MLE for Individual Ancestries Population Covariances and Selection

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Covariance Inference with Nelder-Mead

$$P\left(f_j \mid \Omega,\ \mu_j\right) \sim \mathcal{N}\left(\mu_j,\ \mu_j\left(1-\mu_j\right)\Omega\right).$$

Likelihood Model

$$\begin{aligned}
&\ln\left[P_2\left(F\right)\right] \\
&= \ln\left\{\prod_j^J\left[\frac{1}{\sqrt{\left|2\pi c_j\Omega'\right|}}\right.\right. \\
&\qquad \left.\left.\exp\left(-\frac{1}{2}\cdot f_j'^T\cdot\left(c_j\Omega'\right)^{-1}\cdot f_j'\right)\right]\right\} \\
&= -\frac{1}{2}\cdot\sum_j^J\left\{\left(K-1\right)\cdot\ln\left(2\pi c_j\right)+\right. \\
&\qquad \left.\ln\left[\det\left(\Omega'\right)\right]+\frac{1}{c_j}\cdot f_j'^T\cdot\Omega'^{-1}\cdot f_j'\right\}
\end{aligned}$$

where $c_j = \mu_j\left(1-\mu_j\right)$

$f_j' = f_j - f_{j0}.$

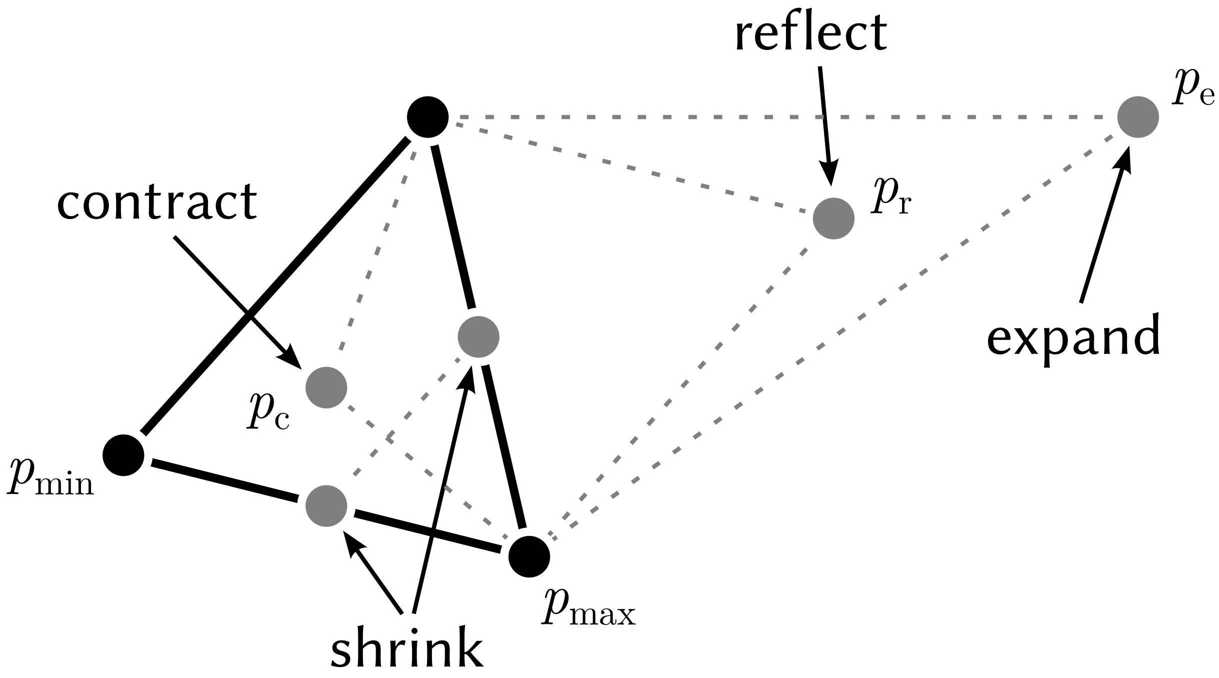
NM

Repeat until a stopping criteria is reached
- Evaluate each point in the simplex using the objective function
- Determine the point $p_{\min}$ with the lowest score
- Reflect $p_{\min}$ through the centroid of the remaining vertices to p_r
- **If** the score at p_r is the highest score in the simplex Then
  - Expand p_r away from the centroid to p_e
  - Use p_e in place of $p_{\min}$
- **Else If** the score at p_r is still the lowest score Then
  - Contract p_r toward the centroid to point p_c
  - **If** the score at p_c is no longer the lowest score Then
    - Use p_c to replace $p_{\min}$
  - **Else**
    - Determine the point $p_{\max}$ with the highest score
    - Shrink all points in the simplex around $p_{\max}$
  - **End If**
- **Else**
  - Use p_r in place of $p_{\min}$
- **End If**

