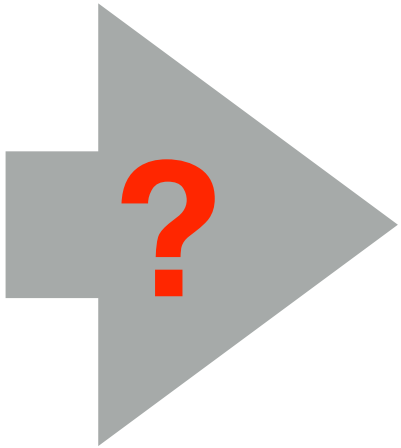
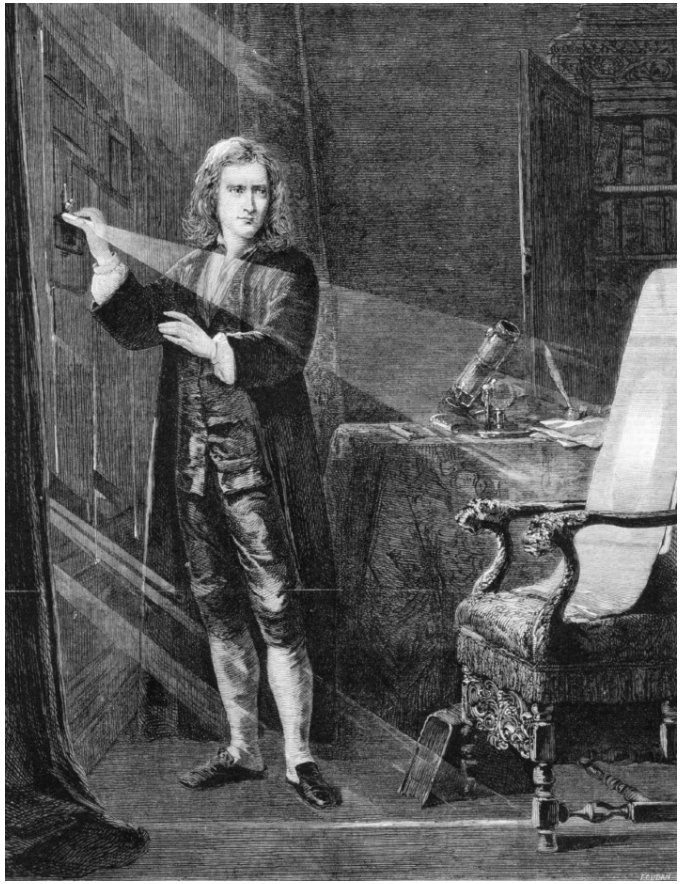
We know (nearly) nothing!

But can we learn?



