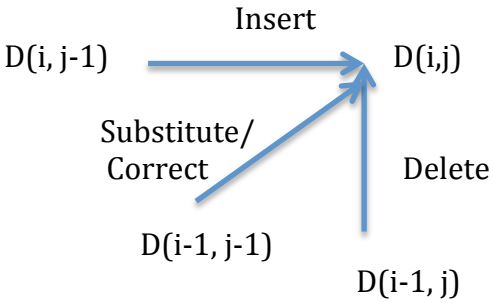
String Edit Distance

D(i, j) = d(i,j) + min[D(i-1, j), D(i-1,j-1), D(i, j-1)] for i=1.....M and j = 1.....N
Path(i,j) = arg min [D(i-1, j), D(i-1,j-1), D(i, j-1)]

Initial condition path starts at D(1,1)
Final condition path ends at D(M,N)

if str(i) = str(j)
  d(i,j) = 0
else
  d(i,j) = 1
end if



Backtrack the path to find the number of insertions, deletion, and substitution.

K	Inf					
R	Inf					
A	Inf					
P	Inf					
	0	Inf	Inf	Inf	Inf	Inf
		S	P	A	K	E

Word Error Rate

Reference transcript: *she had a dark suit in greasy water all year*

ASR output: *he had a dark grey suit in water all there*

WER = (# Ins + # Del + # Sub)/(# of words in reference transcript)

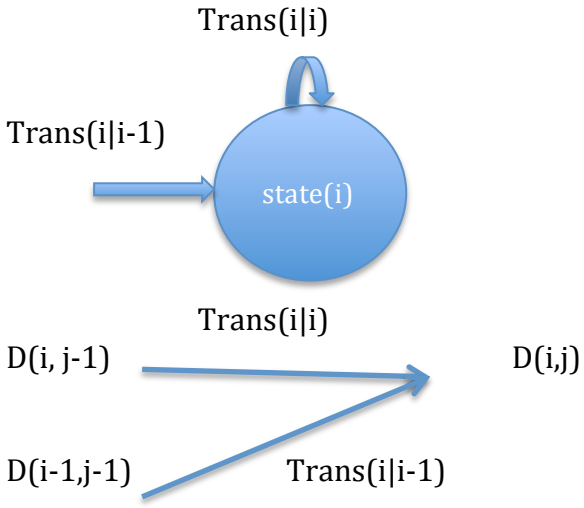
year	Inf										
all	Inf										
water	Inf										
greasy	Inf										
in	Inf										
suit	Inf										
dark	Inf										
a	Inf										
had	Inf										
she	Inf										
	0	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf
		he	*had*	*a*	*dark*	*grey*	*suit*	*in*	*water*	*all*	*there*

Computation of log-likelihood of a HMM given an Observation Sequence using Viterbi algorithm

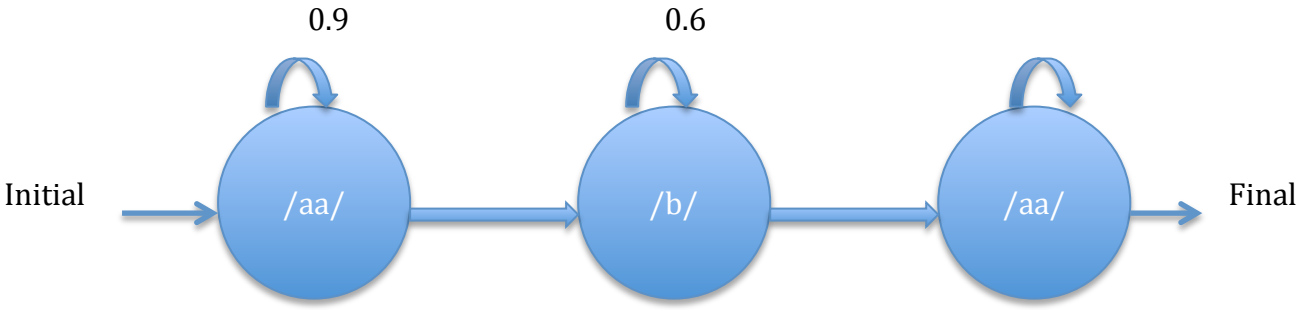
$D(i, j) = d(i, j) + \min[(D(i-1,j-1) + \text{Trans}(i|i-1)), (D(i, j-1) + \text{Trans}(i|i))]$
$\text{Path}(i, j) = \arg\min [(D(i-1,j-1) + \text{Trans}(i|i-1)), (D(i, j-1) + \text{Trans}(i|i))]$

$d(i, j) = -\log(P(\text{obs}(j)|\text{state}(i))$
$\text{Trans}(i|i-1) = -\log(P(\text{state}(i)|\text{state}(i-1))$

NOTE: Local constraints are based on HMM topology



Example with single dimension observation



Initial and Final are non-emitting states

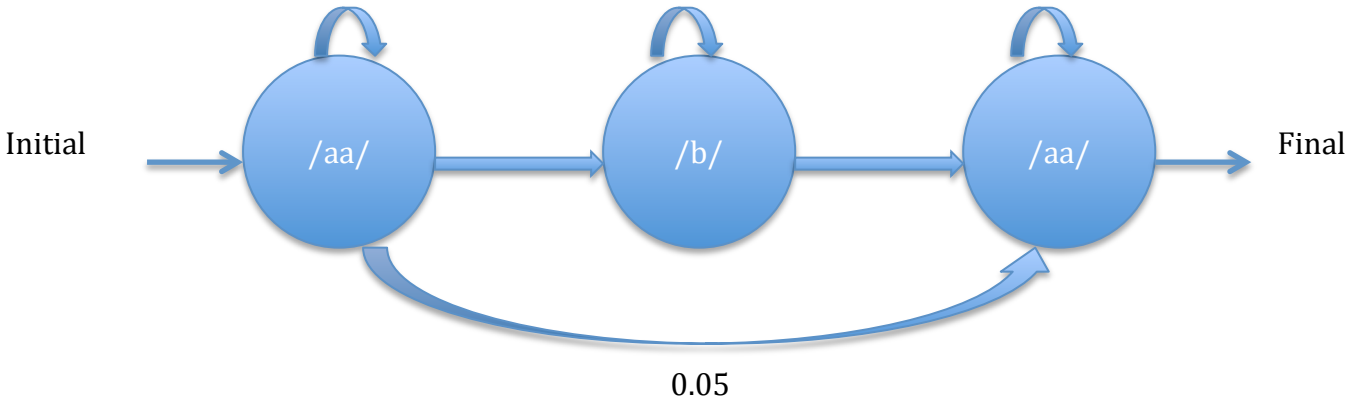
State /aa/:
mean = 15.1
standard deviation = 3.2

State /b/:
mean = 10.3
standard deviation = 4.4

Observation sequence: 16.0, 13.7, 12.0, 9.8, 10.0, 11.8, 14.2, 17.2, 12.5

/aa/	Inf									
/b/	Inf									
/aa/	Inf									
	0.0	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf
		16.0	13.7	12.0	9.8	10.0	11.8	14.2	17.2	12.5

Compute the log-likelihood for the following HMM topology. Note down the key changes in the computation that are to be made w.r.t the previous topology.



/aa/	Inf									
/b/	Inf									
/aa/	Inf									
	0.0	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf
		16.0	13.7	12.0	9.8	10.0	11.8	14.2	17.2	12.5