#### HMM example

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## Parameter estimation of HMM parameters A, B

$(s_0)$	F	F	F	F	L	L	L	F	F	F	F	L	L	L	L	F	F	F	L	L	$(s_f)$
$(k_0)$	- 1	3	4	5	6	6	5	- 1	2	3	- 1	4	3	5	4	1	2	6	1	2	$(k_f)$

lacktriangle Transition matrix A consists of transition probabilities  $a_{ij}$ 

$$a_{ij} = P(X_{t+1} = s_j | X_t = s_i) \sim \frac{count_{trans}(X_t = s_i, X_{t+1} = s_j)}{count_{trans}(X_t = s_i)}$$

lacktriangle Emission matrix B consists of emission probabilities  $b_i(k_j)$ 

kΩ

**Emission** 

$$b_i(k_j) = P(O_t = k_j | X_t = s_i) \sim \frac{count_{emission}(O_t = k_j, X_t = s_i)}{count_{emission}(X_t = s_i)}$$

5

kf |

0.00	0.36	0.18	0.18	0.09	0.09	0.09	0.00
0.00	0.11	0.11	0.11	0.22	0.22	0.22	0.00
1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
proba	bilities	;	to F	to L	to	s0	to sf
			1.00	0.00	0.00	) (	00.0
			0.73	0.27	0.00	) (	00.0
			0.22	0.67	0.00	) (	0.11
			0.00	0.00	0.00	) (	0.00
	0.00 1.00 0.00	0.00 0.11 1.00 0.00 0.00 0.00	0.00 0.11 0.11 1.00 0.00 0.00 0.00 0.00	0.00 0.11 0.11 0.11 1.00 0.00 0.00 0.00 0.00 0.00	0.00 0.11 0.11 0.22 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	0.00   0.11   0.11   0.12   0.22   0.22   1.00   0.22   0.67   0.00   0.00   0.22   0.67   0.00   0.00   0.22   0.67   0.00   0.00   0.00   0.22   0.67   0.00   0.00   0.00   0.00   0.22   0.67   0.00	0.00 0.11 0.11 0.12 0.22 0.22 0.22 1.00 0.00 0

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# Parameter estimation of HMM parameters A, B

(s <sub>0</sub> )	F	F	F	F	L	L	L	F	F	F	F	L	L	L	L	F	F	F	L	L	$(s_f)$
$(k_0)$	- 1	3	4	5	6	6	5	- 1	2	3	1	4	3	5	4	1	2	6	1	2	$(k_f)$

lacktriangle Transition matrix A consists of transition probabilities  $a_{ij}$ 

$$a_{ij} = P(X_{t+1} = s_j | X_t = s_i) \sim \frac{count_{trans}(X_t = F, X_{t+1} = L)}{count_{trans}(X_t = F)}$$

lacktriangle Emission matrix B consists of emission probabilities  $b_i(k_j)$ 

**Fmission** 

$$b_i(k_j) = P(O_t = k_j | X_t = s_i) \sim \frac{count_{emission}(O_t = k_j, X_t = s_i)}{count_{emission}(X_t = s_i)}$$

probabilities	ĸo	•	_	3	7	,	Ü	KI
F	0.00	0.36	0.18	0.18	0.09	0.09	0.09	0.00
L	0.00	0.11	0.11	0.11	0.22	0.22	0.22	0.00
s0	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sf	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Transition	proba	bilities	6	to F	to L	to	s0	to sf
From s0				1.00	0.00	0.00	) (	0.00
From F				0.73	0.27	0.00	) (	0.00
From L				0.22	0.67	0.00	) (	0.11
From sf				0.00	0.00	0.00	) (	0.00



## Parameter estimation of HMM parameters A, B

$(s_0)$	F	F	F	F	L	L	L	F	F	F	F	L	L	L	L	F	F	F	L	L	$(s_f)$
$(k_0)$	- 1	3	4	5	6	6	5	- 1	2	3	1	4	3	5	4	1	2	6	1	2	$(k_f)$

lacktriangle Transition matrix A consists of transition probabilities  $a_{ij}$ 

$$a_{ij} = P(X_{t+1} = s_j | X_t = s_i) \sim \frac{count_{trans}(X_t = F, X_{t+1} = L)}{count_{trans}(X_t = F)}$$

lacktriangle Emission matrix B consists of emission probabilities  $b_i(k_j)$ 

Emission

$$b_i(k_j) = P(O_t = k_j | X_t = s_i) \sim \frac{count_{emission}(O_t = 6, X_t = L)}{count_{emission}(X_t = L)}$$

probabilities		-	_	•	•	•	•	
F	0.00	0.36	0.18	0.18	0.09	0.09	0.09	0.00
L	0.00	0.11	0.11	0.11	0.22	0.22	0.22	0.00
s0	0.00	0.00	0.00	0.00	0.00	0.00		
sf	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Transition	proba	bilities	;	to F	to L	to	s0	to sf
From s0			:	1.00	0.00	0.00	) (	0.00
From F			(	0.73	0.27	0.00	) (	0.00
From L			(	0.22	0.67	0.00	) (	0.11
- ,				200	0.00	0.00		
From sf			,	0.00	0.00	0.00	) (	0.00

2 3

