

Genome 540 Discussion

March 3rd 2026



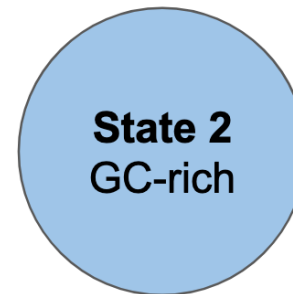
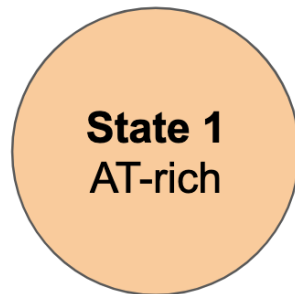
HW8 Overview

HW8 Overview

- Implement a 2-state HMM
- Use Baum-Welch to compute improved parameter estimates
- Iterate until convergence

HW8 Overview

start



ACTATACTGTCATATTCGCGGCTCGCATCGCGCATATATTCGCGTAATAAAA

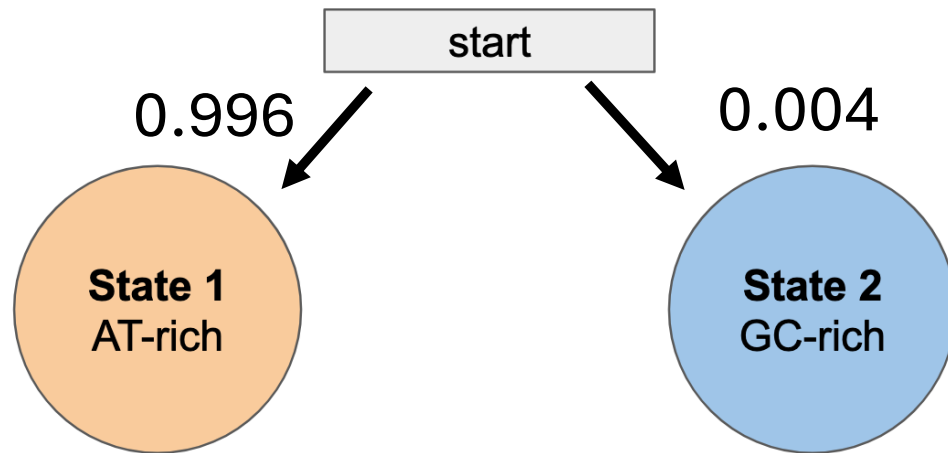


HW8 Overview

Initiation Probabilities:

$$\pi_1 = 0.996$$

$$\pi_2 = 0.004$$



ACTATACTGTCATATTCGCGGCTCGCATCGCGCATATATTCGCGTAATAAAA



HW8 Overview

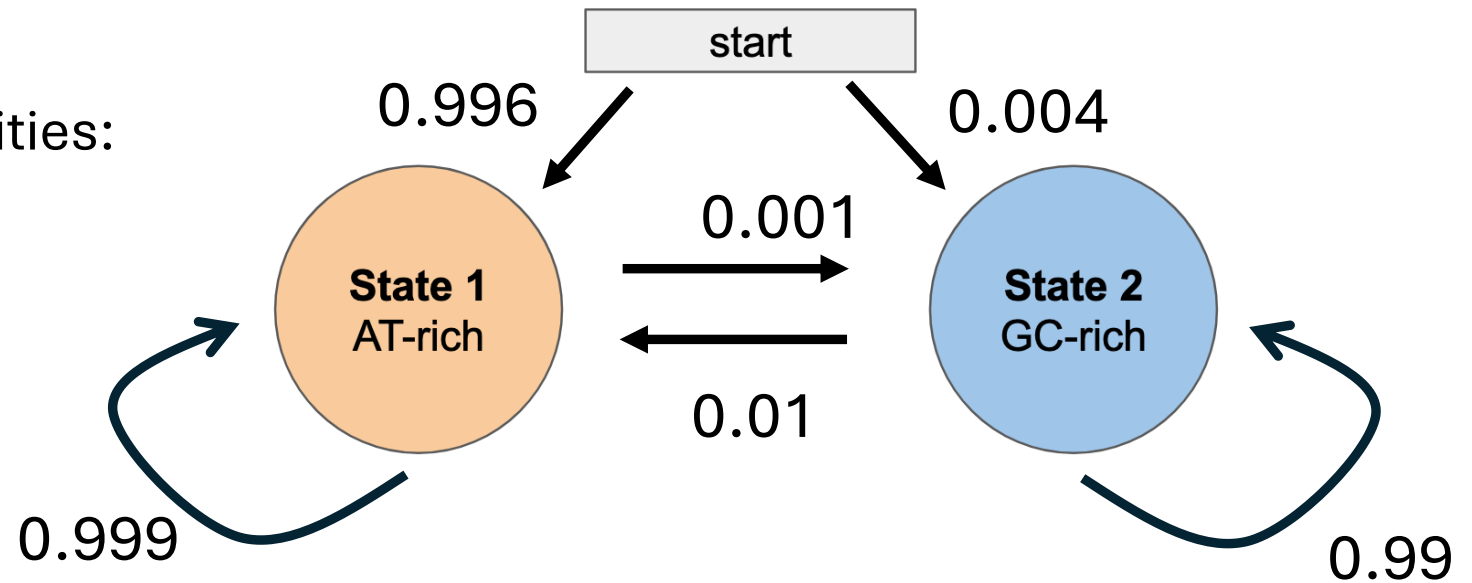
Transition Probabilities:

