Emprircal Performace Models

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History

- Early work by Cheeseman *et al.* (1991) $\rightarrow$Varied paramters and looked at results
- Fink (1998) $\rightarrow$Used regression to predict which of three algorithms would work best
- Leyton-Brown *et al.* (2003) $\rightarrow$Predicted runtimes for several solvers.
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EPH Motivation

- We already have complexity theory to analyze algorithm performance.
- Why this too?

Consider

- TSP is $O(n!)$ (if solved via brute force)
- However I can solve instances with 5000 points on my grad student laptop?
- Imagine an algorithm with $O(n^{\log(\log(n))})$ performance?
- ... still polynomial

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Motivation Pt 2

- Knowing how a particular instance of a problem will work gives us some options
- Potentially select the "best" predicted solver for a given instance (more on this)
- Provide some insights into how solvers handle instances (*eg* 4.3 clauses-to-literal ratio)

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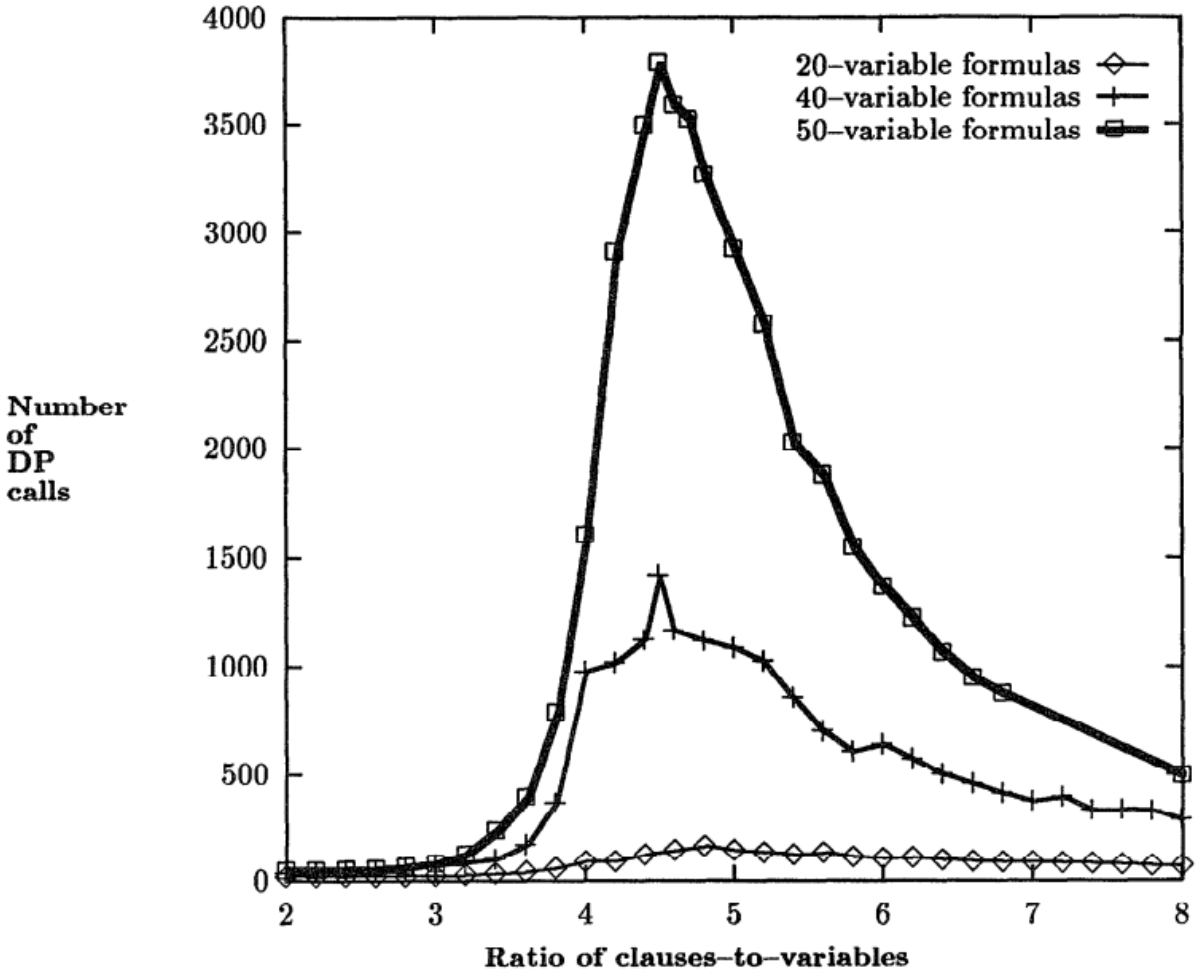
Clause-to-Literal Ratio



Graph taken from Mitchell, Selman, Levesque 1992

Marker time

To the board

Types of Models

- Ridge Regression
- Neural Networks
- Gaussian Process Regression
- Regression Trees
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- Number of constraints and variables
- Variable types
- $\leq, \geq$, or $=$ for the RHS
- Mean of objective function coefficients

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Example Time

- now to the example

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