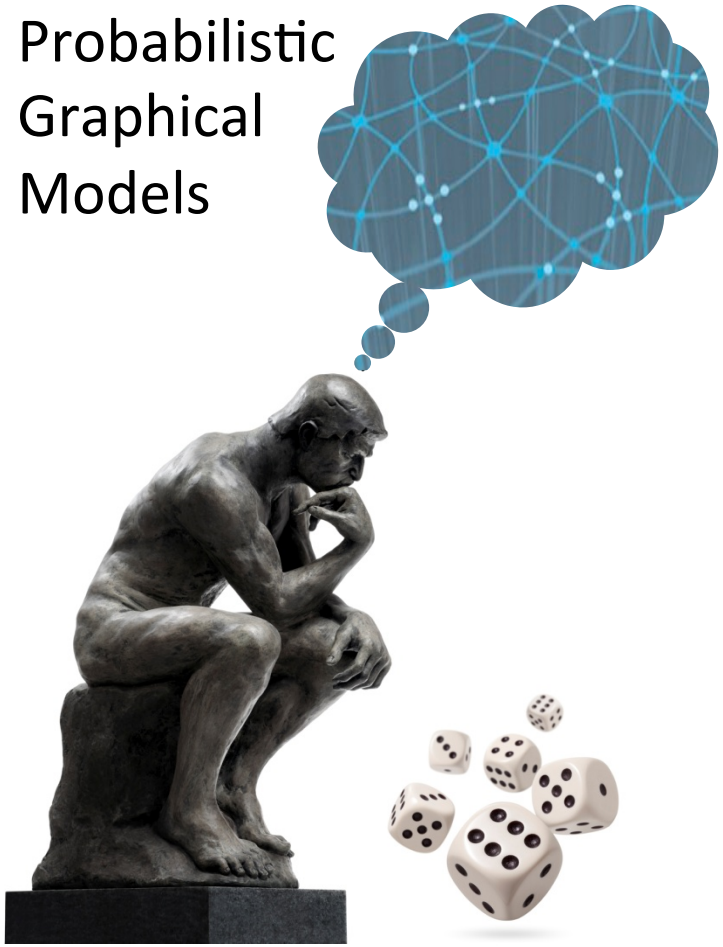
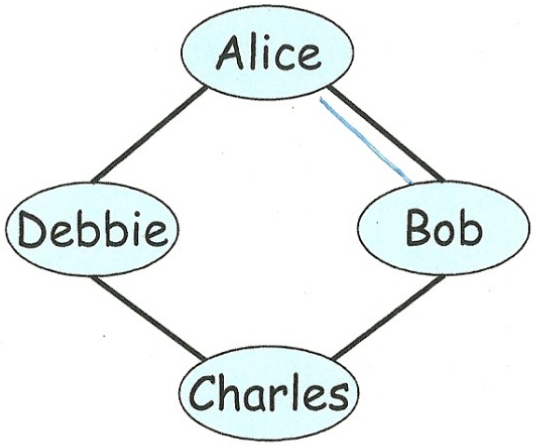
Probabilistic Graphical Models



