

Lattice theoretic aspects of inference and parameter estimation

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Abstract

We present a lattice representation of known model parameters where edges on the lattice represent conditional probabilities. We show how information in the form of marginals and conditionals can be combined combinatorially, and the set of knowns is shown to be the union of sub-lattice order ideals of this lattice. Model construction using conditional independence assumptions and the grammar of inference is defined on the lattice. Using well-orderings of random variables in Directed Acyclic graphical models, information propagation is explicitly depicted on the lattice, motivating combinatorial approximate inference algorithms based on local maximum entropy assignment. Finally, the EM algorithm shown as iterative path projections on the lattice, motivating combinatorial EM variations.

Key Words: Lattice theory, maximum entropy, iterative projections