Workshop PRMs

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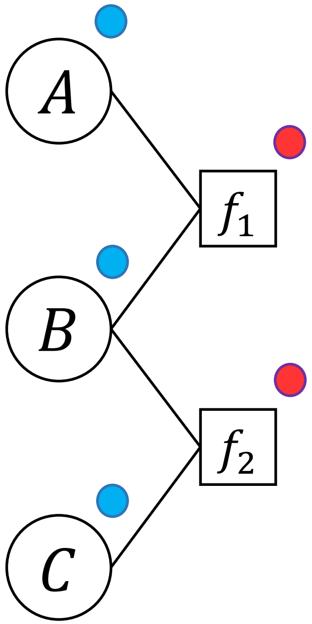
Übersicht

- Color Passing
  - Color Passing mit kommutativen Potentialen
  - Color Passing mit kleinen Abweichungen zwischen Potentialen
  - Color Passing mit fehlenden Potentialen
- Kausale Inferenz
  - Kausale Inferenz mit Lifting kombinieren
  - Qualitative kausale Inferenz

Color Passing



A	B	$f_1(A, B)$
True	True	φ_1
True	False	φ_2
False	True	φ_3
False	False	φ_4

C	B	$f_2(C, B)$
True	True	φ_1
True	False	φ_2
False	True	φ_3
False	False	φ_4

Ahmadi, B., Kersting, K., Mladenov, M., and Natarajan, S. (2013).
»Exploiting symmetries for scaling loopy belief propagation and relational training«. Machine learning, 92:91–132.

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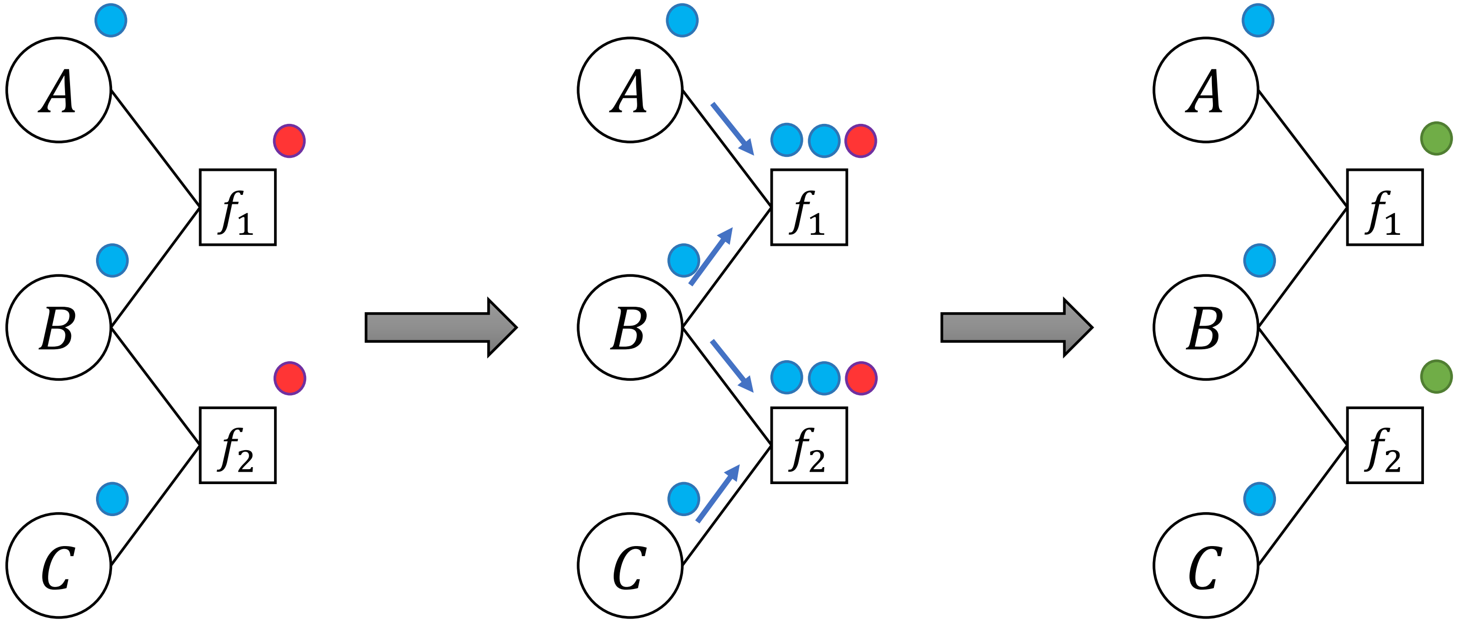

