

# Neural networks

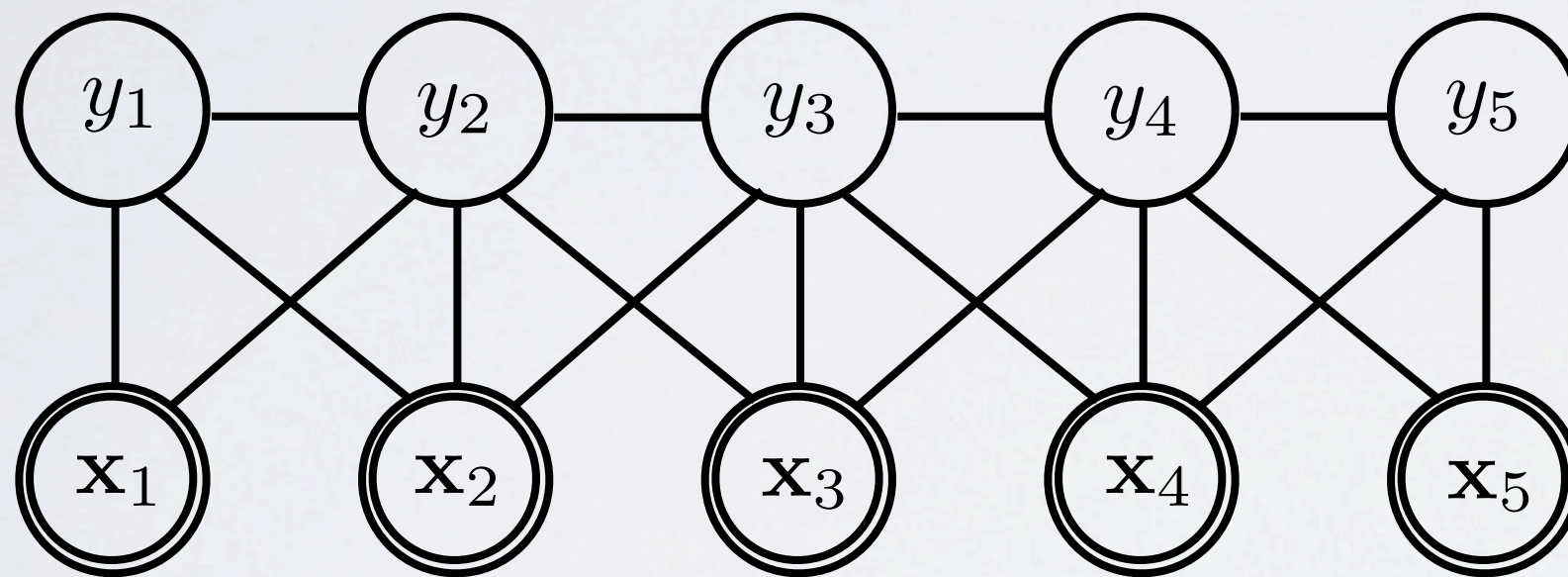
Conditional random fields - factor graph