Representation

Markov Networks

Pairwise Markov Networks



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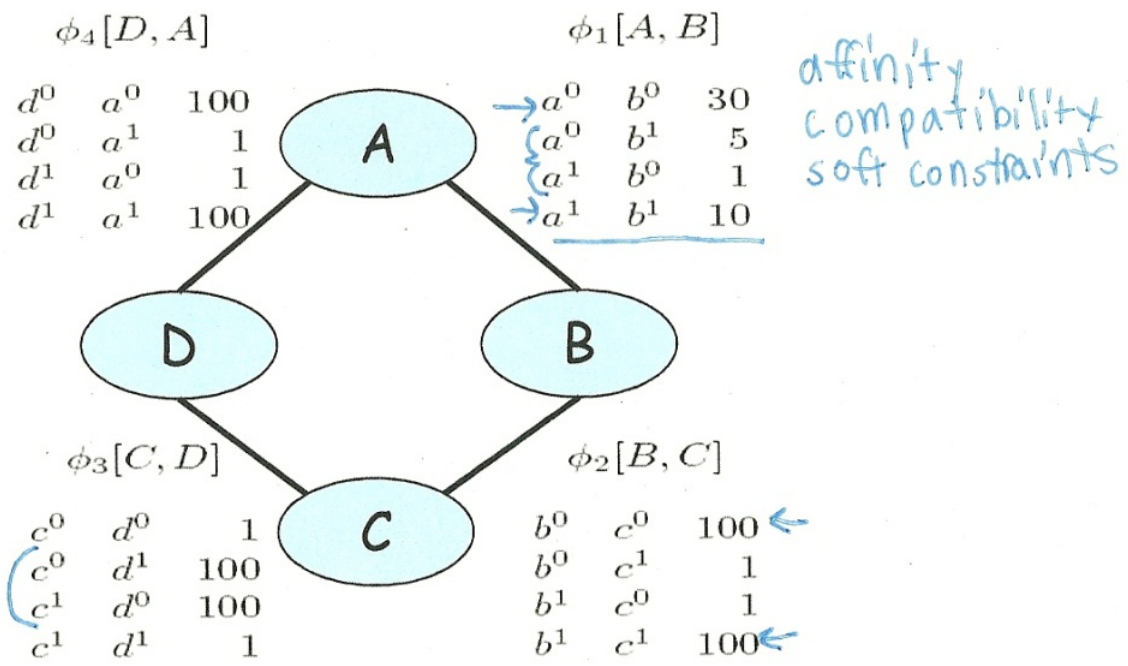

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$$\tilde{P}(A,B,C,D) = \phi_1(A,B) \times \phi_2(B,C) \times \phi_3(C,D) \times \phi_4(A,D)$$

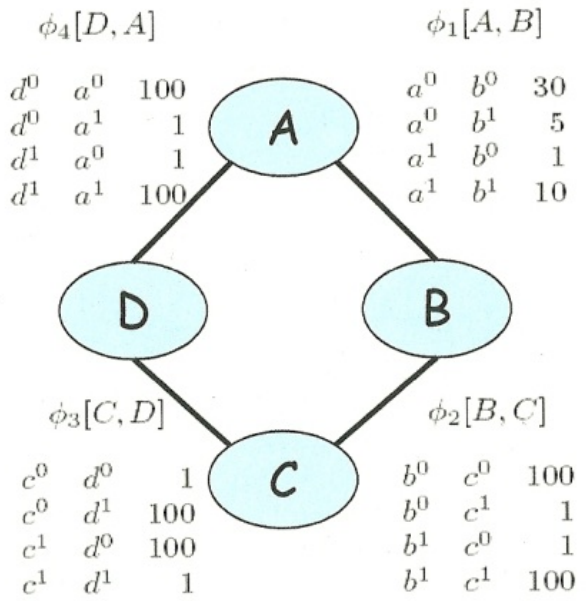
unnormalizedMeasure

$$P(A,B,C,D) = \frac{1}{Z}\tilde{P}(A,B,C,D)$$

partition function

Assignment				Unnormalized
a^0	b^0	c^0	d^0	300000
a^0	b^0	c^0	d^1	300000
a^0	b^0	c^1	d^0	300000
a^0	b^0	c^1	d^1	30
a^0	b^1	c^0	d^0	500
a^0	b^1	c^0	d^1	500
a^0	b^1	c^1	d^0	5000000
a^0	b^1	c^1	d^1	500
a^1	b^0	c^0	d^0	100
a^1	b^0	c^0	d^1	1000000
a^1	b^0	c^1	d^0	100
a^1	b^0	c^1	d^1	100
a^1	b^1	c^0	d^0	10
a^1	b^1	c^0	d^1	100000
a^1	b^1	c^1	d^0	100000
a^1	b^1	c^1	d^1	100000

Z



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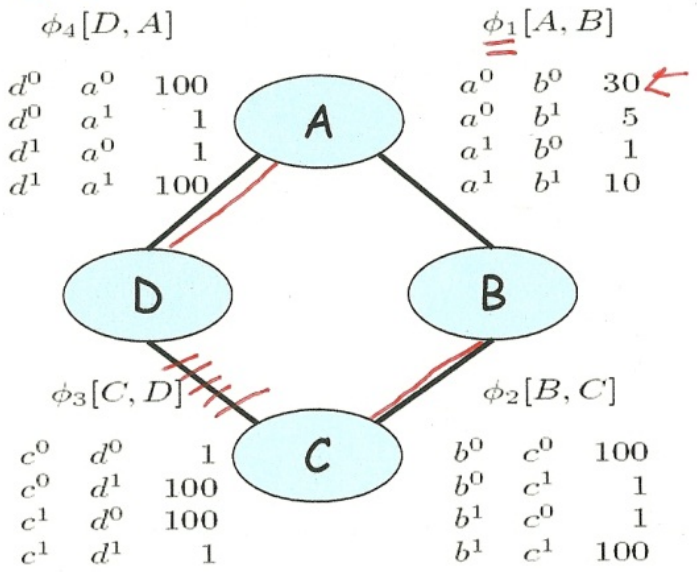
$\Phi = \{\phi_1, \phi_2, \phi_3, \phi_4\}$