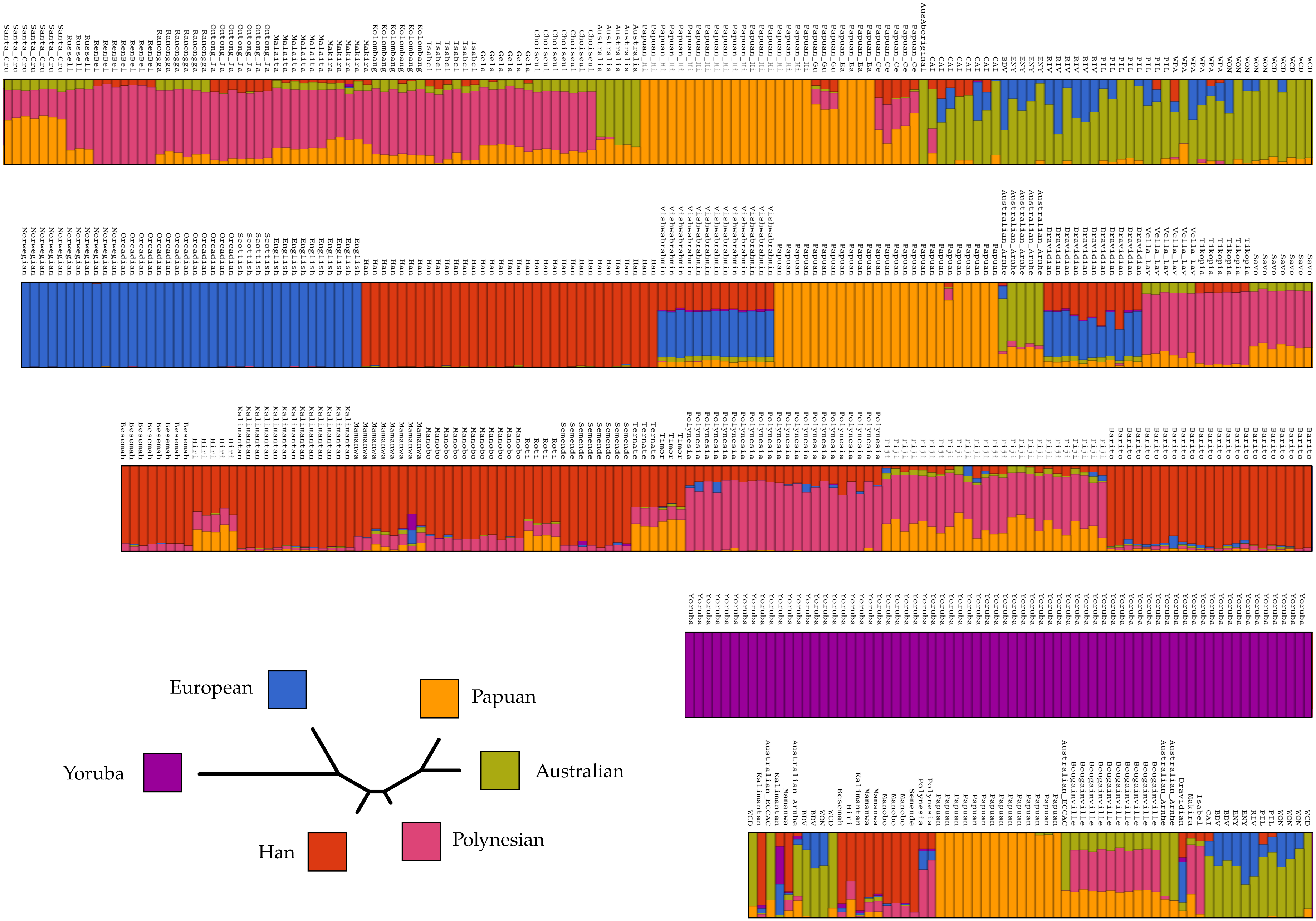
End Repeat

Covariance Inference with Nelder-Mead

$$P\left(f_j \mid \Omega,\ \mu_j\right) \sim \mathcal{N}\left(\mu_j,\ \mu_j\left(1-\mu_j\right)\Omega\right) \qquad \ln\left[P_2\left(F\right)\right] \ = \ \ln\left\{\prod_j^J\left[\frac{1}{\sqrt{\left|2\pi