$$a_{11}=0.999$$

$$a_{12}=0.001$$

$$a_{21}=0.01$$

$$a_{22}=0.99$$



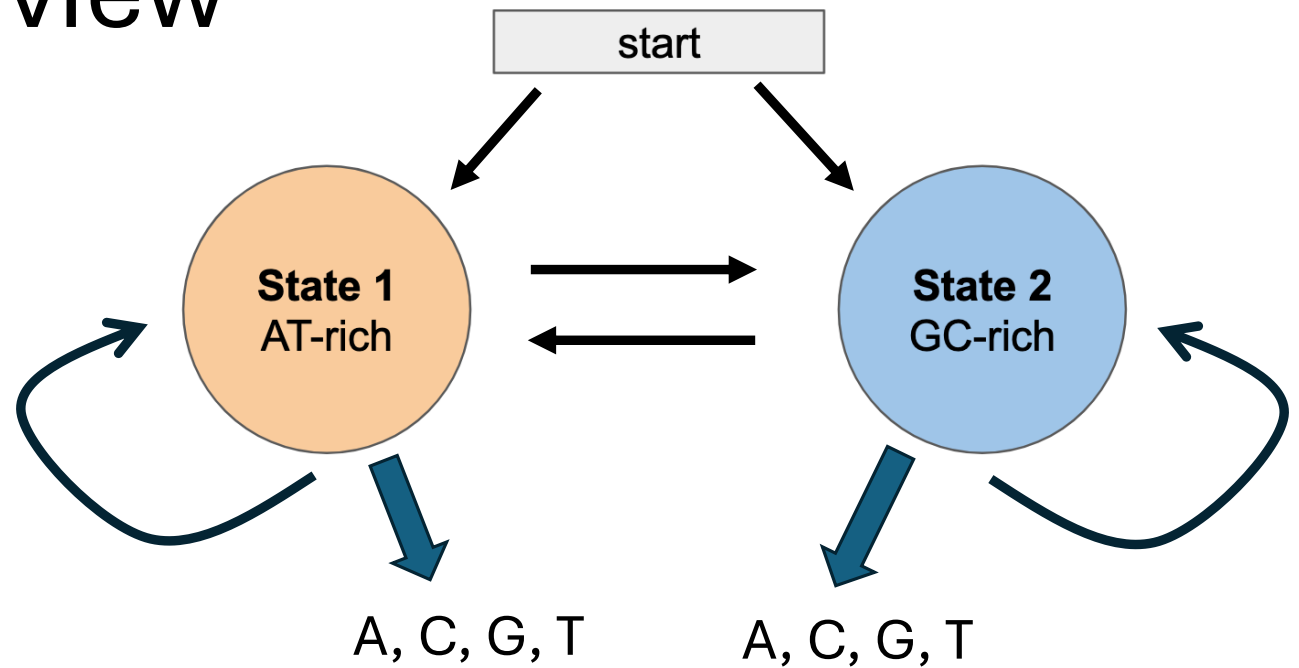
ACTATACTGTCATATTCGCGGCTCGCATCGCGCATATATTCGCGTAATAAAA



HW8 Overview

Emission Probabilities:

State 1	State 2
$e_A=0.3$	$e_A=0.15$
$e_C=0.2$	$e_C=0.35$
$e_G=0.2$	$e_G=0.35$
$e_T=0.3$	$e_T=0.15$