# MARKOV NETWORK VISUALIZATION

**Topics:** Markov network

- Illustration for  $K=5$

 = observed



- Each edge is associated with one of more factors

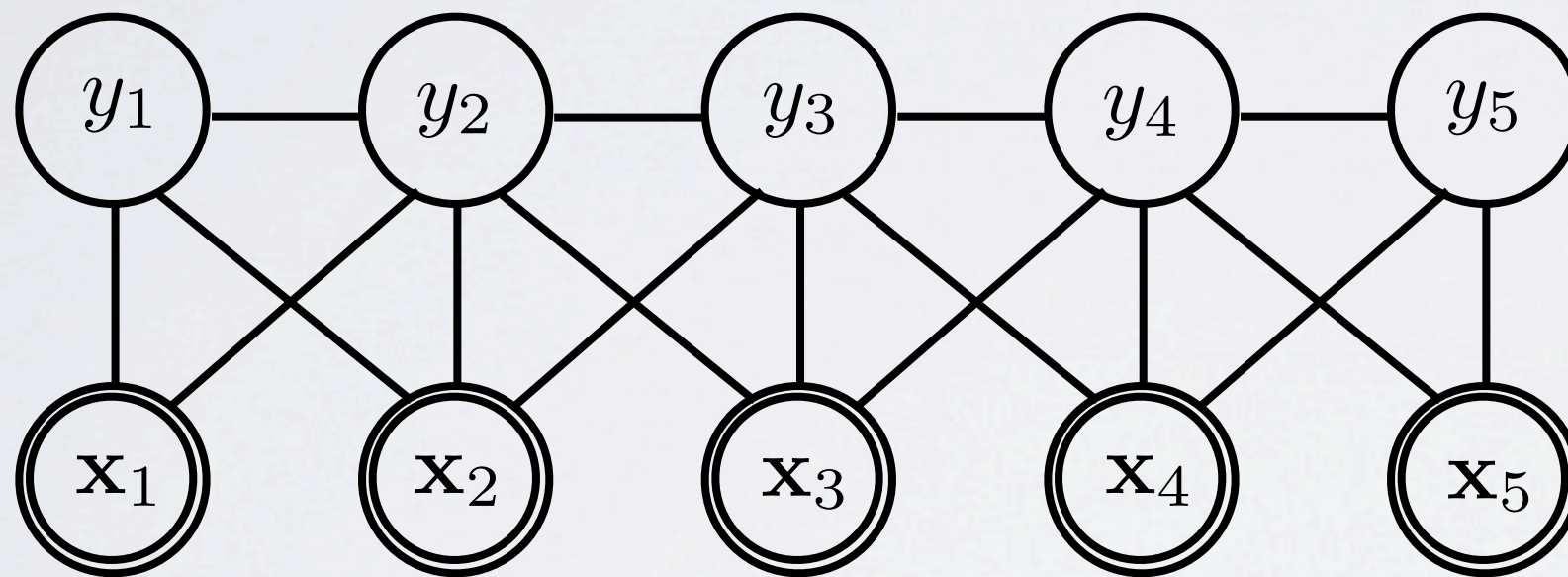


# MARKOV NETWORK VISUALIZATION

## Topics: Markov network

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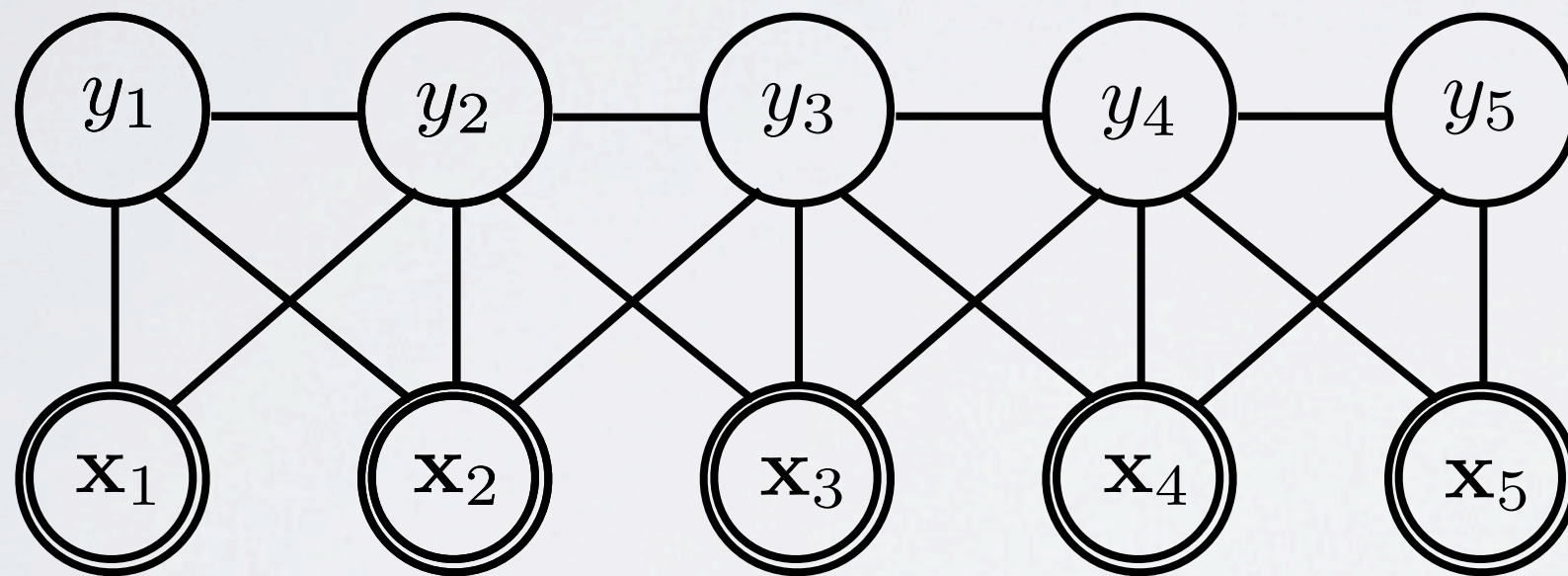
- Representation is ambiguous:
  - ▶ clique between  $y_1$ ,  $y_2$  and  $\mathbf{x}_2$ , but we didn't explicitly define a joint factor  $\phi_f(y_1, y_2, \mathbf{x}_2)$
  - ▶ in fact, we defined  $\phi_f(y_1, y_2)$ ,  $\phi_f(y_2, \mathbf{x}_2)$  and  $\phi_f(y_1, \mathbf{x}_2)$ , which is equivalent to having:
 