c_j \Omega'\right|}}\exp\left(-\frac{1}{2}\cdot f_j'^T\cdot\left(c_j\Omega'\right)^{-1}\cdot f_j'\right)\right]\right\}$$



Admixture Analysis with Population Covariances



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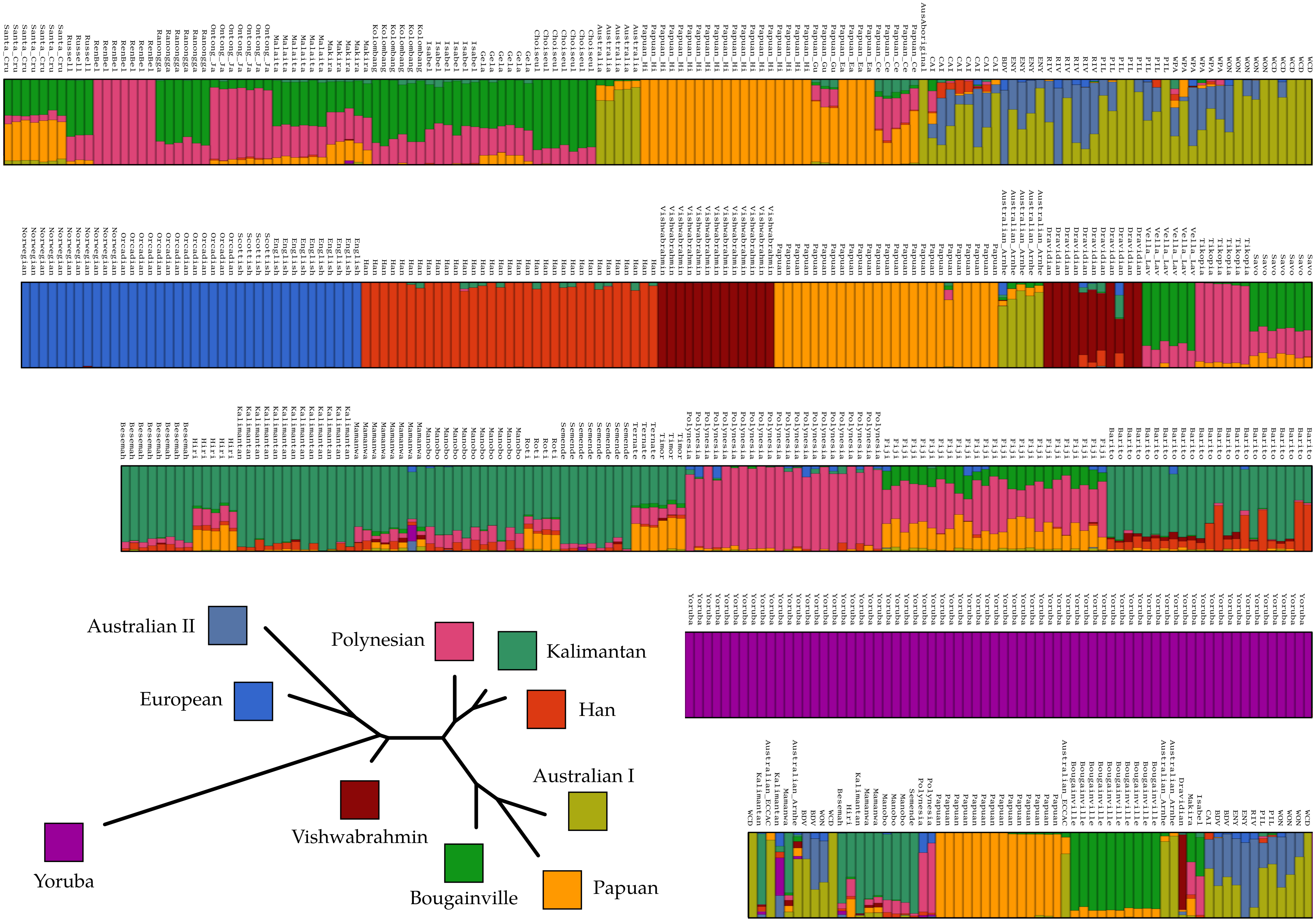