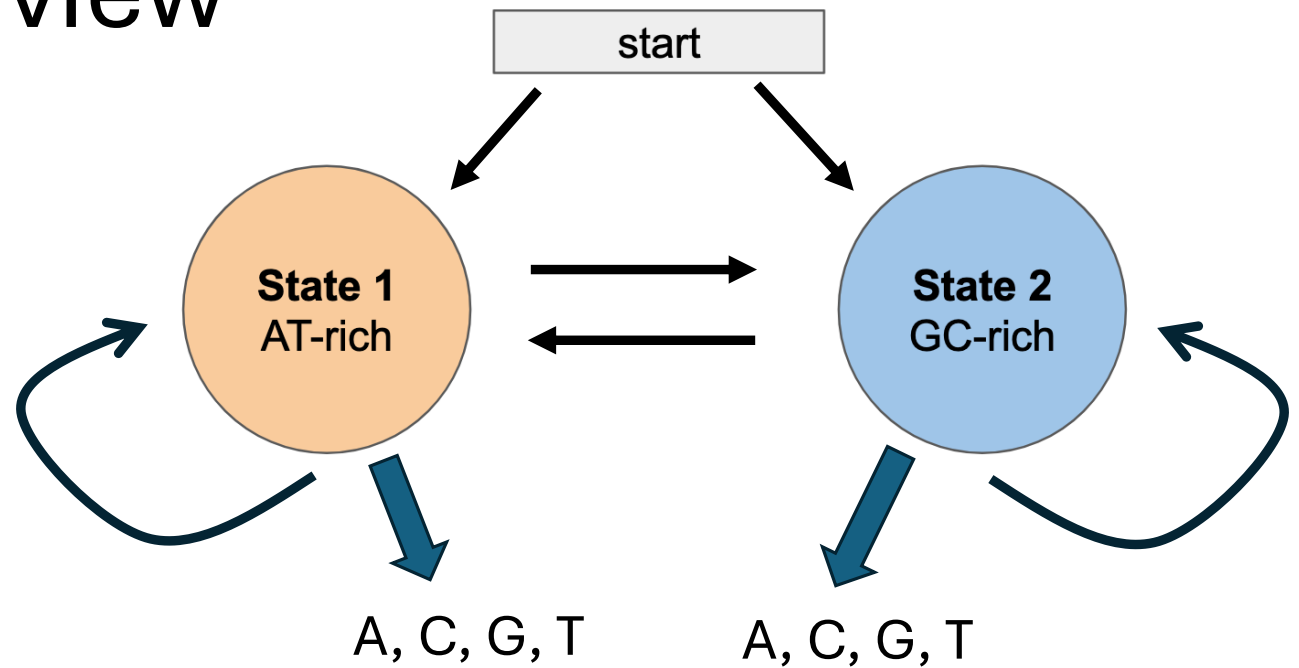
ACTATACTGTCATATTCGCGGCTCGCATCGCGCATATATTCGCGTAATAAAA



HW8 Overview

Emission Probabilities:

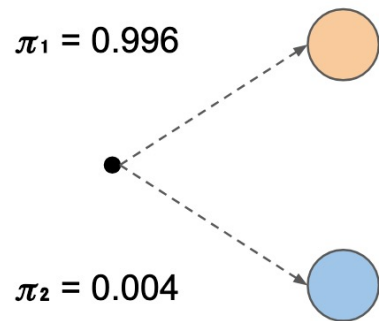
State 1	State 2
$e_A=0.3$	$e_A=0.15$
$e_C=0.2$	$e_C=0.35$
$e_G=0.2$	$e_G=0.35$
$e_T=0.3$	$e_T=0.15$



