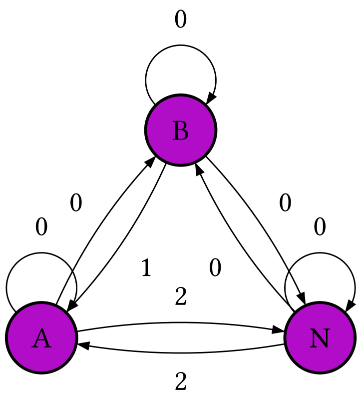
BANANA

Bigram counts



Character map

$$[\mathrm{A}, \mathrm{B}, \mathrm{N}]$$

Probability matrix (global probabilities)

$$P = \begin{bmatrix} 0 & \frac{1}{5} & \frac{2}{5} \\ 0 & 0 & 0 \\ \frac{2}{5} & 0 & 0 \end{bmatrix}$$

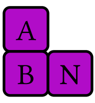
Markov chain transposition matrix (local outgoing edge probabilities)

$$A = \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

Stationary probability vector (key importance)

$$\pi A = \pi$$
$$A^T \pi^T = \pi^T \text{ (eigenvalue } \lambda = 1)$$
$$\pi = [0.5 \;\; 0 \;\; 0.5]$$

Preferred position matrix (e.g. B and N are on the home row)



$$R = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

Distance matrix (distance can be non-metric; must be positive, symmetric, $d_{i,i} = 0$)

$$D = \begin{bmatrix} 0 & 1 & \sqrt{2} \\ 1 & 0 & 1 \\ \sqrt{2} & 1 & 0 \end{bmatrix}$$

Same finger bigram matrix (e.g. left index finger is assigned to A and B)

$$F = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Other matrices

$$\vdots$$

Permutation matrix (we need to find the optimal permutation)

$$E = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

Final cost c (C is a weighted sum of normalized matrices multiplied with probabilities) ... only some matrices are permuted with E

$$c = \min_E \sum_i \sum_j C_{i,j}$$
$$C(E) = EP \odot (w_1 F + w_2 (E\pi) R + w_3 ED + \ldots)$$
$$\pi \leftarrow \mathrm{diag}(\pi)$$
$$w \text{ ... weight vector}$$