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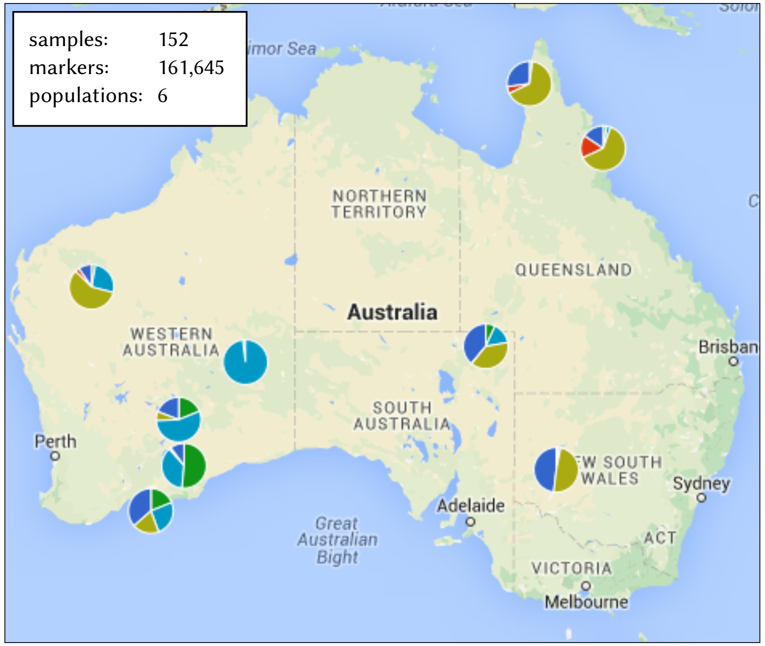
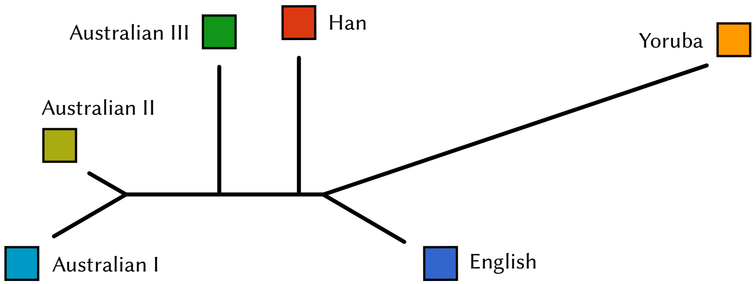
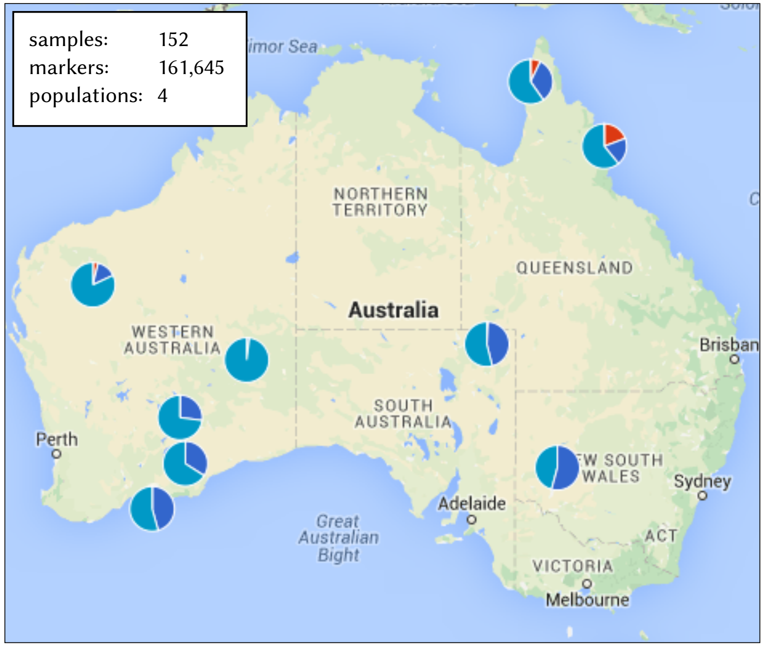
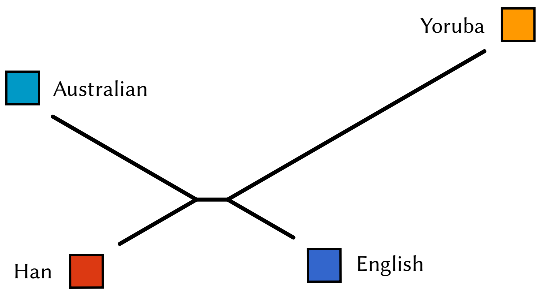
Admixture Analysis with Population Covariances









