



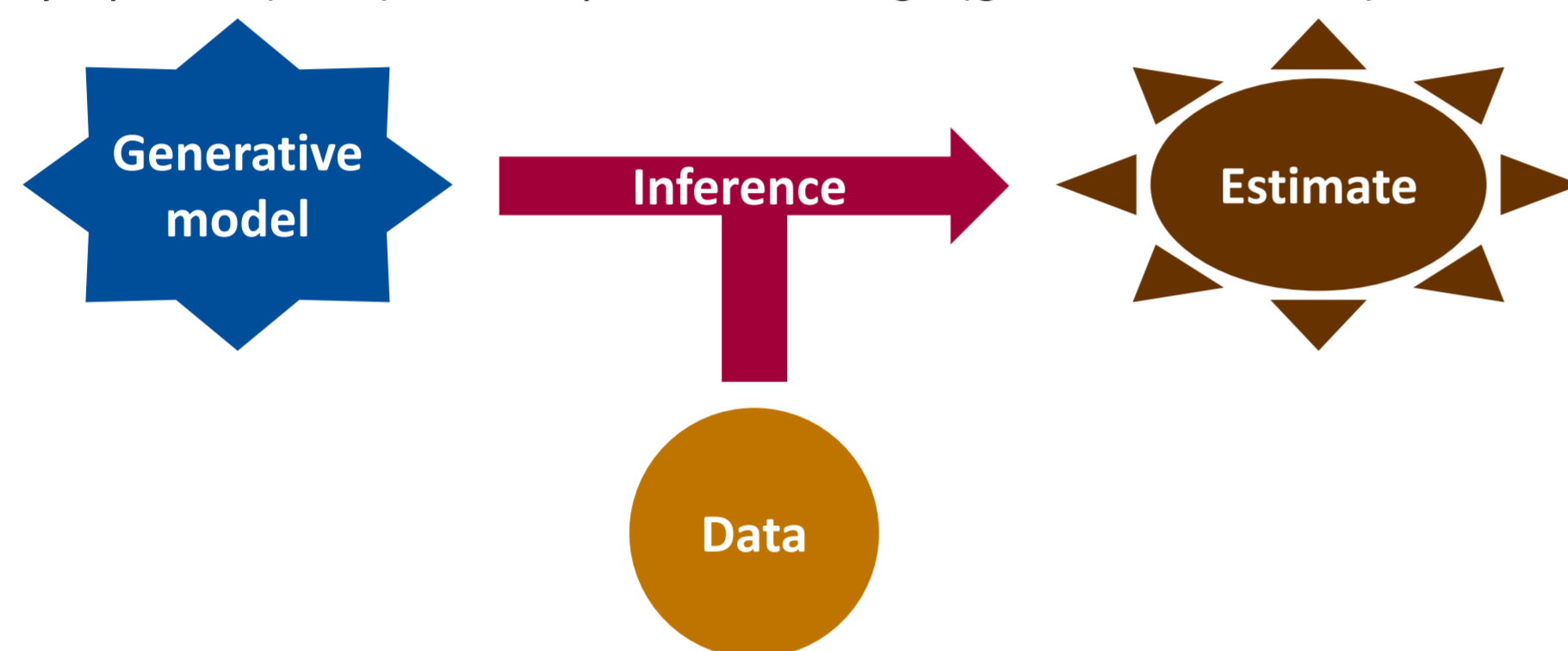
Approximate Inference by Kullback-Leibler Tensor Belief Propagation

Approximate Inference for Probabilistic Programming

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PROBABILISTIC PROGRAMMING

Goal: automatically solve estimation problems. *Example:* a doctor diagnoses (estimates) a patient's illness, based on observed symptoms (data) and his prior knowledge (generative model).



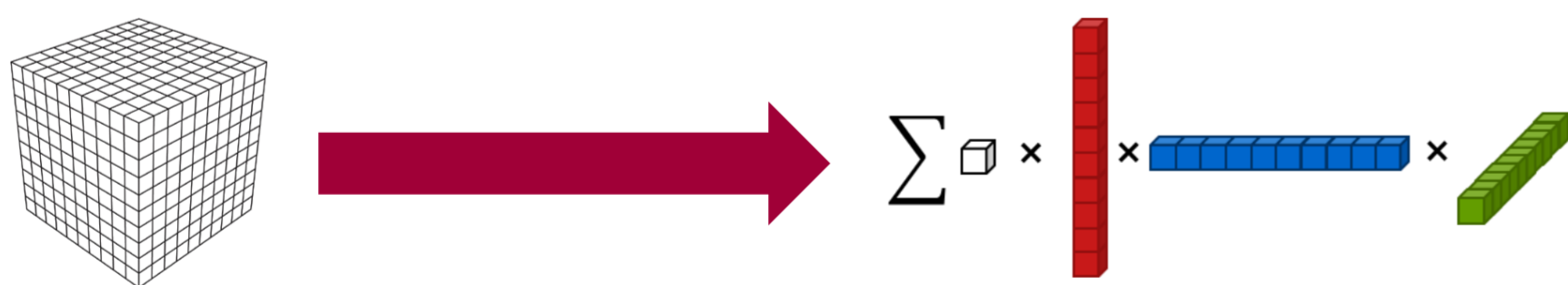
In probabilistic programming, all quantities are random variables. Estimates are inferred *automatically* using the axioms of probability.