$$\phi_f(y_1, y_2, \mathbf{x}_2) = \phi_f(y_1, y_2)\phi_f(y_2, \mathbf{x}_2)\phi_f(y_1, \mathbf{x}_2)$$

# FACTOR GRAPH VISUALIZATION

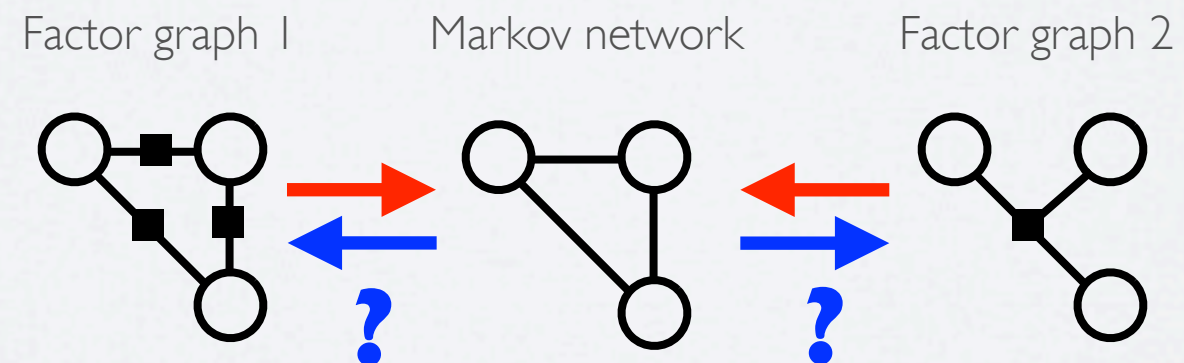
**Topics:** factor graph

- Factor graphs better represent factors

 = observed



- This is less ambiguous:





