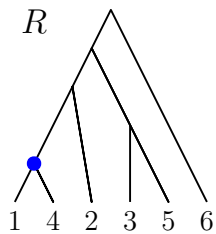
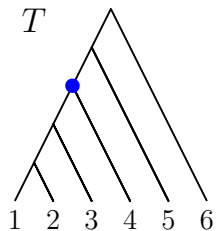
Rank move



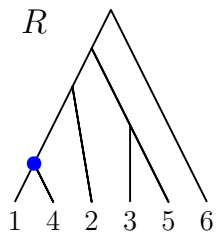
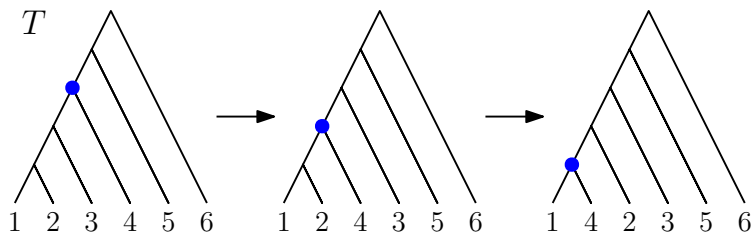
FINDPATH



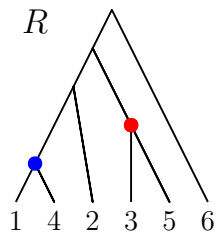
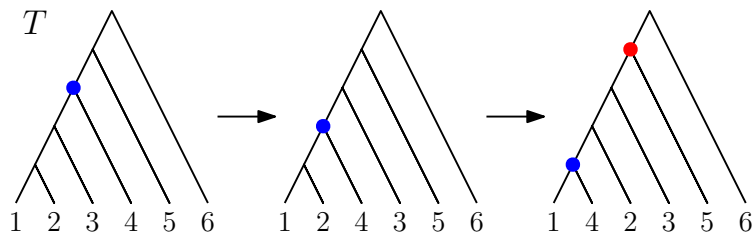
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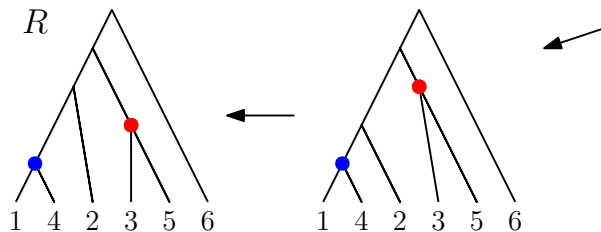
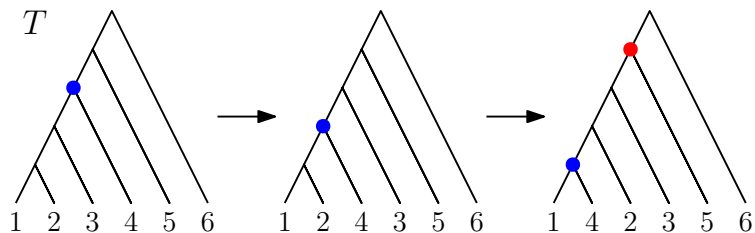
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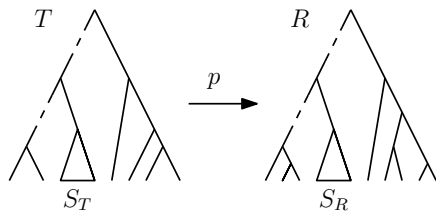
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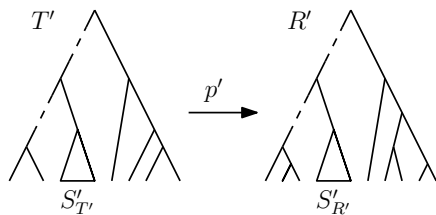
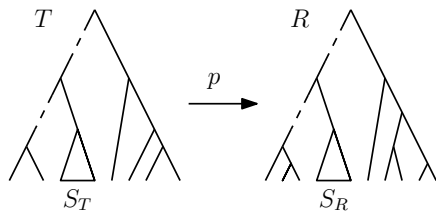
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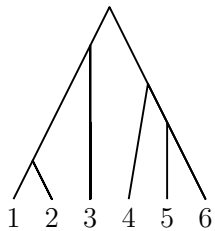
Online FINDPATH