MAIN CHALLENGE: EFFICIENCY

Efficient computation of estimates is problematic. In general, as the number of correlated variables increases (*treewidth*), required computational resources grow exponentially fast.

OUR CONTRIBUTION

We focus on reducing model size by storing intermediate results in lossy compressed form.



The *Kullback-Leibler divergence*, a metric from information theory, is used to achieve better accuracy *with less computational resources* than related approaches from the literature such as *Tensor Belief Propagation*.

BENCHMARK PROBLEMS

Performance is assessed using well-known benchmark problems.



Medical diagnosis



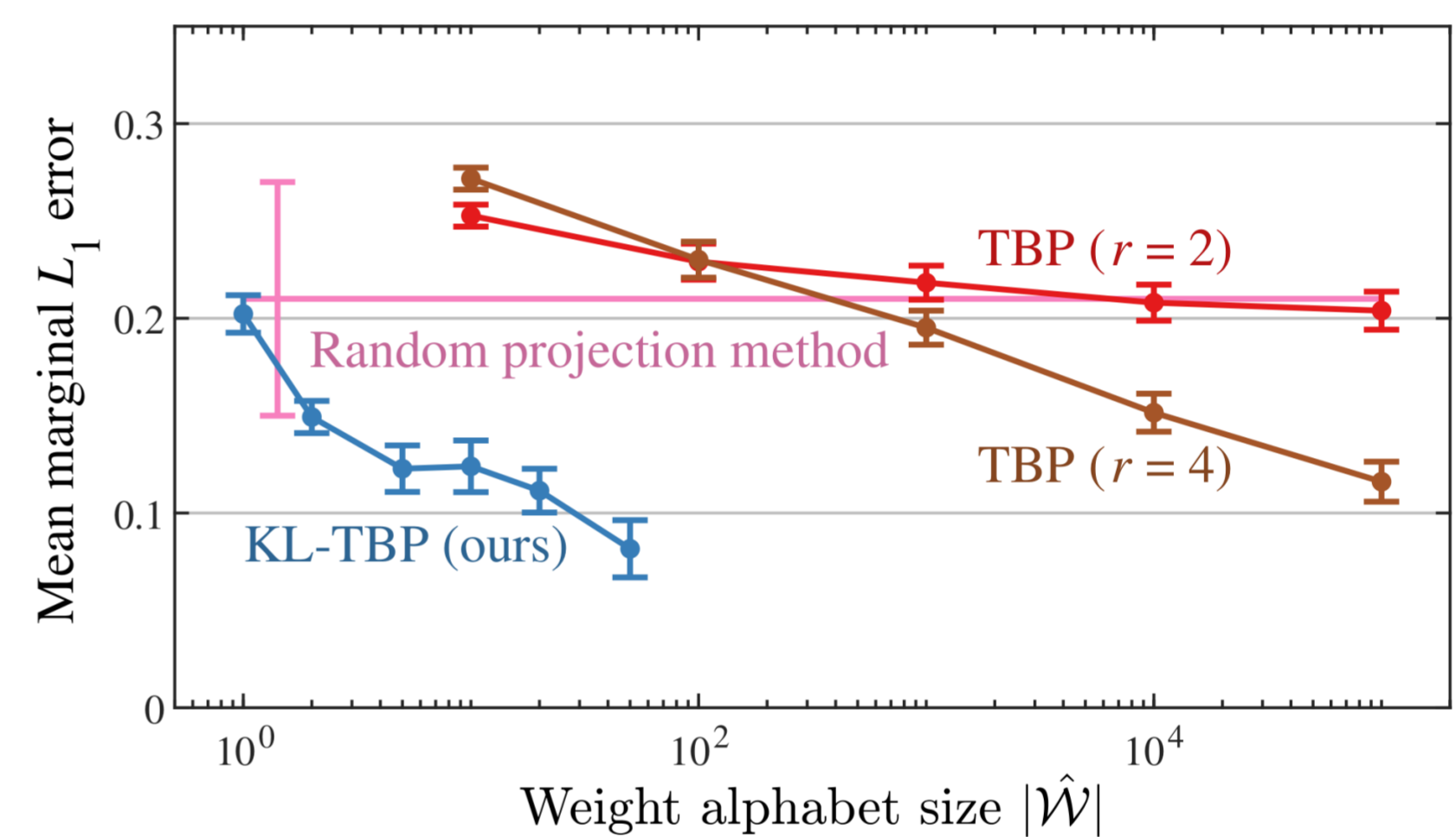
Genetic linkage



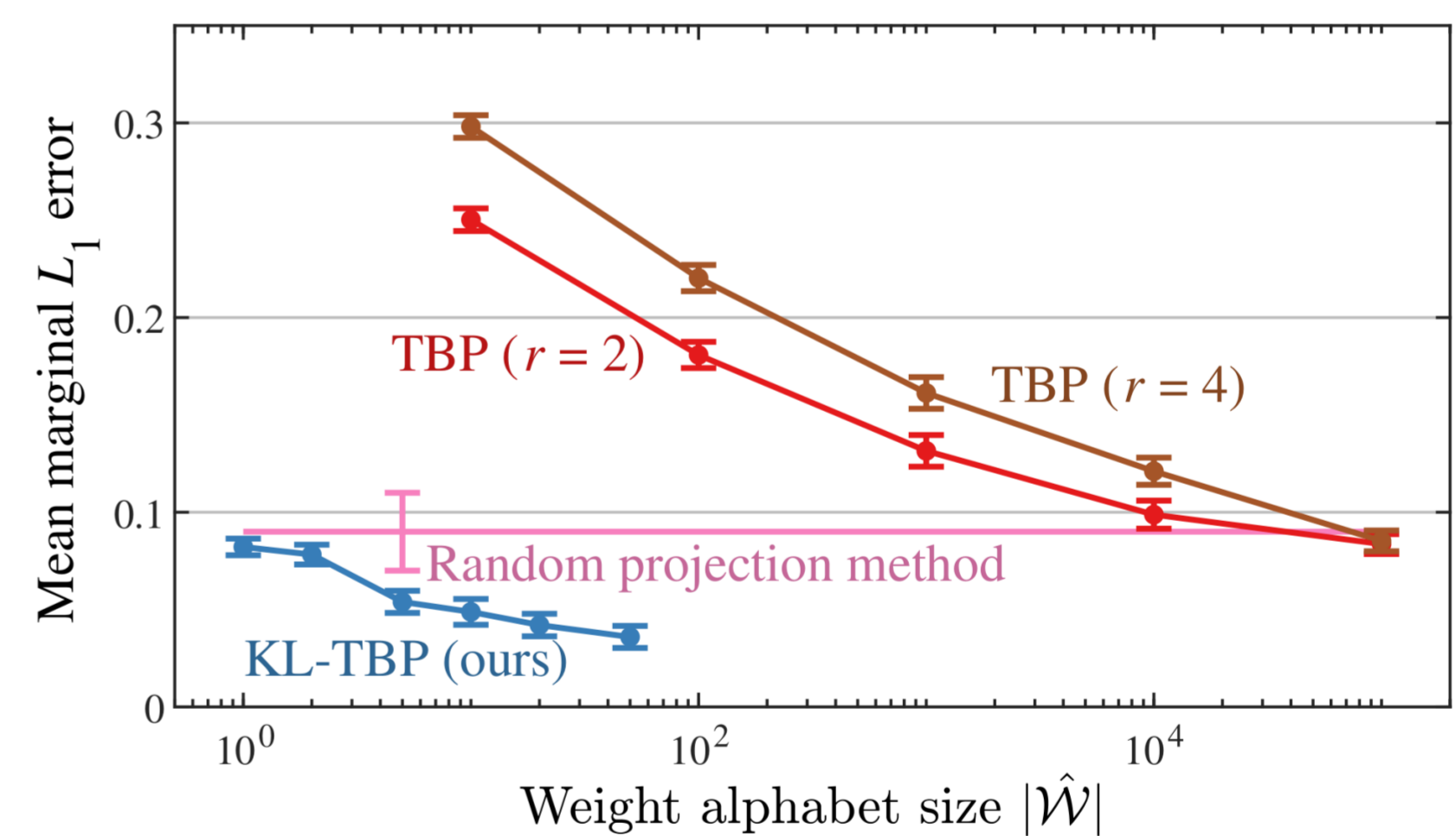
Ferromagnetism

BENCHMARK RESULTS

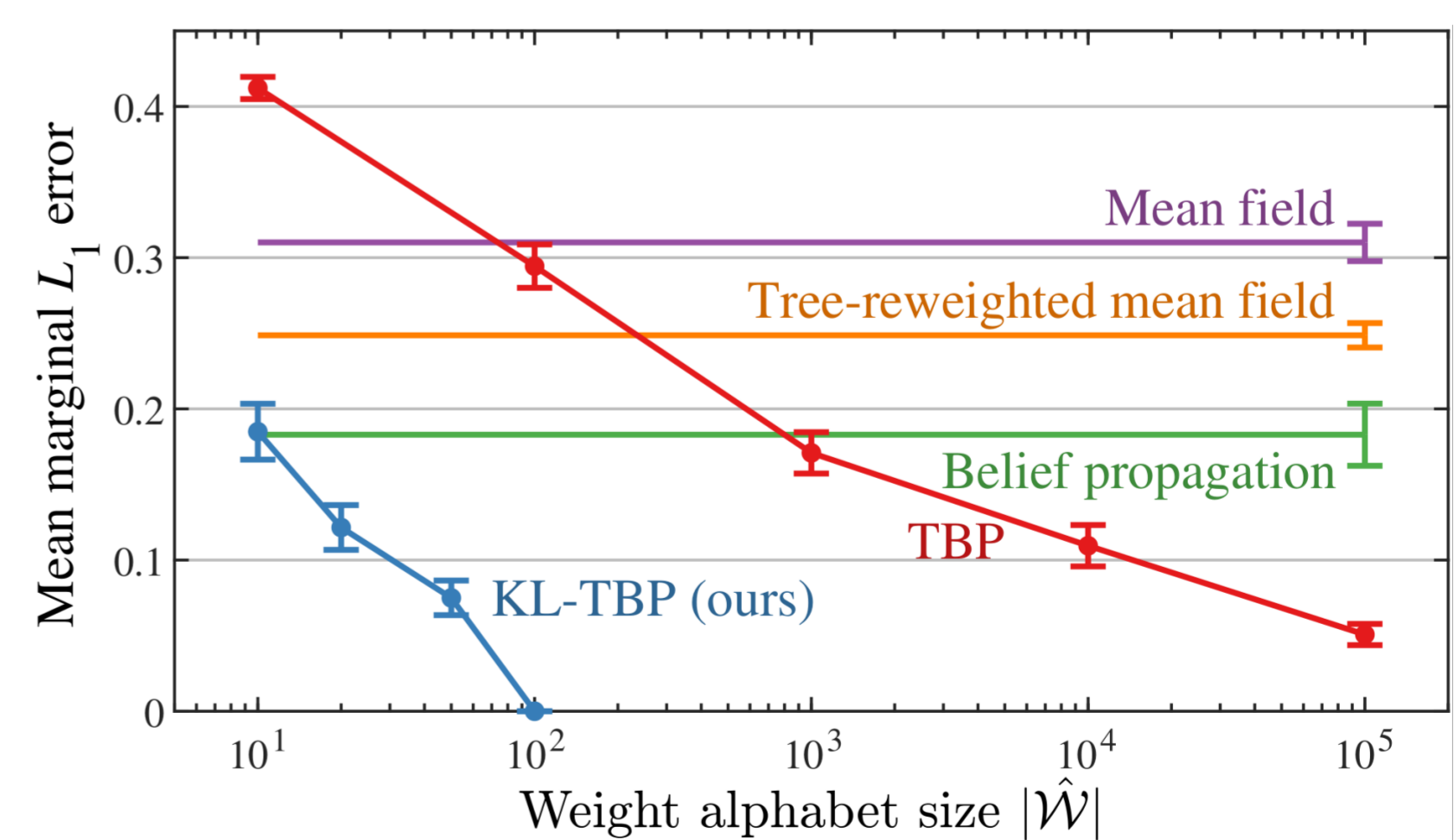
Accuracy is compared with several approximate inference methods from the literature. Our method achieves better accuracy (vertical axis; smaller is better) with less memory usage (horizontal axis; smaller is better) and competitive runtime (not shown here).



Automatic medical diagnosis (UAI2014 Promedus)



Computation of genetic linkage (UAI2014 Linkage)



Modelling of ferromagnetic materials (10x10 Attractive Ising Grid)