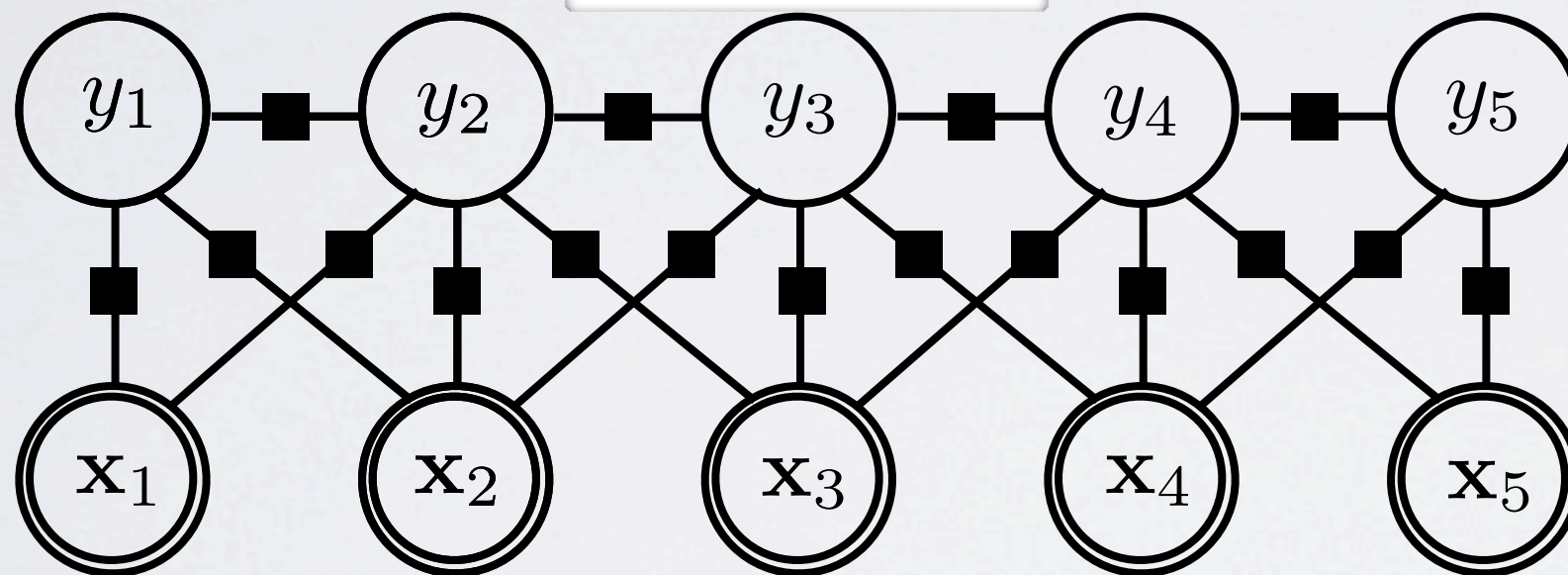
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**Topics:** factor graph

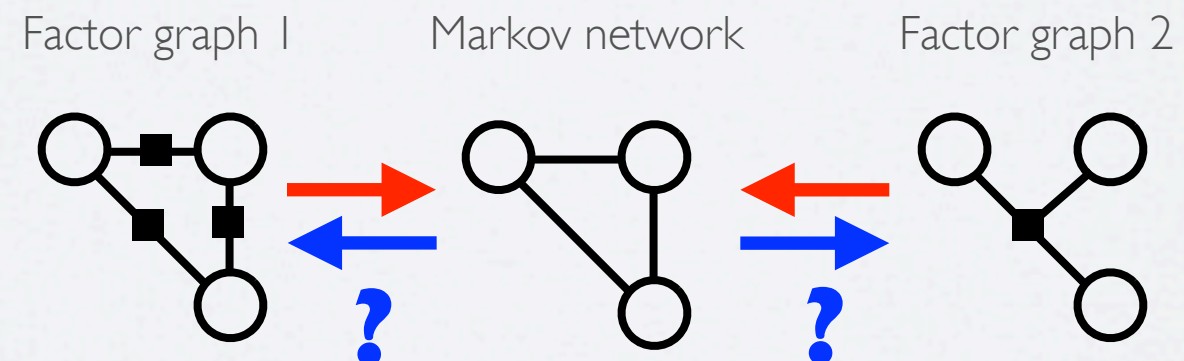
- Factor graphs better represent factors