$P(A, B)$

A	B	Prob.
a^0	b^0	0.13
a^0	b^1	0.69
a^1	b^0	0.14
a^1	b^1	0.04



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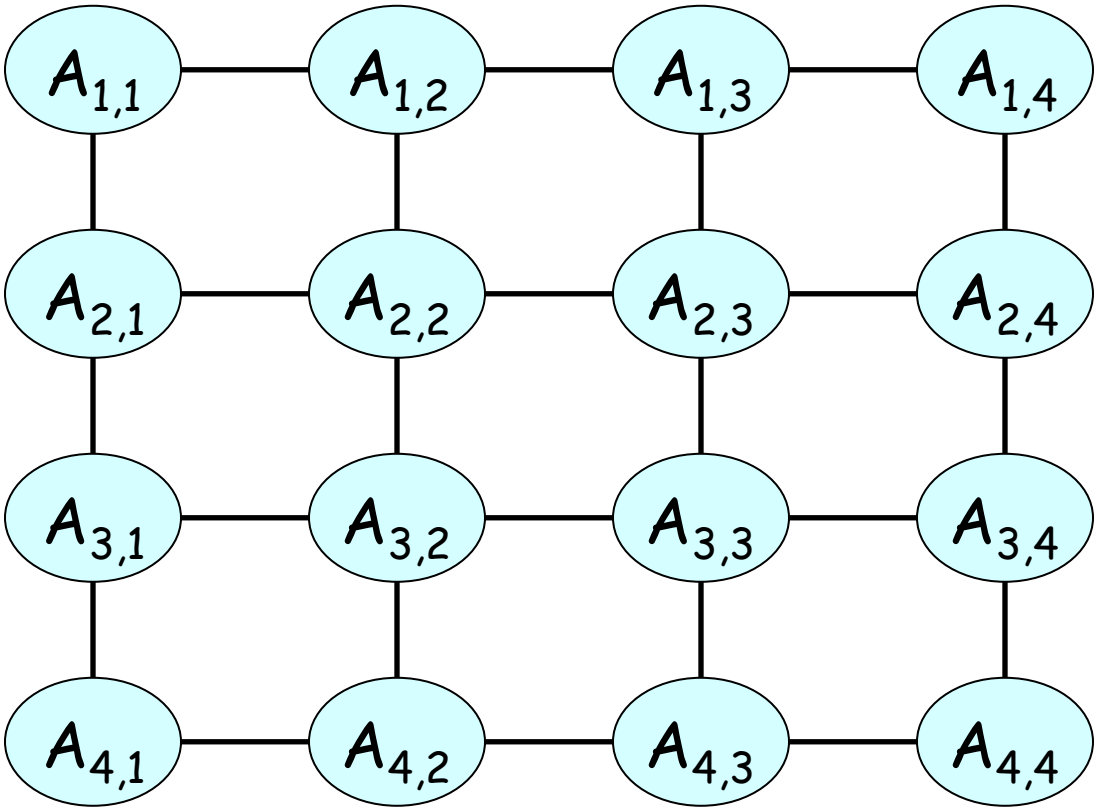
Pairwise Markov Networks

- A pairwise Markov network is an undirected graph whose nodes are $X_1,\ldots,X_n$ (random variables) and each edge $X_i - X_j$ is associated with a factor (potential) $\phi_{ij}(X_i, X_j)$