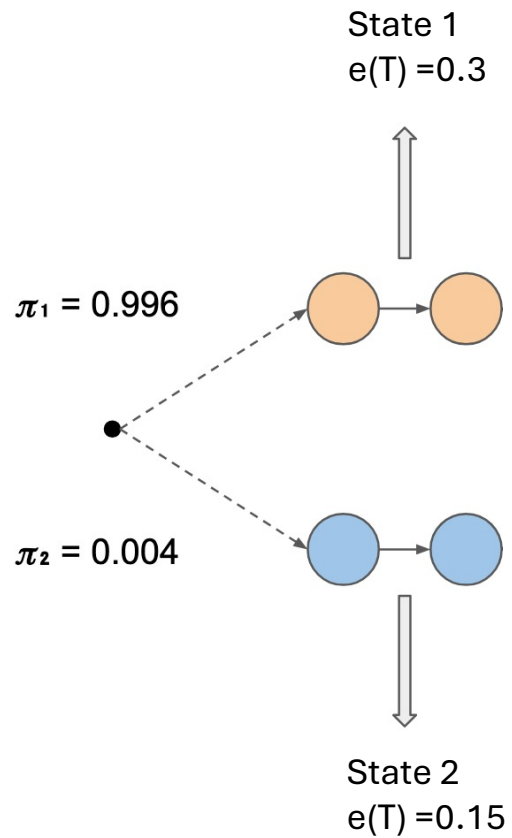
ACTATACTGTCATATTCGCGGCTCGCATCGCGCATATATTCGCGTAATAAAA



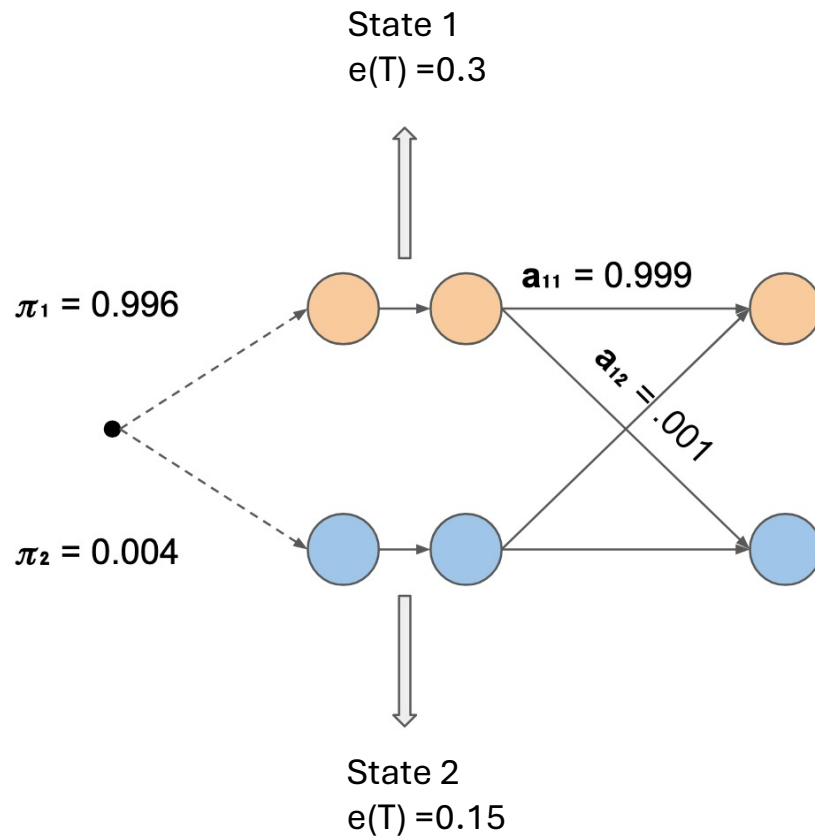
HW8 Example: “TCG”



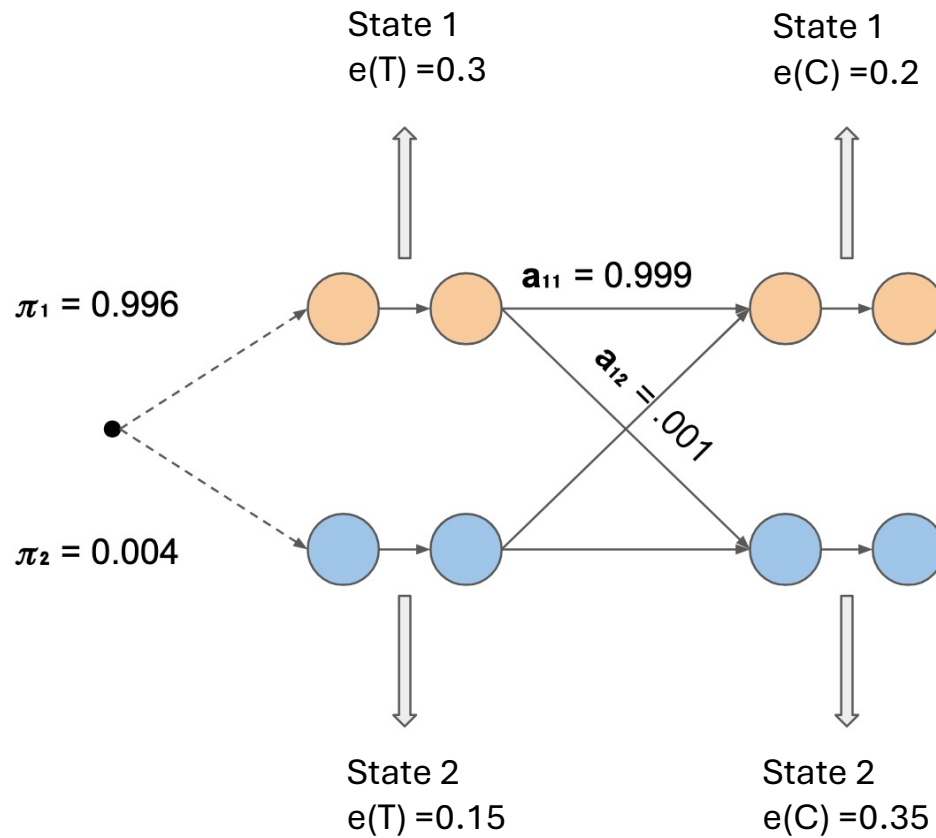
HW8 Example: “TCG”