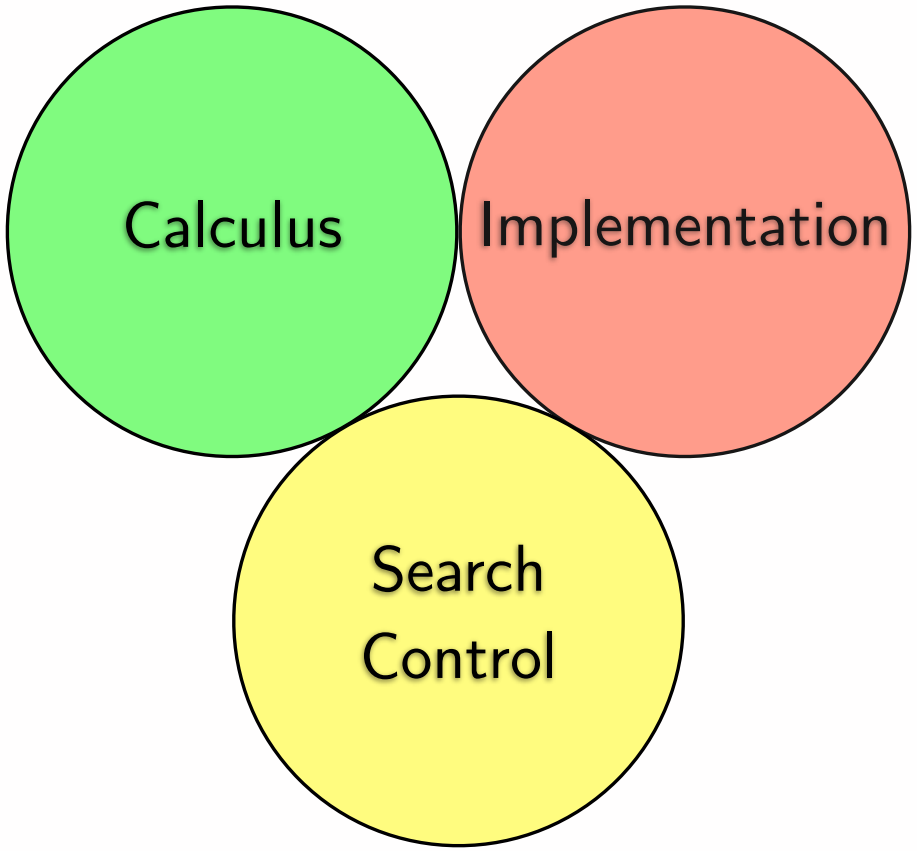


DHBW

Stephan Schulz

schulz@eprover.org

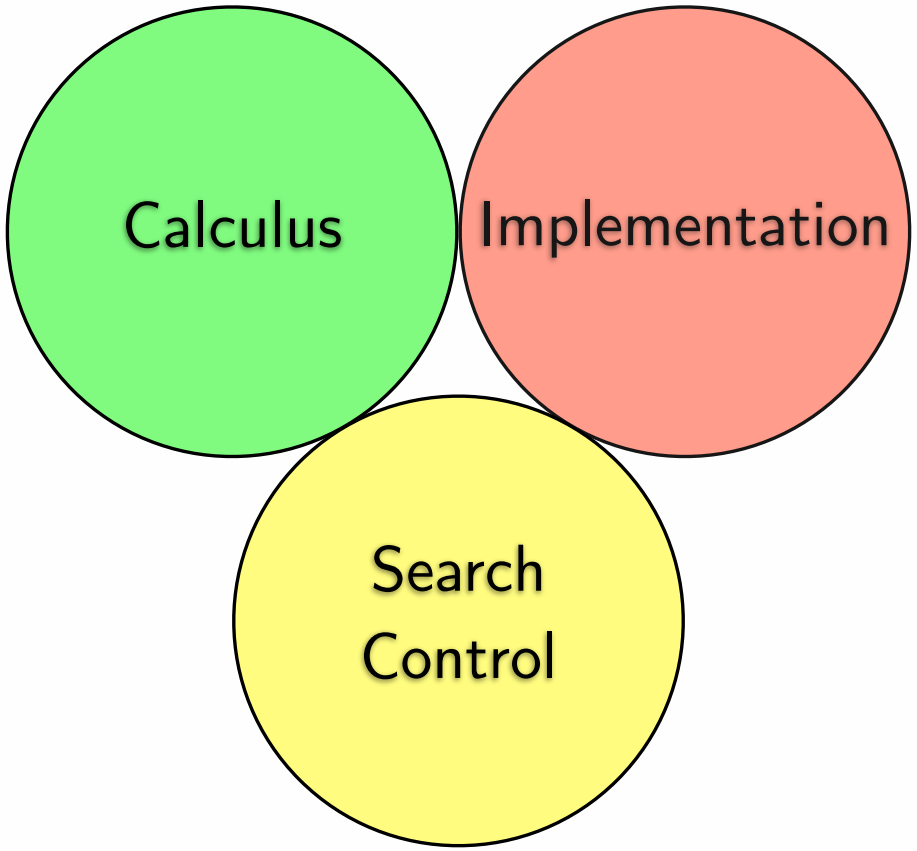
Driving the State of the Art



Driving the State of the Art

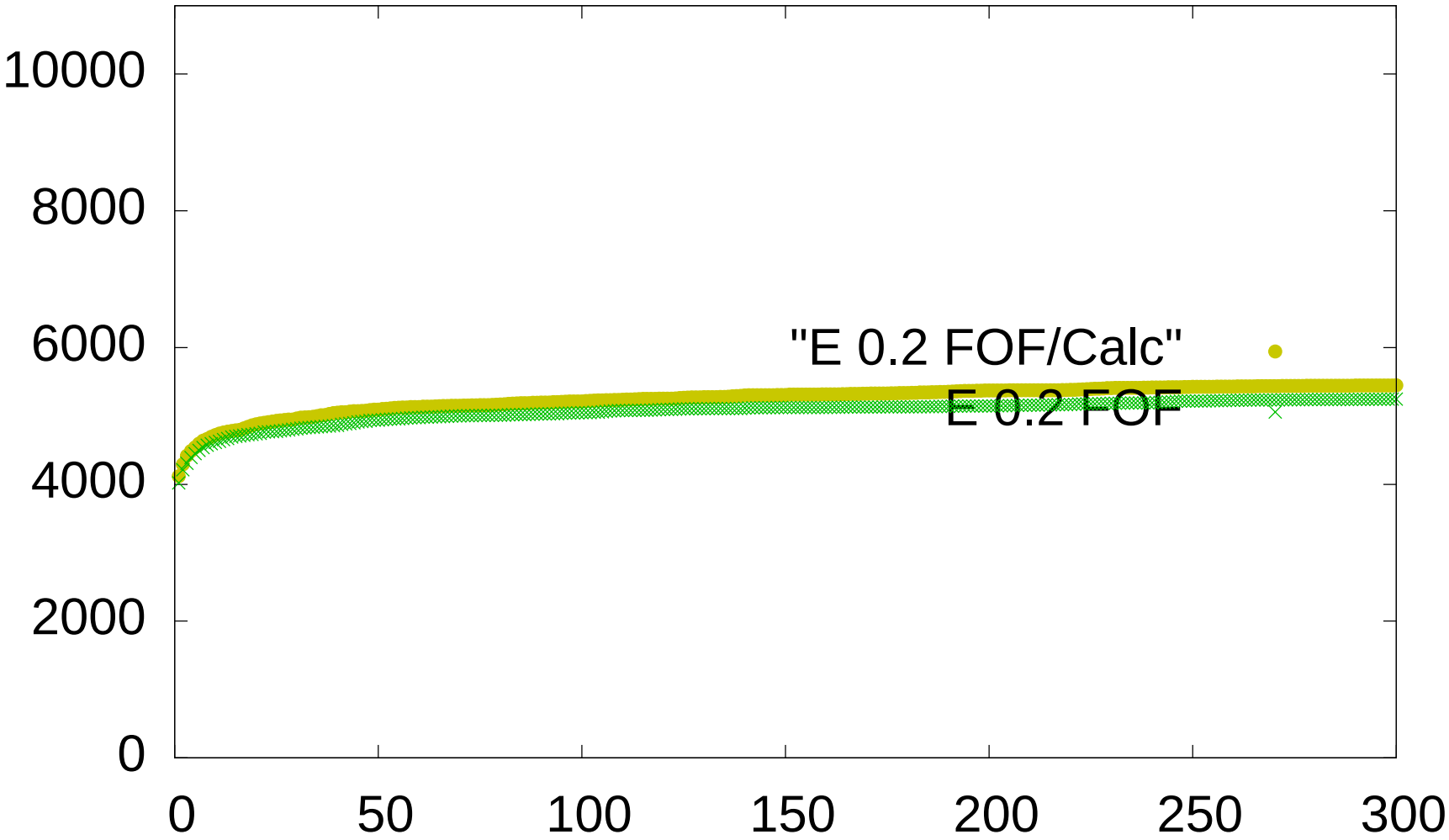
What inference system to use?