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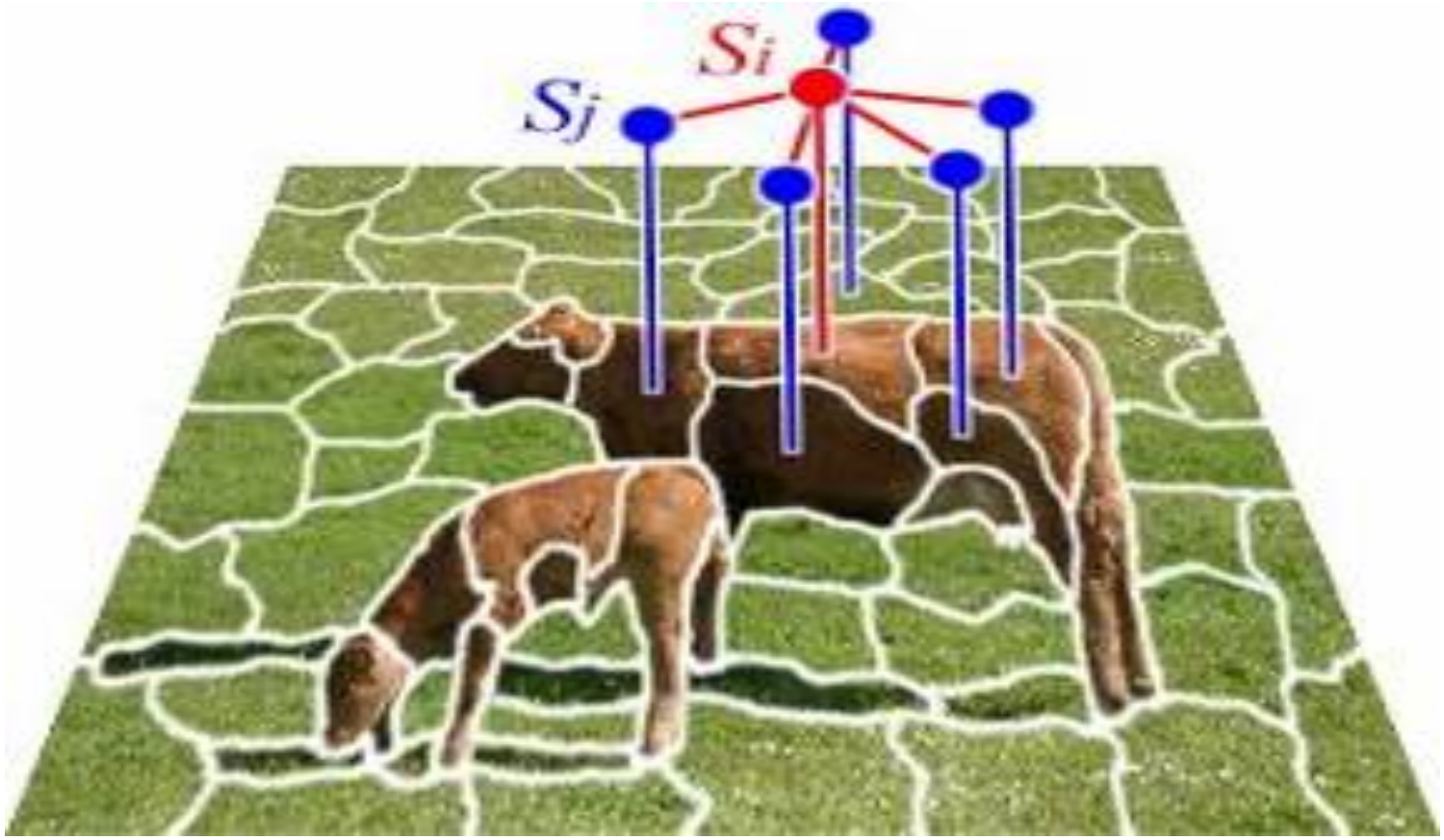

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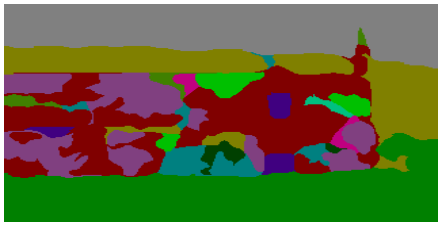
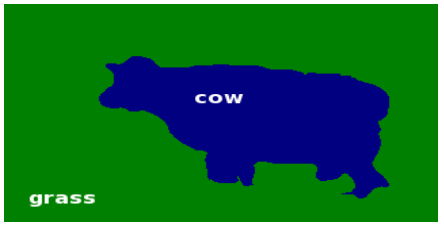

(a) (b) (c) (d)

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