○ = observed

■ = factor



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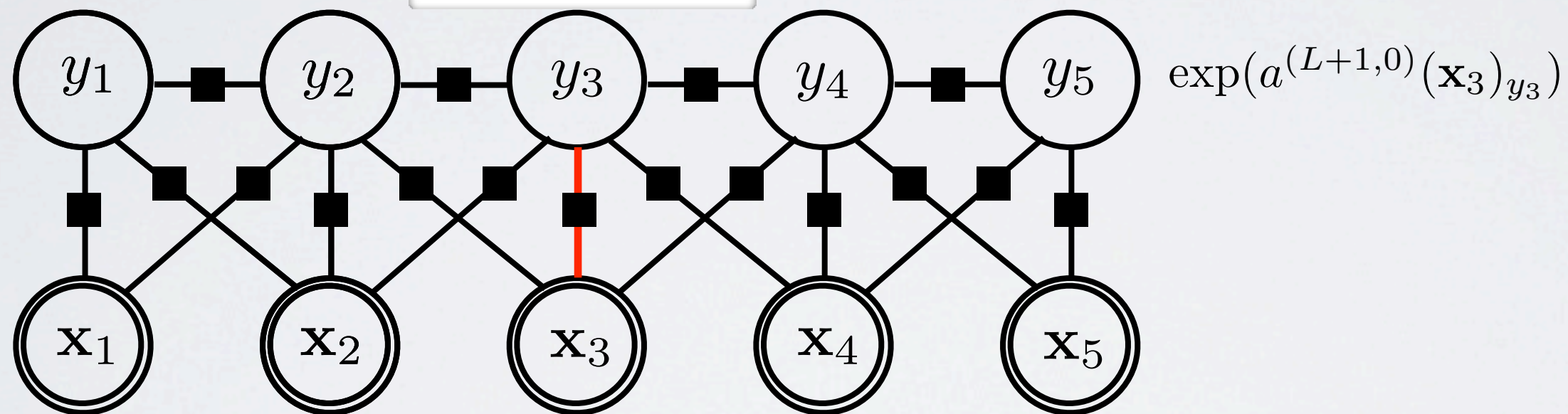
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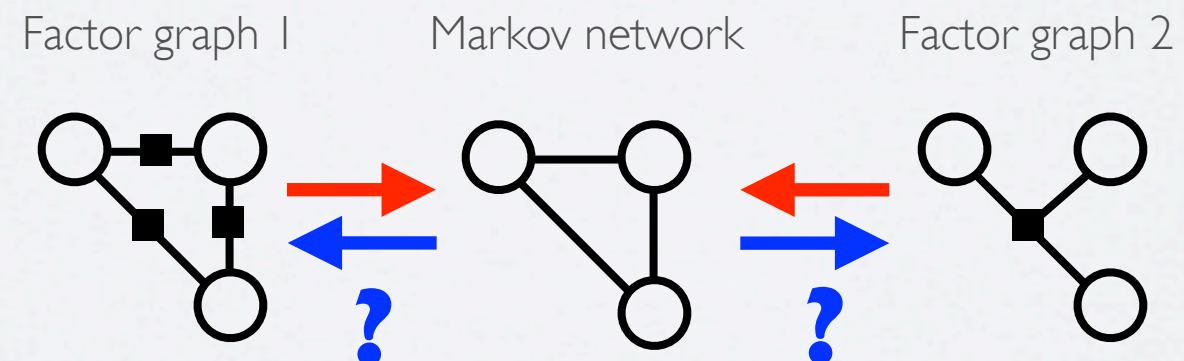
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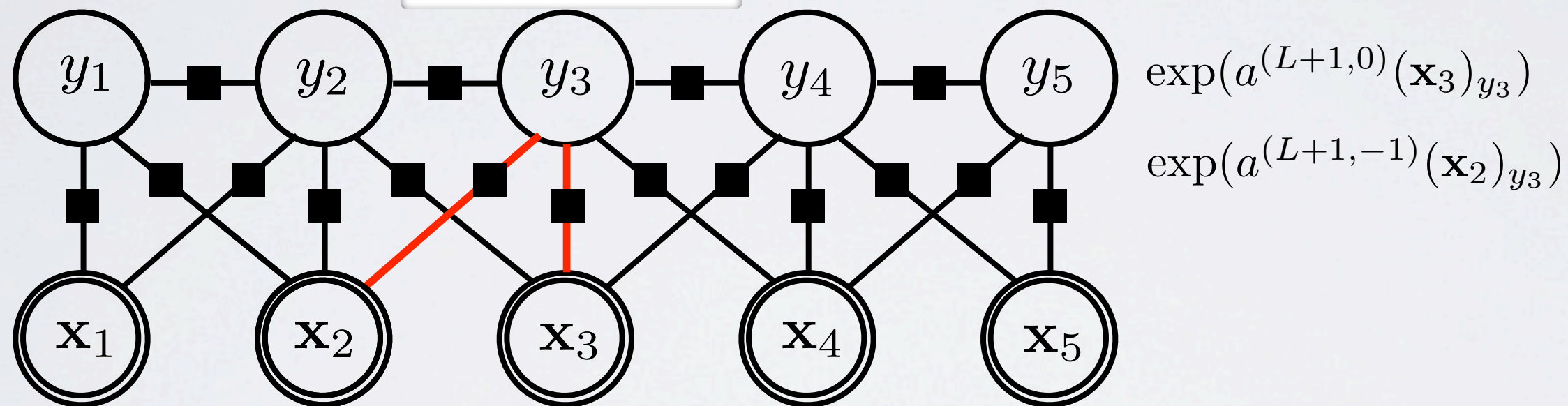