How to do inferences efficiently?

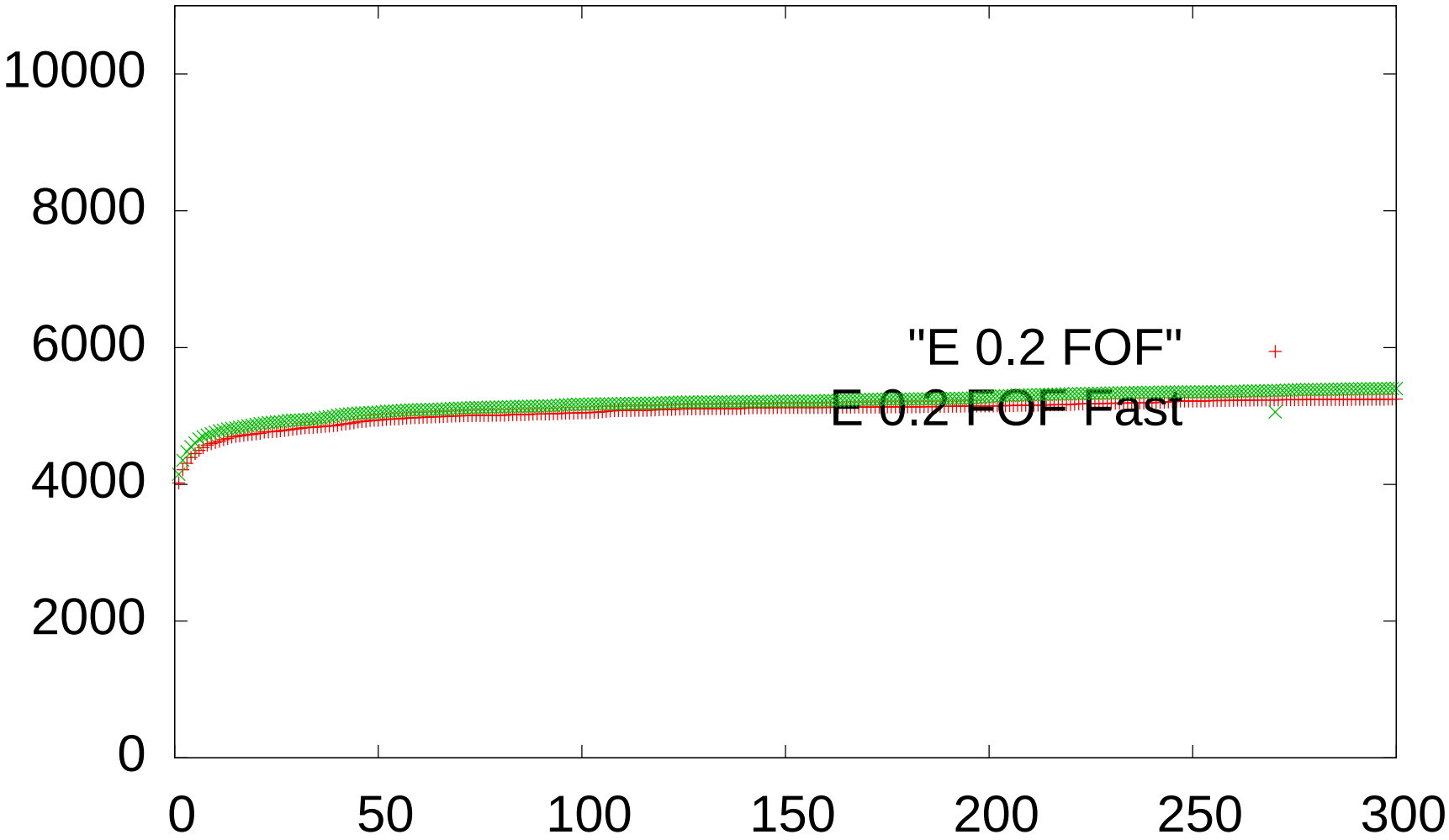


Where to search for proofs?