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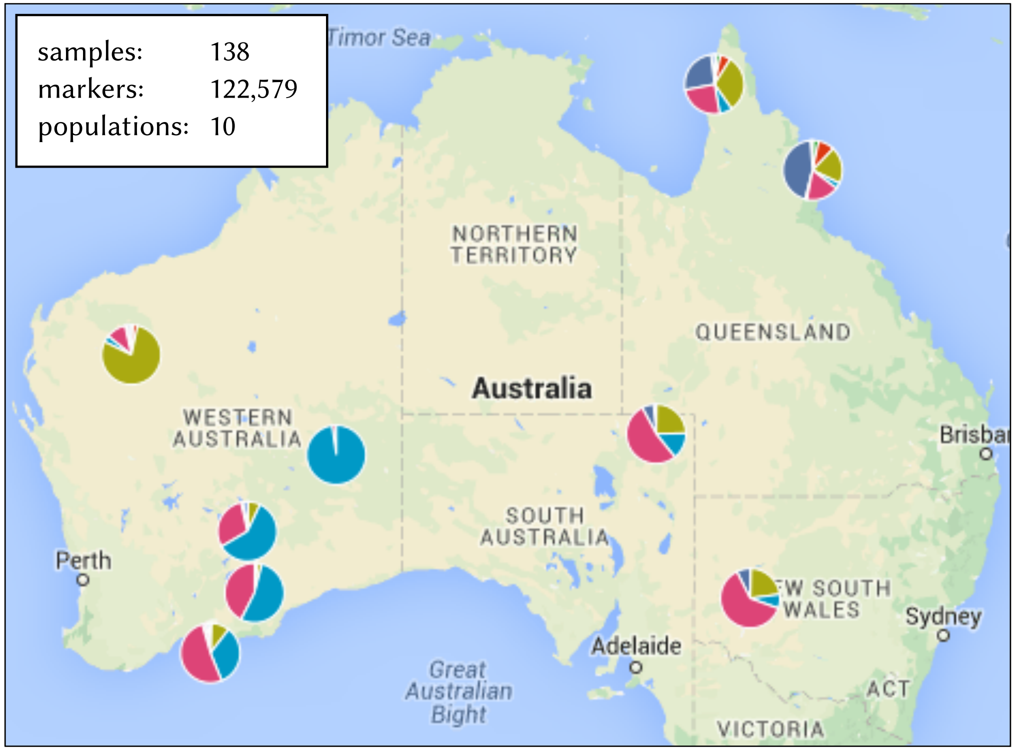