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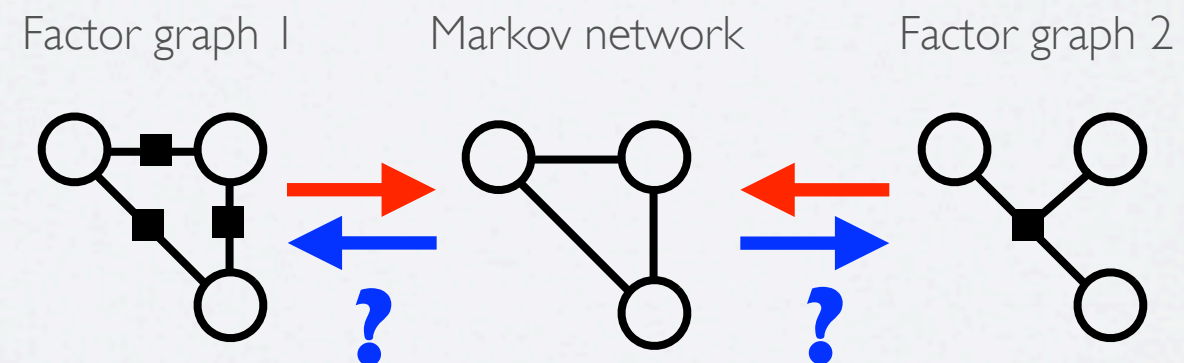
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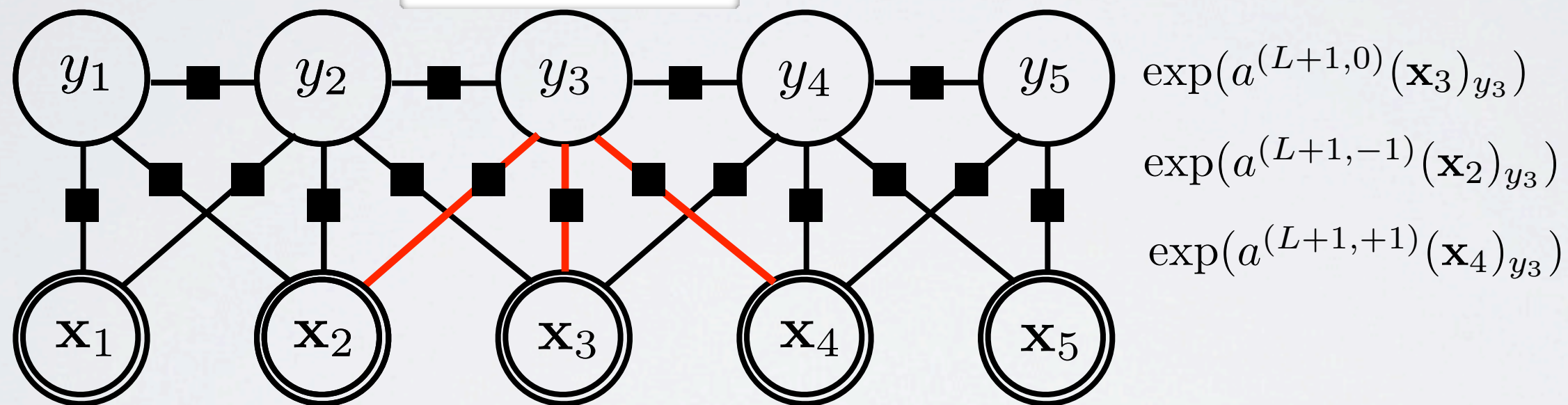
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## Topics: factor graph

