The Viterbi Algorithm

q_{end}	end					
q_4	NN	0				
q_3	TO	0				
q_2	VB	0				
q_1	PPSS	0				
q_o	start	**1.0**				
		<s>	I	want	to	race
		o_o	o_1	o_2	o_3	o_4

1. Create probability matrix, with one column for each observation (i.e., word), and one row for each state (i.e., tag).
2. We proceed by filling cells, column by column

The Viterbi Algorithm

q_{end}	end					
q_4	NN	0	$1.0 \times .041 \times 0$			
q_3	TO	0	$1.0 \times .0043 \times 0$			
q_2	VB	0	$1.0 \times .19 \times 0$			
q_1	PPSS	0	$1.0 \times .67 \times .37$			
q_o	start	**1.0**				
		<s>	I	want	to	race
		o_o	o_1	o_2	o_3	o_4

- For each state q_j at time t compute
  $v_t(j) = \max_{i=j}^{N} v_{t-1}(i) a_{ij} b_j(o_t)$
- $v_{t-1}(i)$ is **previous Viterbi path probability**, a_{ij} is **transition probability**, and $b_j(o_t)$ is **emission probability**

The Viterbi Algorithm

q_{end}	end					
q_4	NN	0	0	$.025 \times .0012 \times 0.000054$		
q_3	TO	0	0	$.025 \times .00079 \times 0$		
q_2	VB	0	0	$.025 \times .23 \times .0093$		
q_1	PPSS	0	**.025**	$.025 \times .00014 \times 0$		
q_0	start	**1.0**				
		<s>	I	want	to	race
		o_o	o_1	o_2	o_3	o_4

- For each state q_j at time t compute
  $v_t(j) = \max_{i=j}^{N} v_{t-1}(i) a_{ij} b_j(o_t)$
- $v_{t-1}(i)$ is **previous Viterbi path probability**, a_{ij} is **transition probability**, and $b_j(o_t)$ is **state observation likelihood**

The Viterbi Algorithm

q_{end}	end					
q_4	NN	0	0	.000000002	$.000053 \times .047 \times 0$	
q_3	TO	0	0	0	$.000053 \times .035 \times .99$	
q_2	VB	0	0	**.00053**	$.000053 \times .0038 \times 0$	
q_1	PPSS	0	**.025**	0	$.000053 \times .0070 \times 0$	
q_0	start	**1.0**				
		<s>	I	want	to	race
		o_o	o_1	o_2	o_3	o_4

- For each state q_j at time t compute
  $v_t(j) = \max_{i=j}^{N} v_{t-1}(i) a_{ij} b_j(o_t)$
- $v_{t-1}(i)$ is **previous Viterbi path probability**, a_{ij} is **transition probability**, and $b_j(o_t)$ is **state observation likelihood**

The Viterbi Algorithm

q_{end}	end					
q_4	NN	0	0	.0000000002	0	.0000018 × .00047 × .00057
q_3	TO	0	0	0	**.0000018**	.0000018×0×0
q_2	VB	0	0	**.00053**	0	.0000018×.83×.00012
q_1	PPSS	0	**.025**	0	0	.0000018 × 0 × 0
q_0	start	**1.0**				
		<s>	I	want	to	race
		o_o	o_1	o_2	o_3	o_4

- For each state q_j at time t compute
  $v_t(j) = \max_{i=j}^{N} v_{t-1}(i) a_{ij} b_j(o_t)$
- $v_{t-1}(i)$ is **previous Viterbi path probability**, a_{ij} is **transition probability**, and $b_j(o_t)$ is **state observation likelihood**

The Viterbi Algorithm

q_{end}	end					
q_4	NN	0	0	.000000002	0	4.8222e-13
q_3	TO	0	0	0	**.0000018**	0
q_2	VB	0	0	**.00053**	0	**1.7928e-10**
q_1	PPSS	0	**.025**	0	0	0
q_0	start	**1.0**				
		<s>	I	want	to	race
		o_o	o_1	o_2	o_3	o_4

- For each state q_j at time t compute
  $v_t(j) = \max_{i=j}^{N} v_{t-1}(i) a_{ij} b_j(o_t)$
- $v_{t-1}(i)$ is **previous Viterbi path probability**, a_{ij} is **transition probability**, and $b_j(o_t)$ is **state observation likelihood**