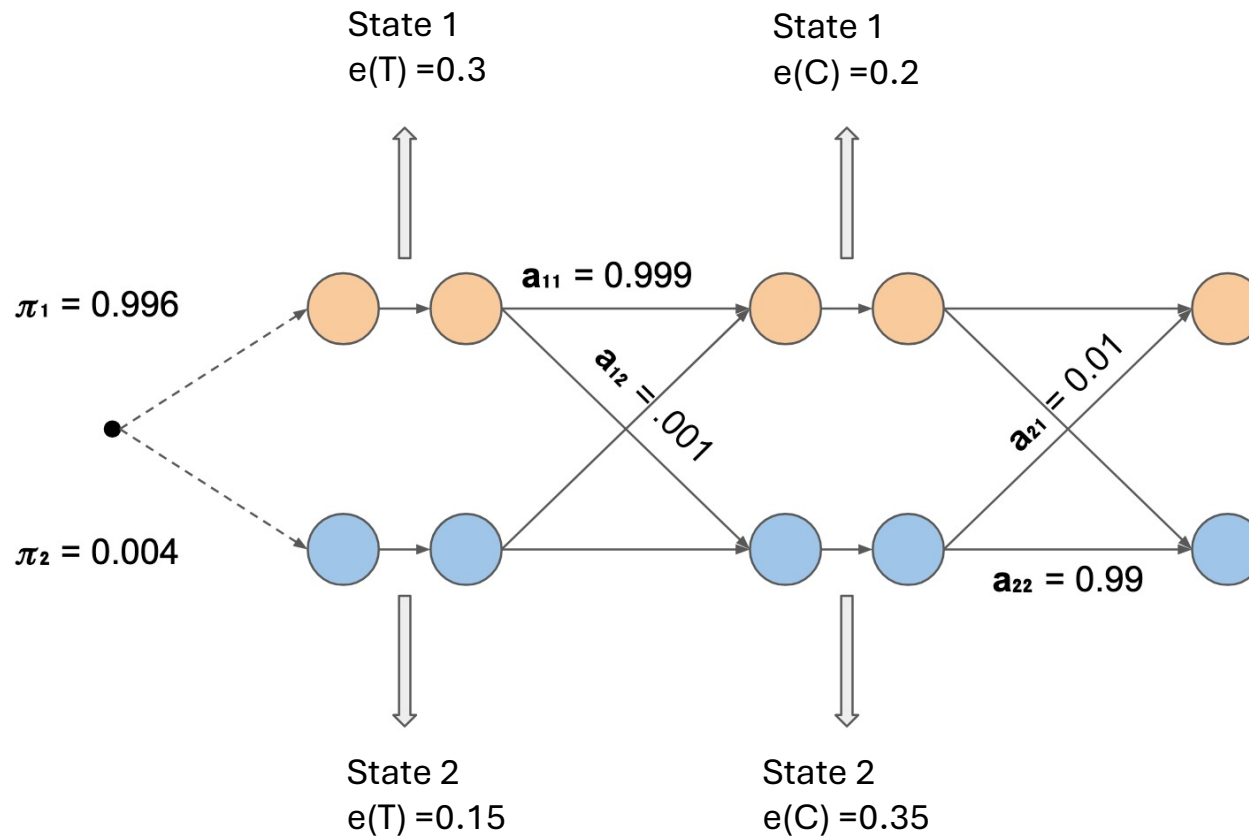
HW8 Example: “TCG”