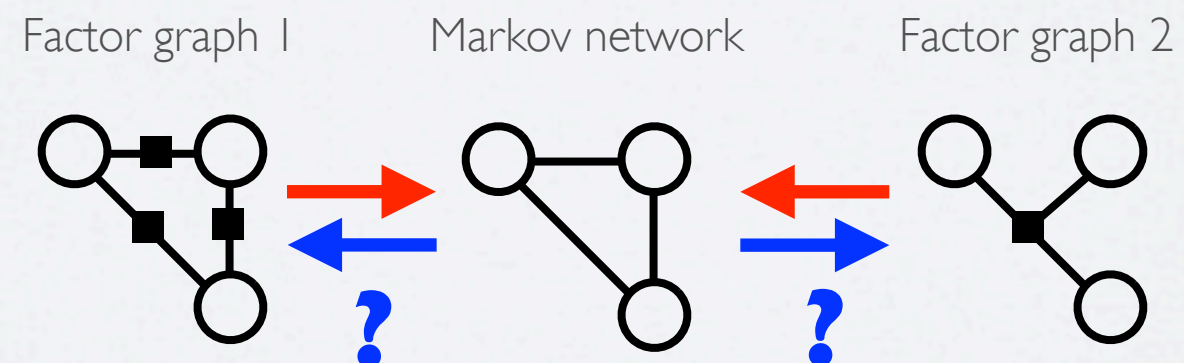
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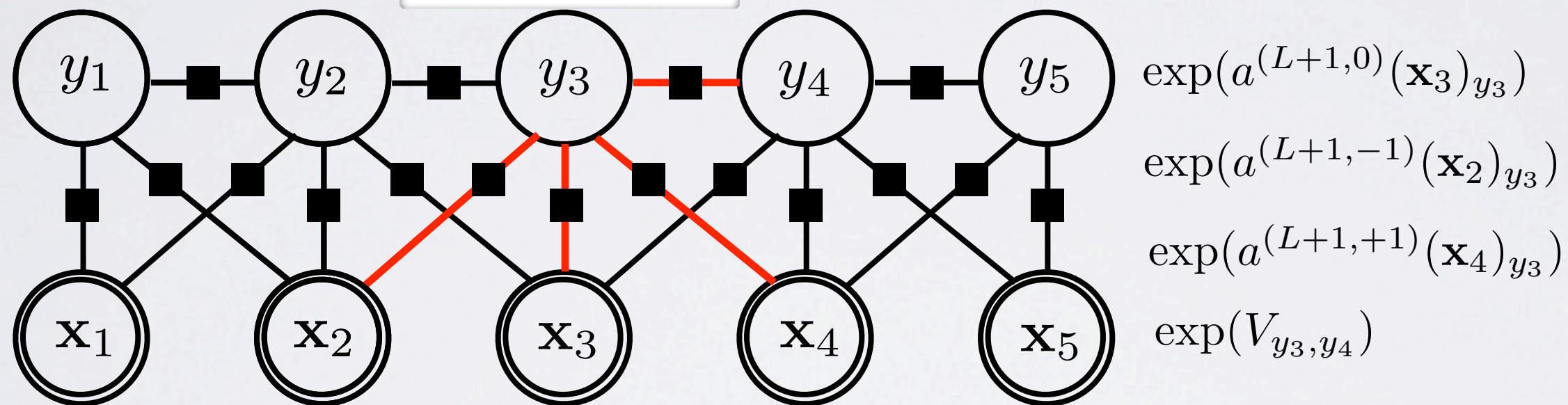
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