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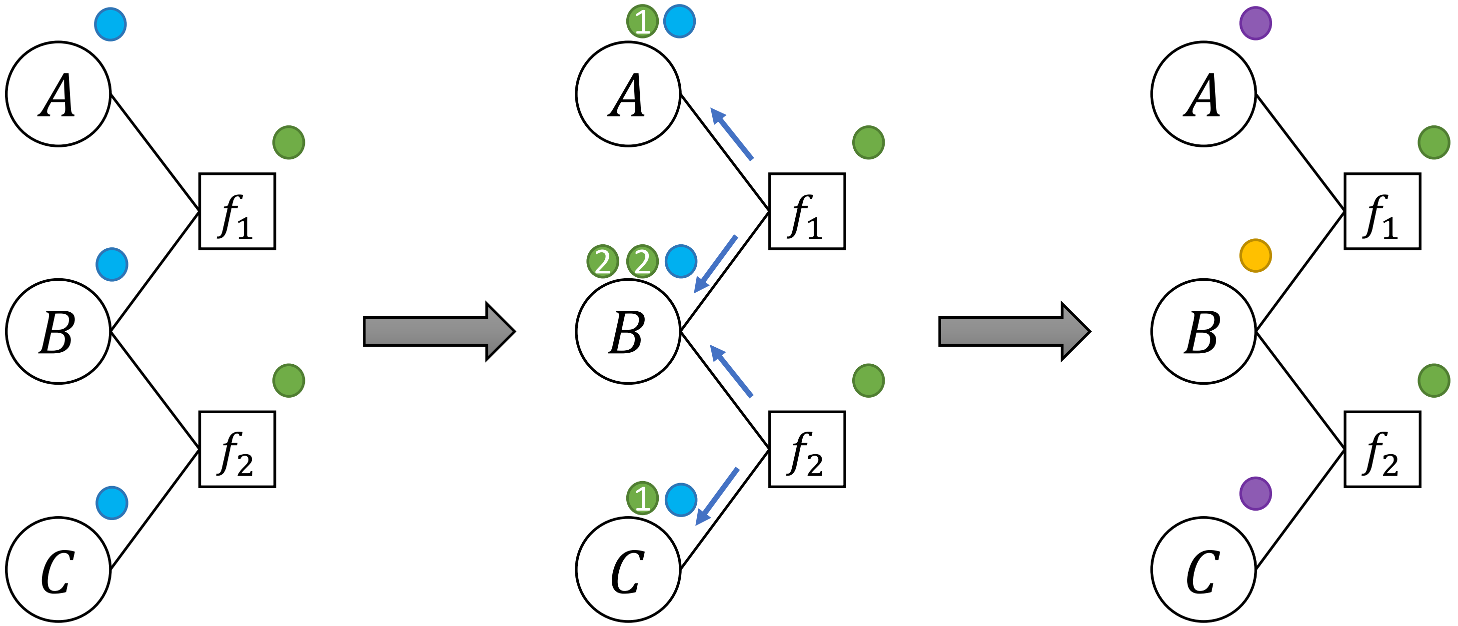

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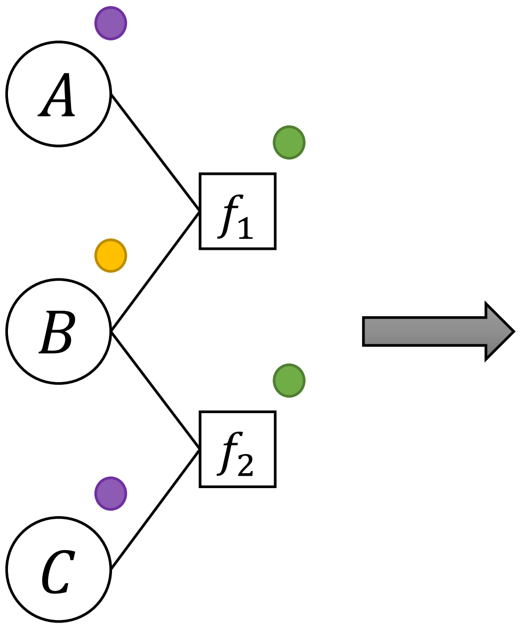