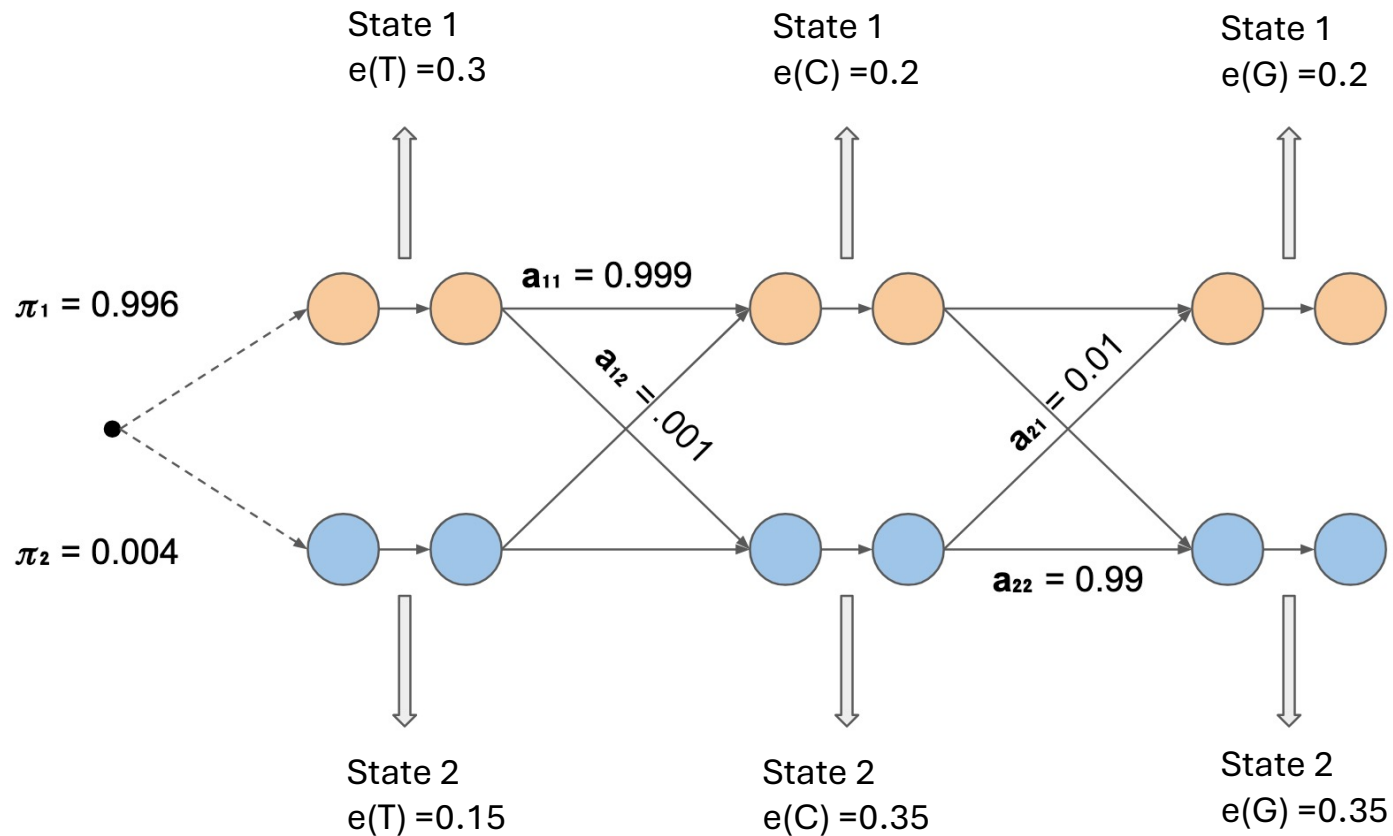
HW8 Example: “TCG”



HW8 Example: “TCG”



HW8 Example: “TCG”



HW8 Overview

- We already know how to find the Viterbi path given a set of parameters (highest weight path)! But... what should the parameters be?
- Baum-Welch: Iteratively update the parameter estimates (initiation, transition and emission probabilities) to find parameters that best explain the observed sequence
- The twist: Need to keep everything in normal probability space (how??)