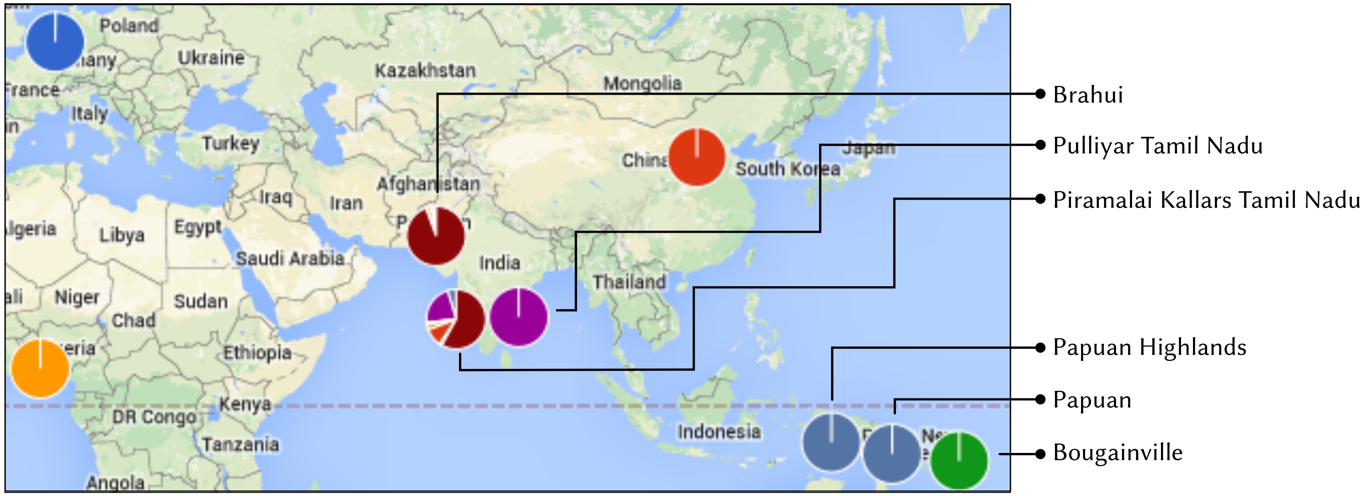

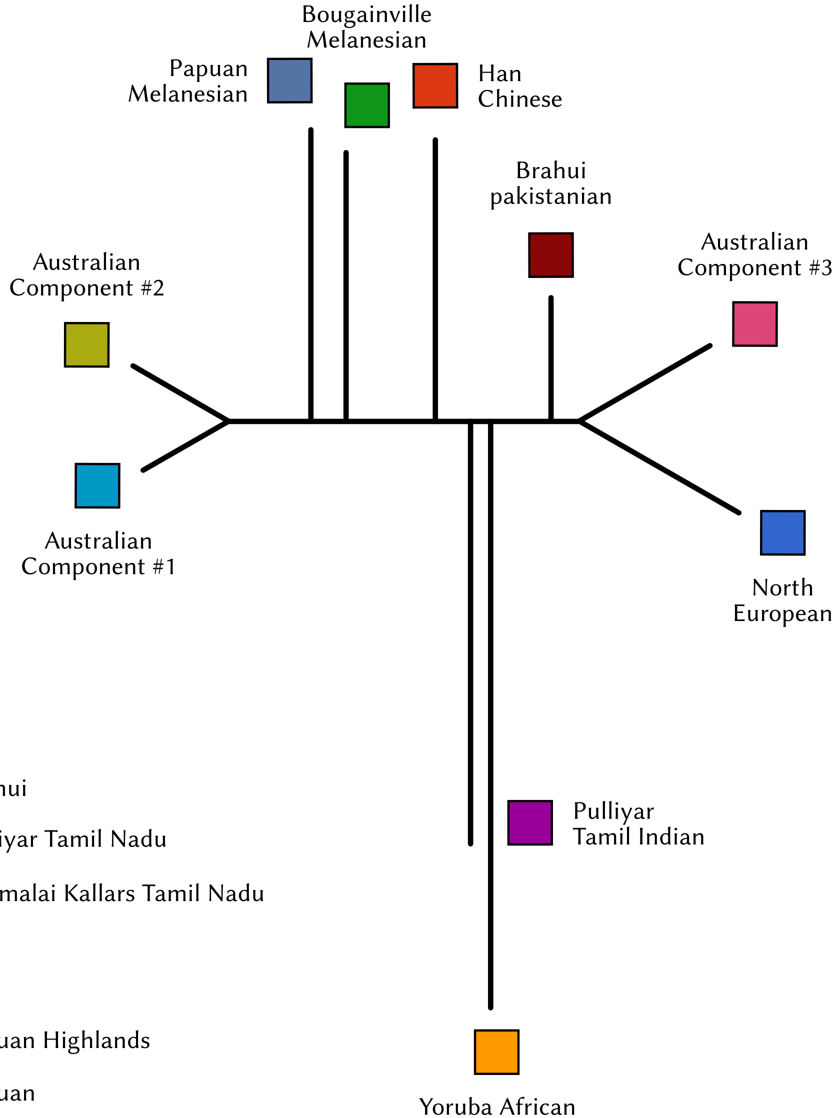

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