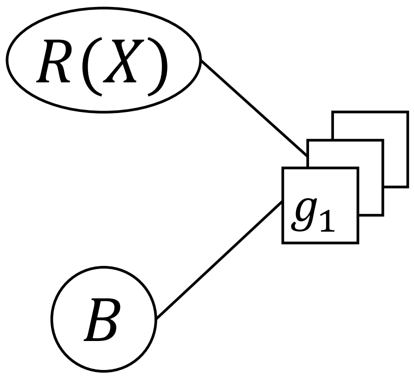

$\mathcal{D}(X) = \{A, C\}$

$R(X)$	B	$g_1(R(X), B)$
True	True	φ_1
True	False	φ_2
False	True	φ_3
False	False	φ_4

Ahmadi, B., Kersting, K., Mladenov, M., and Natarajan, S. (2013).
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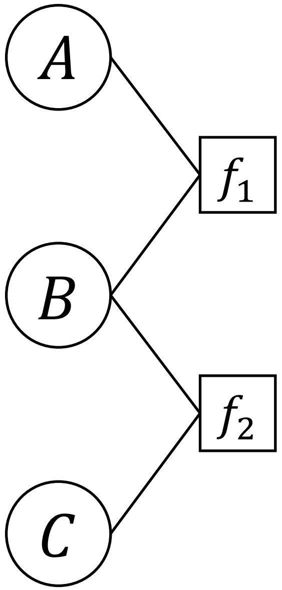
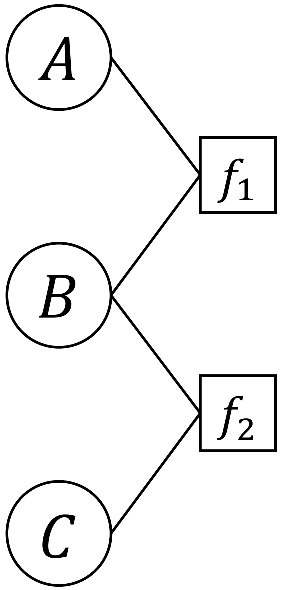
Kommutative Potentiale: Inter-Faktor



A	B	$f_1(A,B)$
True	True	φ_1
True	False	φ_2
False	True	φ_3
False	False	φ_4

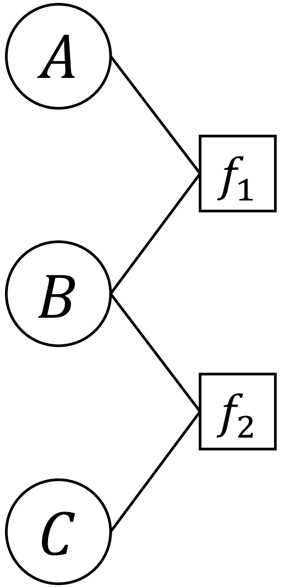
B	C	$f_2(B,C)$
True	True	φ_1
True	False	φ_3
False	True	φ_2
False	False	φ_4



A	B	$f_1(A,B)$
True	True	φ_1
True	False	φ_2
False	True	φ_3
False	False	φ_4

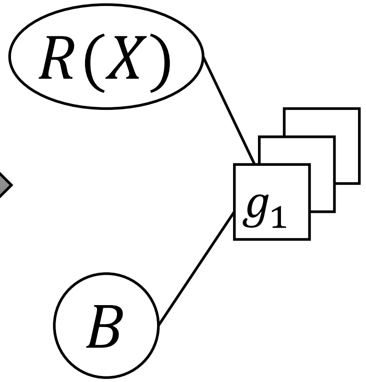
C	B	$f_2(C,B)$
True	True	φ_1
True	False	φ_2
False	True	φ_3
False	False	φ_4