Evolution of Calculus



Evolution of Implementation



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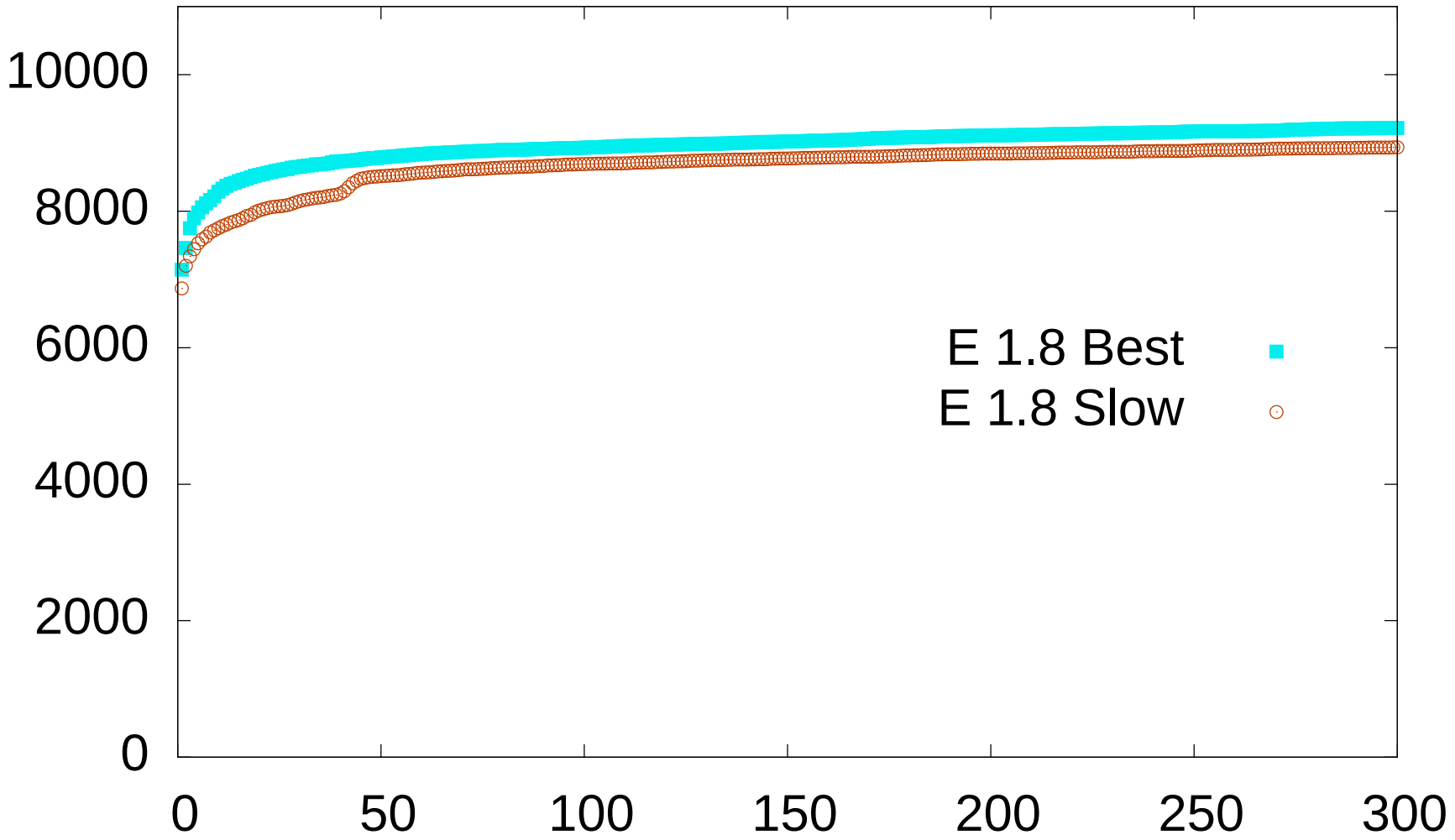
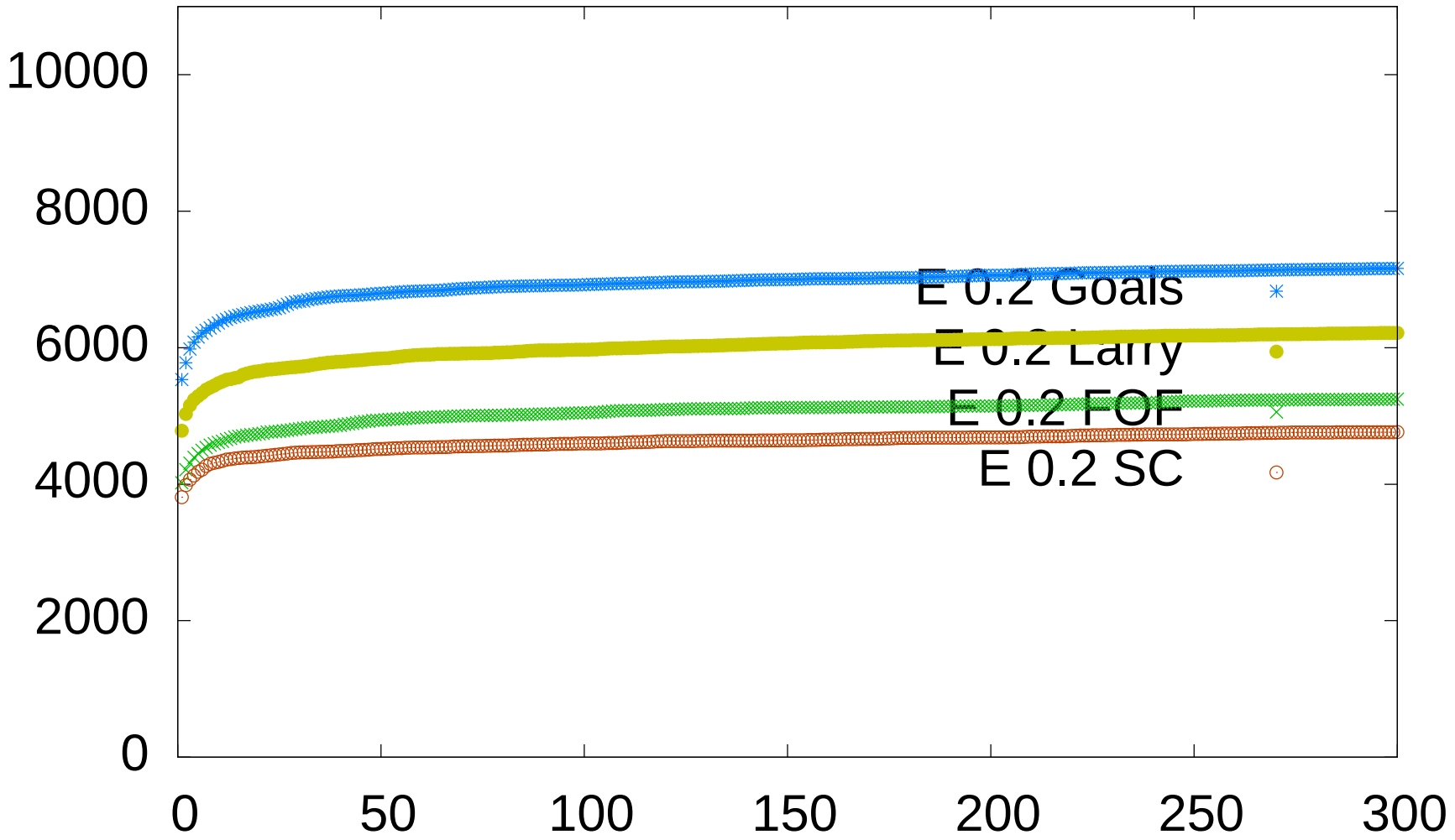
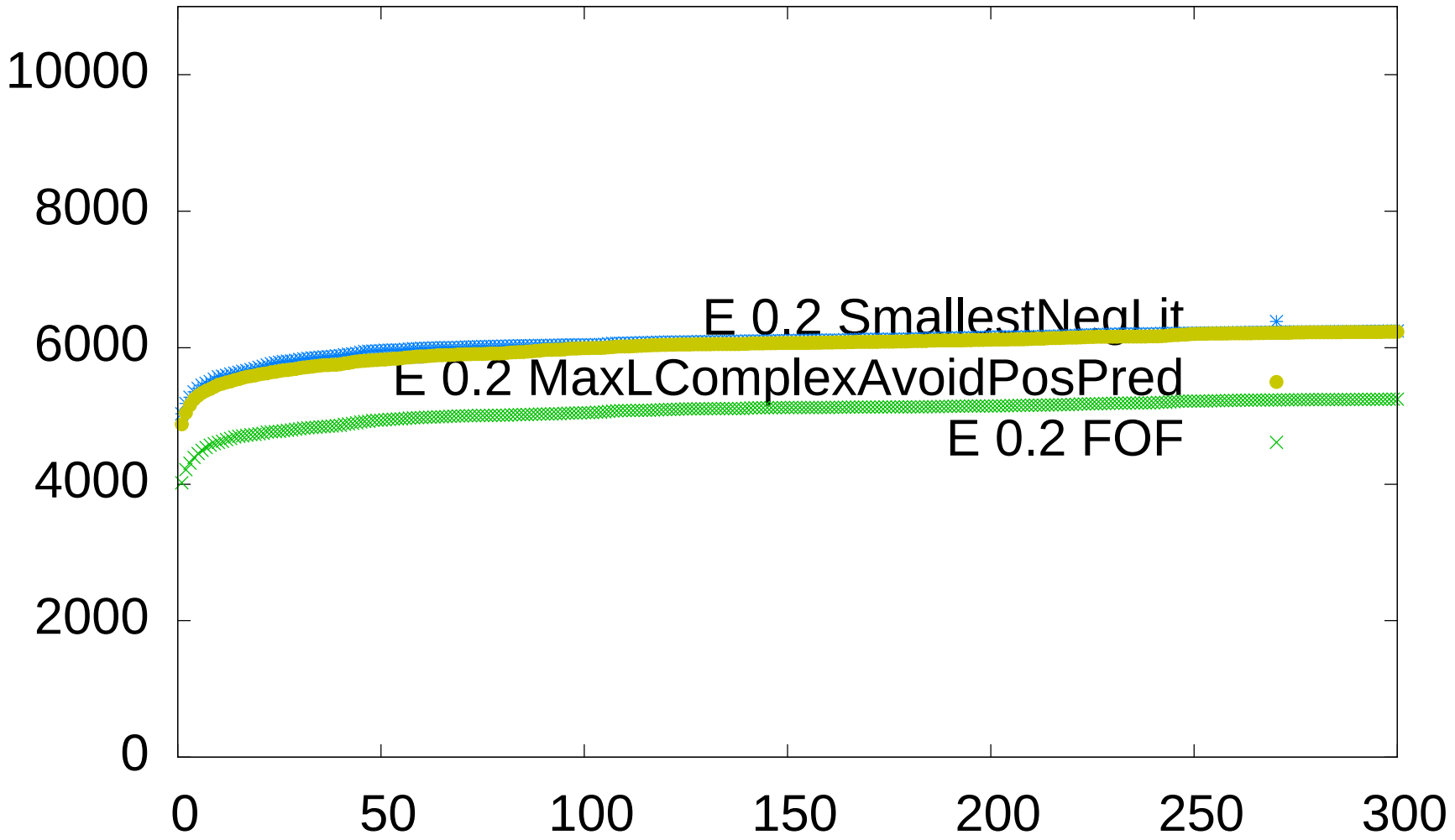