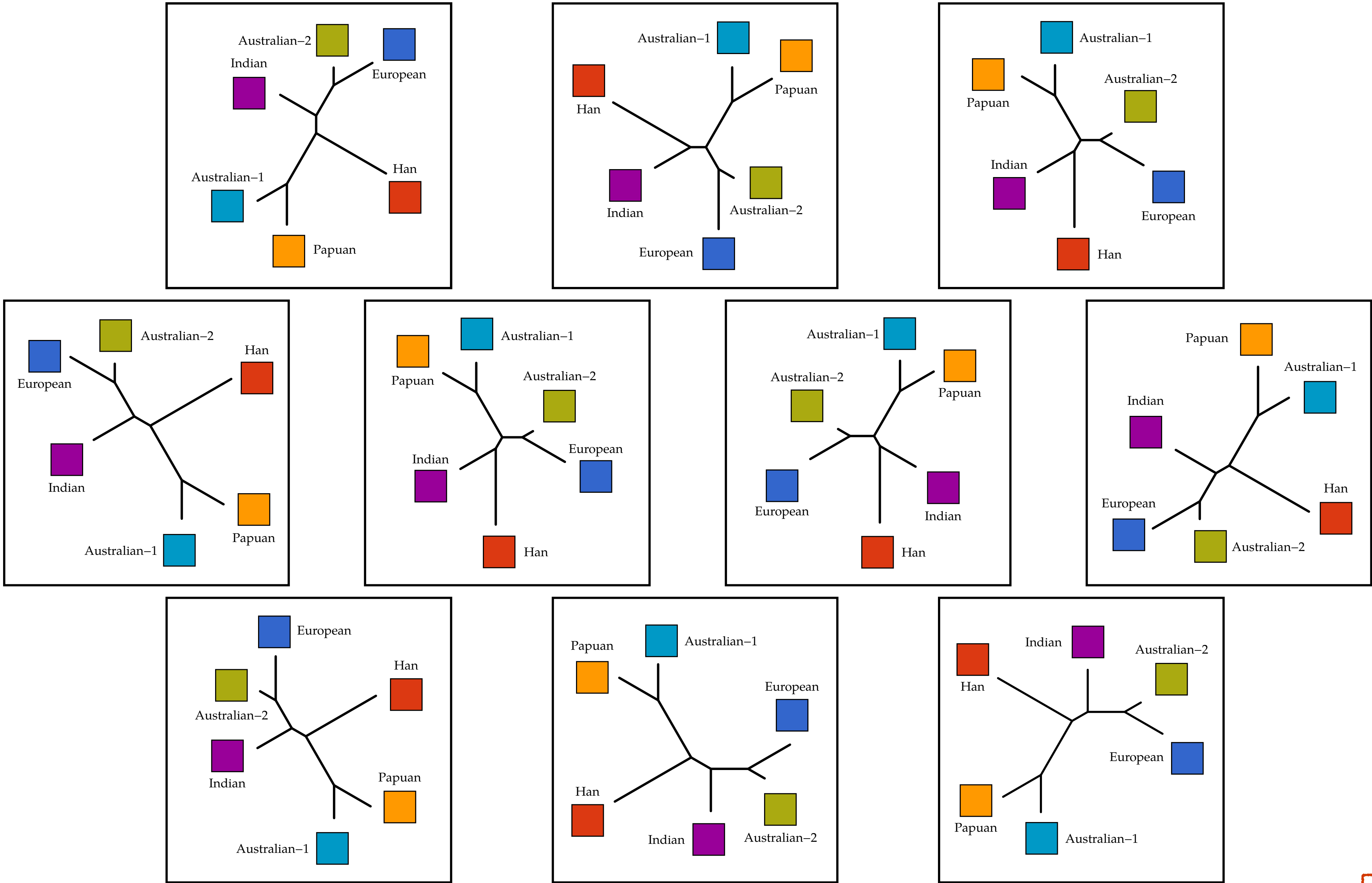

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