Kommutative Potentiale: Inter-Faktor



A	B	$f_1(A,B)$
True	True	φ_1
True	False	φ_2
False	True	φ_3
False	False	φ_4

B	C	$f_2(B,C)$
True	True	φ_1
True	False	φ_3
False	True	φ_2
False	False	φ_4

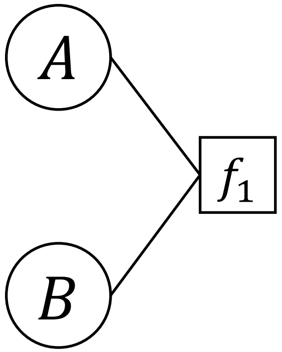


$R(X)$	B	$g_1(R(X),B)$
True	True	φ_1
True	False	φ_2
False	True	φ_3
False	False	φ_4

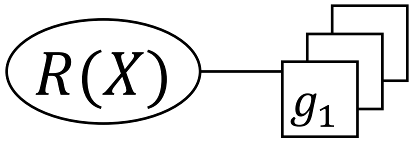
$\mathcal{D}(X) = \{A, C\}$

Wie Kommutativität prüfen?

Kommutative Potentiale: Intra-Faktor



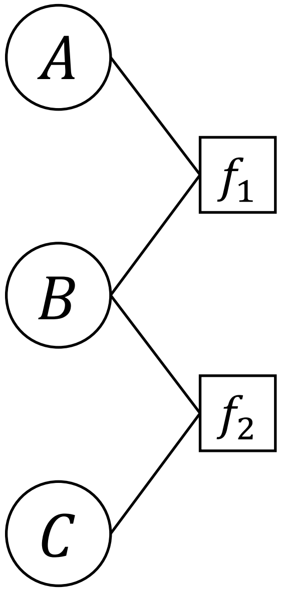
A	B	$f_1(A,B)$
True	True	φ_1
True	False	φ_2
False	True	φ_2
False	False	φ_3



$\mathcal{D}(X) = \{A, B\}$

$R(X)$	$g_1(R(X))$
[2,0]	φ_1
[1,1]	φ_2
[0,2]	φ_3

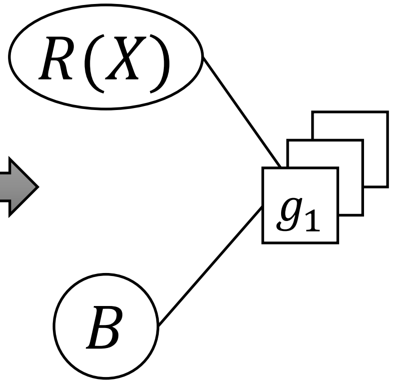
Kleine Abweichungen in Potentialen zulassen



$\forall i\colon |\varphi_i - \varphi'_i| \leq \varepsilon$

A	B	$f_1(A,B)$
True	True	φ_1
True	False	φ_2
False	True	φ_3
False	False	φ_4

C	B	$f_2(C,B)$
True	True	φ'_1
True	False	φ'_2
False	True	φ'_3
False	False	φ'_4

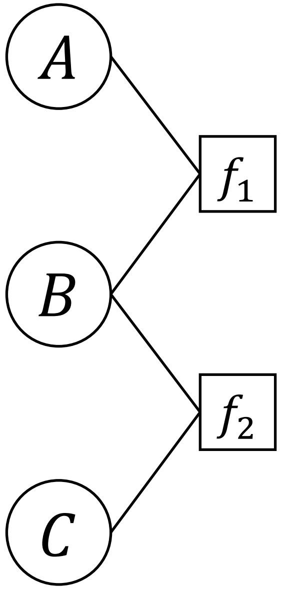


$R(X)$	B	$g_1(A,B)$
True	True	$(\varphi_1 + \varphi'_1)/2$
True	False	$(\varphi_2 + \varphi'_2)/2$
False	True	$(\varphi_3 + \varphi'_3)/2$
False	False	$(\varphi_4 + \varphi'_4)/2$

$\mathcal{D}(X) = \{A, C\}$

- Sinnvolle Potentiale für g_1?
- Kann man zeigen, dass die Ungenauigkeit bei Inferenz maximal um einen von ε abhängigen Term beschränkt ist?