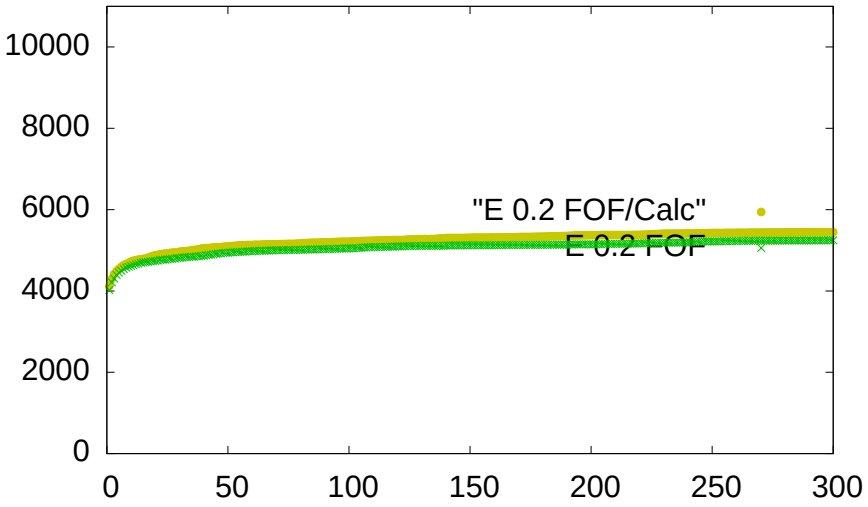
Evolution of Search Control/Clause Selection

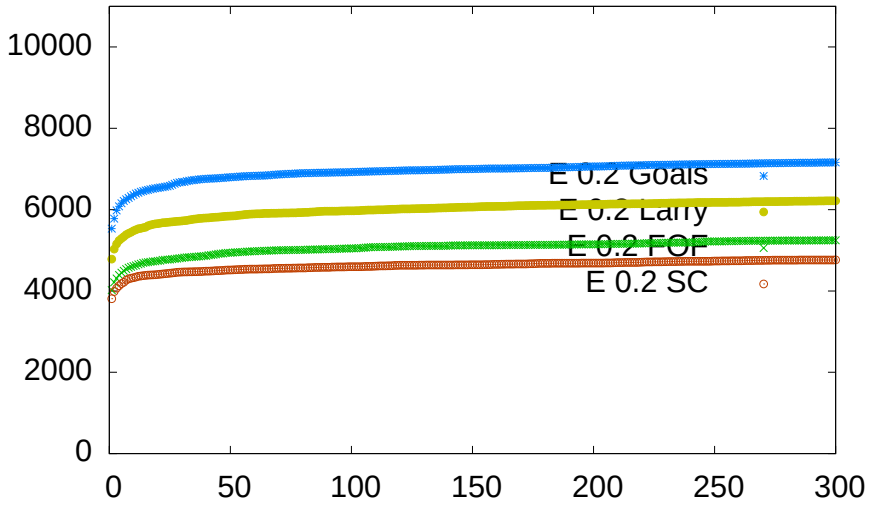


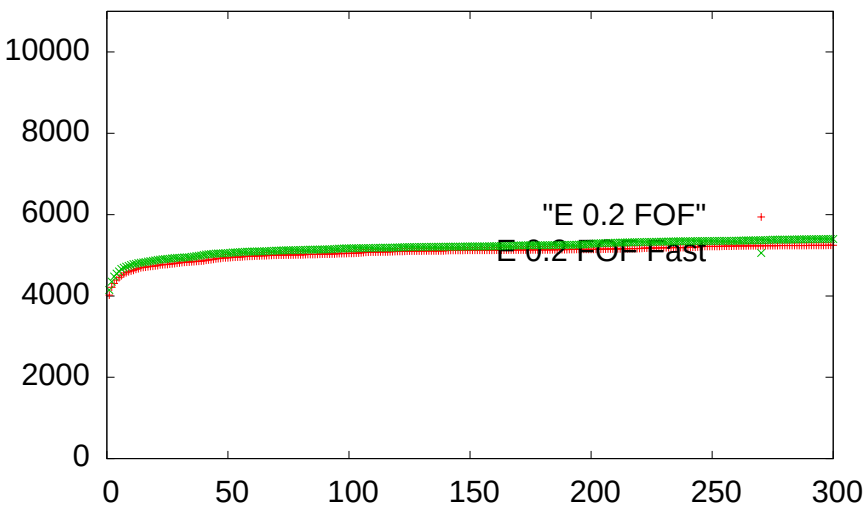
Evolution of Search Control/Literal Selection