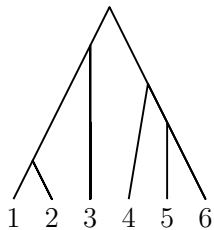
Online FINDPATH



MDTREE

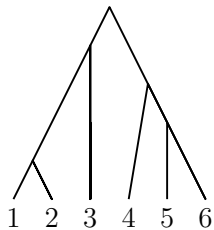


MDTREE

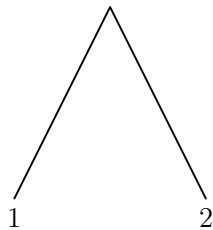


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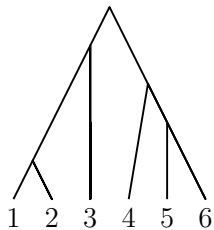
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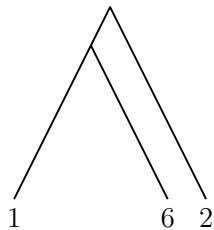
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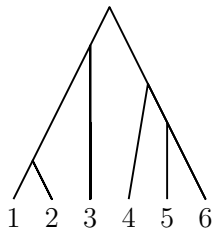
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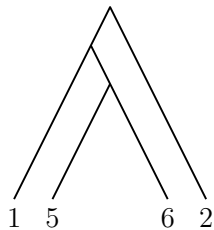
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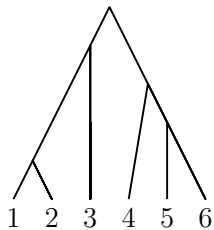
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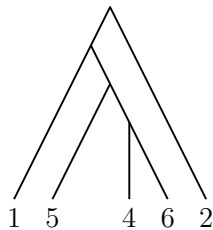
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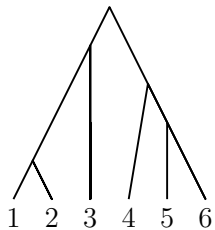
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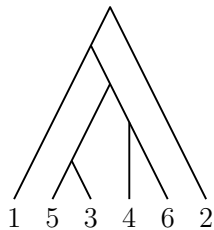
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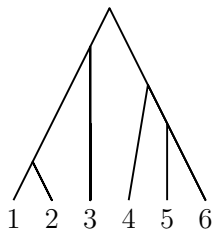
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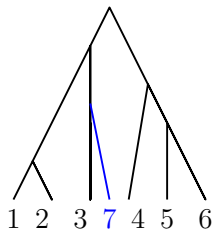
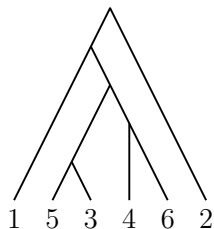
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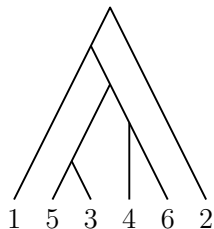
Online MDTREE



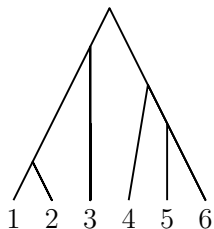
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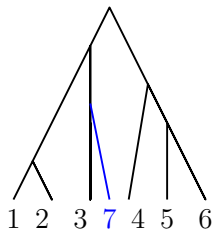
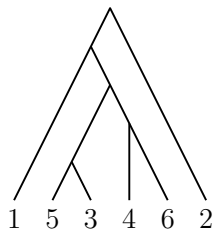
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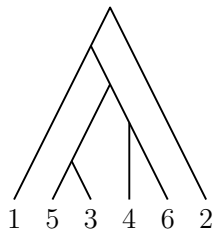
Online MDTREE



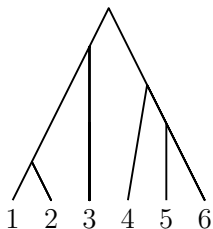
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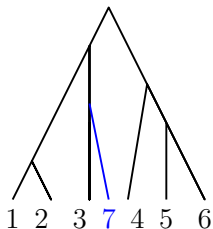
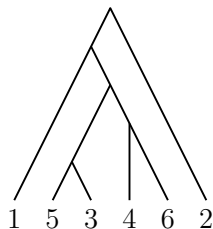
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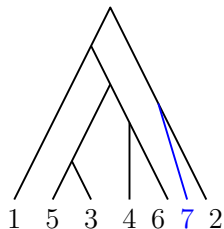
Online MDTREE



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[1, 2, 6, 5, 7, 4, 3]



Acknowledgements

Alex Gavryushkin (University of Otago)

David Bryant (University of Otago)

RUTHERFORD
DISCOVERY FELLOWSHIPS