Erweiterung auf fehlende Potentiale

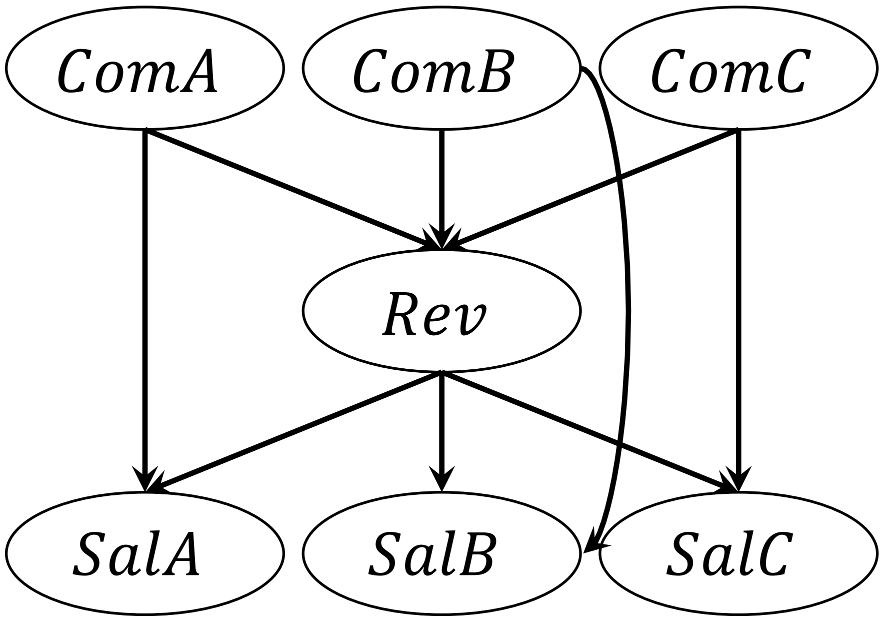


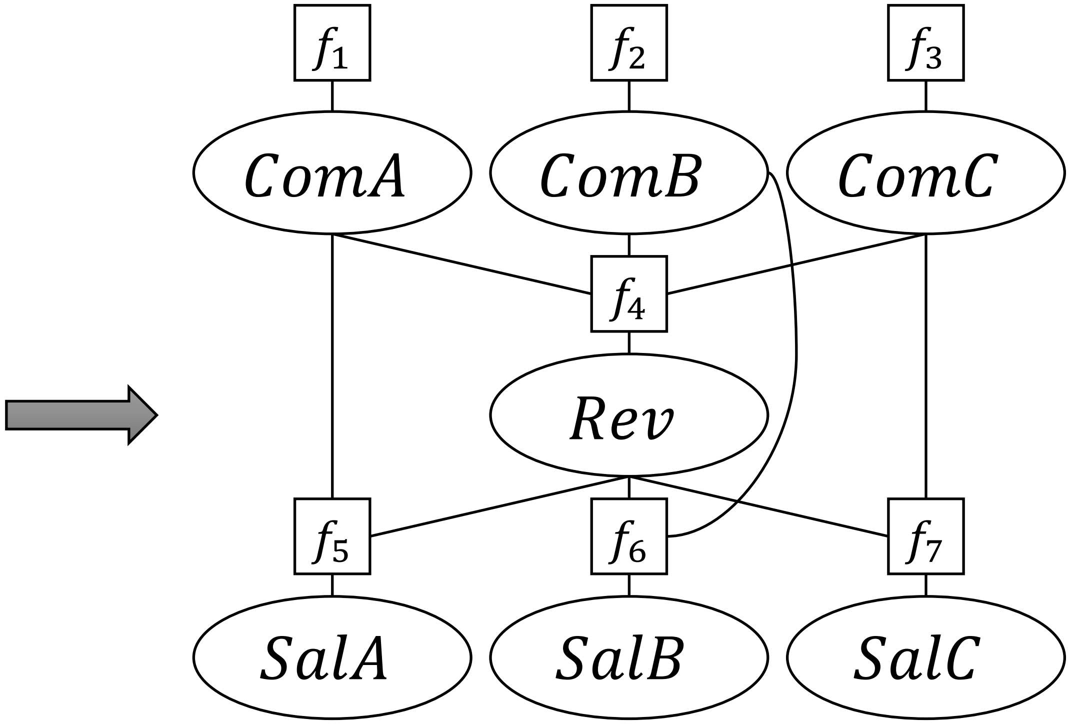
A	B	$f_1(A,B)$
True	True	φ_1
True	False	φ_2
False	True	φ_3
False	False	φ_4

C	B	$f_2(C,B)$
True	True	?
True	False	?
False	True	?
False	False	?