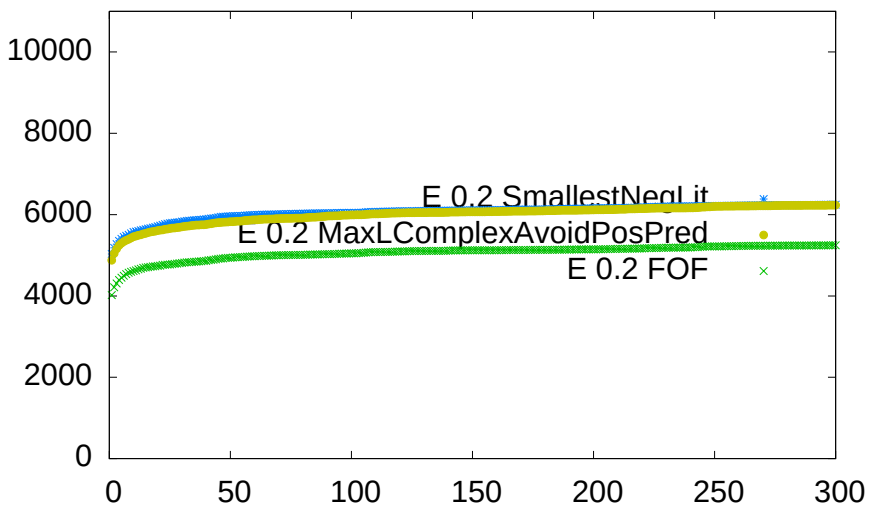


Compare and Contrast



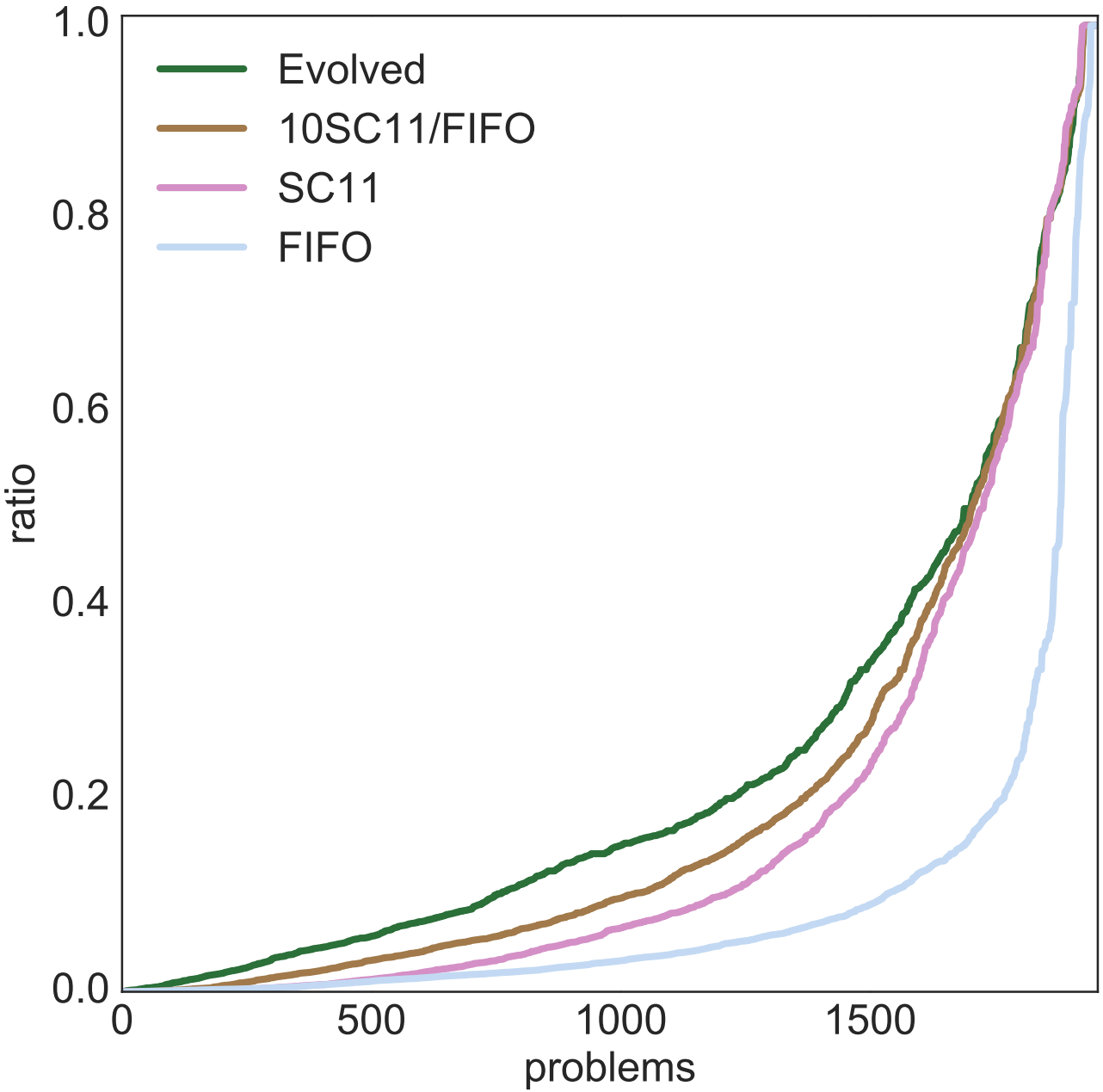






Improving heuristics has been the main source of progress in proof search!

. . . and our heuristics still suck!



Humans are Inadequate!

- We are not good at keeping large amounts of data in our head
- We are not good at analysing large amounts of data without help
- We are not good visualising complex relationships

Compare "The Magical Number Seven, Plus or Minus Two"

Player of Games

- Chess
  - State: Different pieces on an 8x8 board
  - Choice point: Which piece moves where
    - (Opening)
  - Success: Capture of the king

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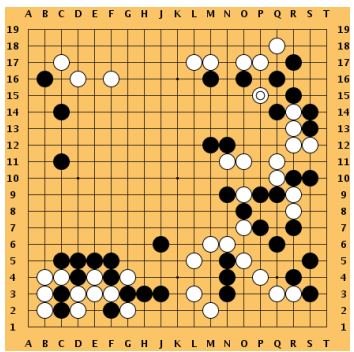

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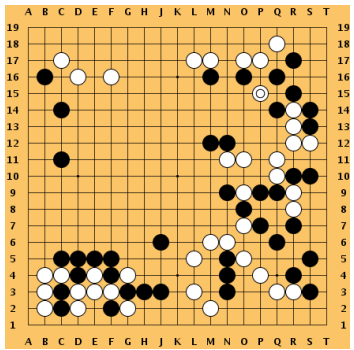

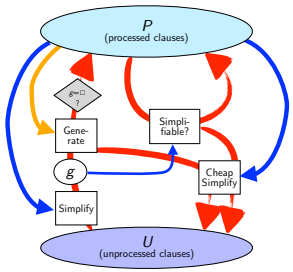

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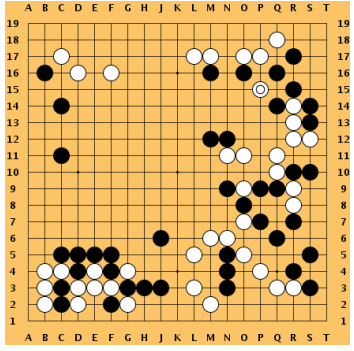

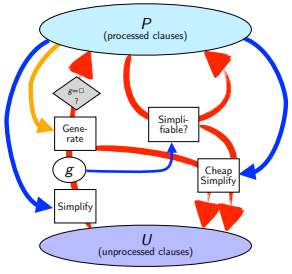

