

Uniqueness of Belief Propagation on Signed Graphs

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Main result: new condition for the uniqueness
of the fixed point of BP algorithm

■ What is BP

- BP is for approximate inference on graphical models.
- BP is a message passing algorithm on graphs.

■ Problem of BP

- BP may have multiple fixed points.

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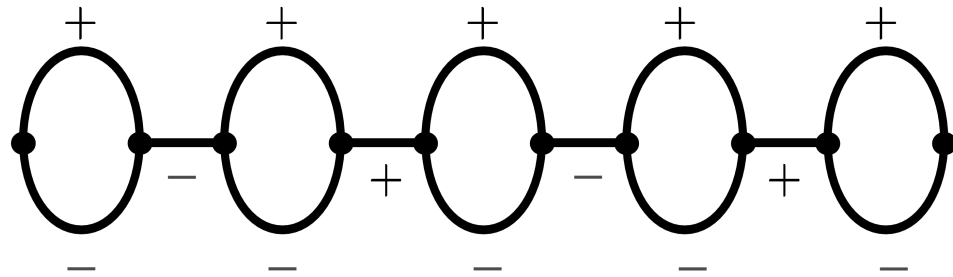
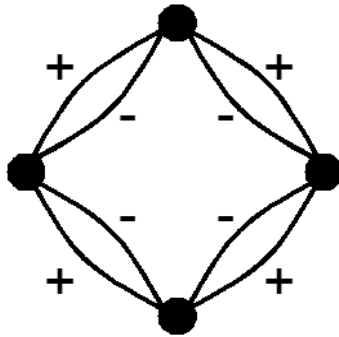
■ Problem of BP

- BP may have multiple fixed points.
 - Matters for uniqueness
 1. Graph topology: cycles
 2. Interaction of variables: strength, **sign**

In previous researches, information of sign is never used!

■ Main result

- We explicitly give the class of signed graphs where the uniqueness of BP is *always* guaranteed.
- Examples:



■ Technical novelty

- Extend graph zeta function techniques.

Y. Watanabe and K. Fukumizu, “Graph zeta function in the Bethe free energy and loopy belief propagation”, NIPS 2009.