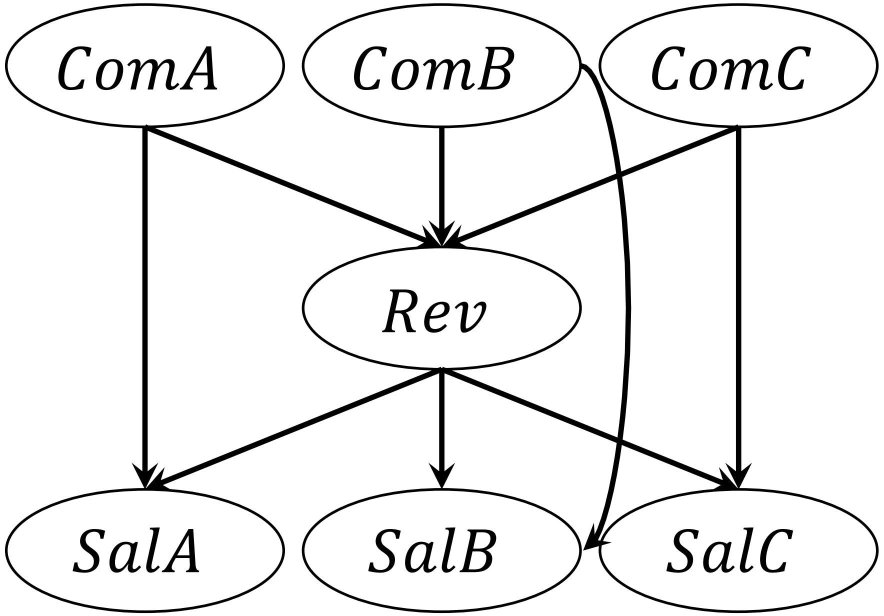
- Annahme: Symmetrien vorhanden
- Gruppierungen nur anhand der Graphstruktur finden
- Offenes Problem:
  - Keine Inferenz möglich, wenn nach Gruppieren Faktoren mit fehlenden Potentialen übrig bleiben

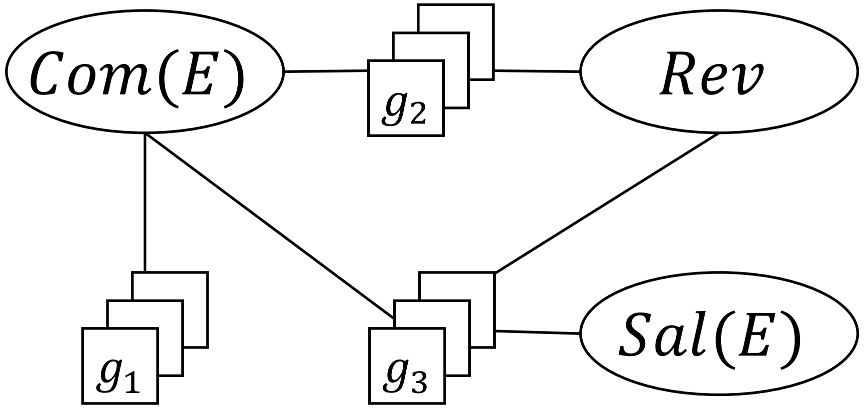
Kausale Inferenz und Lifting





Kausale Inferenz und Lifting





$\mathcal{D}(E) = \{A, B, C\}$

Average Causal Effect (ACE) von $ComA$ auf Rev:

$$P(\,Rev = true \mid do(ComA = true)\,) - P(\,Rev = true \mid do(ComA = false)\,) = ?$$

Qualitative kausale Inferenz

- Wahrscheinlichkeiten unbekannt
- Einflüsse an Kanten mit $+, -, ?$