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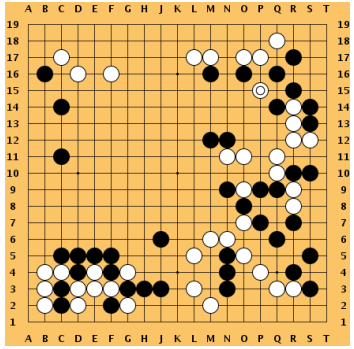

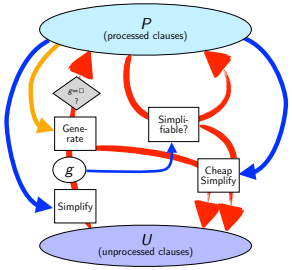

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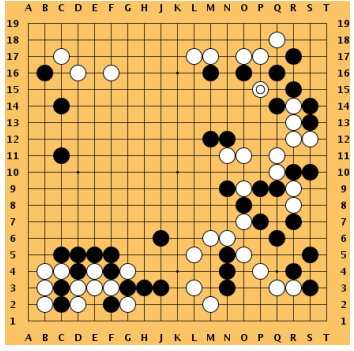

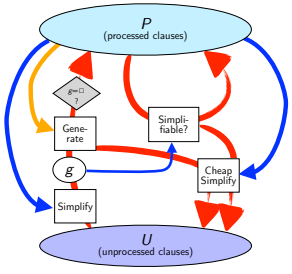

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AlphaGo

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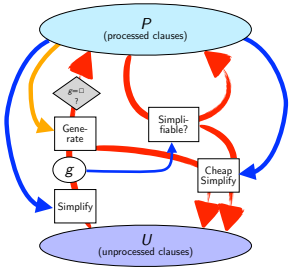

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AlphaGo

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Grand Challenge

Integrate Machine Learning and Symbolic Reasoning

Discussion

- Should we target domain-specific or more general search control knowledge?
- Deep learning or hand-selected features - which is better for learning search control knowledge?
- What is a better source for learning: Meta-information (success/failure, time to success, . . .), full proofs, or even full search protocols?

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Discuss away!