Is continual resolving really almighty?

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Outline

- continual resolving recapitulation
- PAWS domain
- CR and PAWS
- should everyone use CR

Is continual resolving really almighty?

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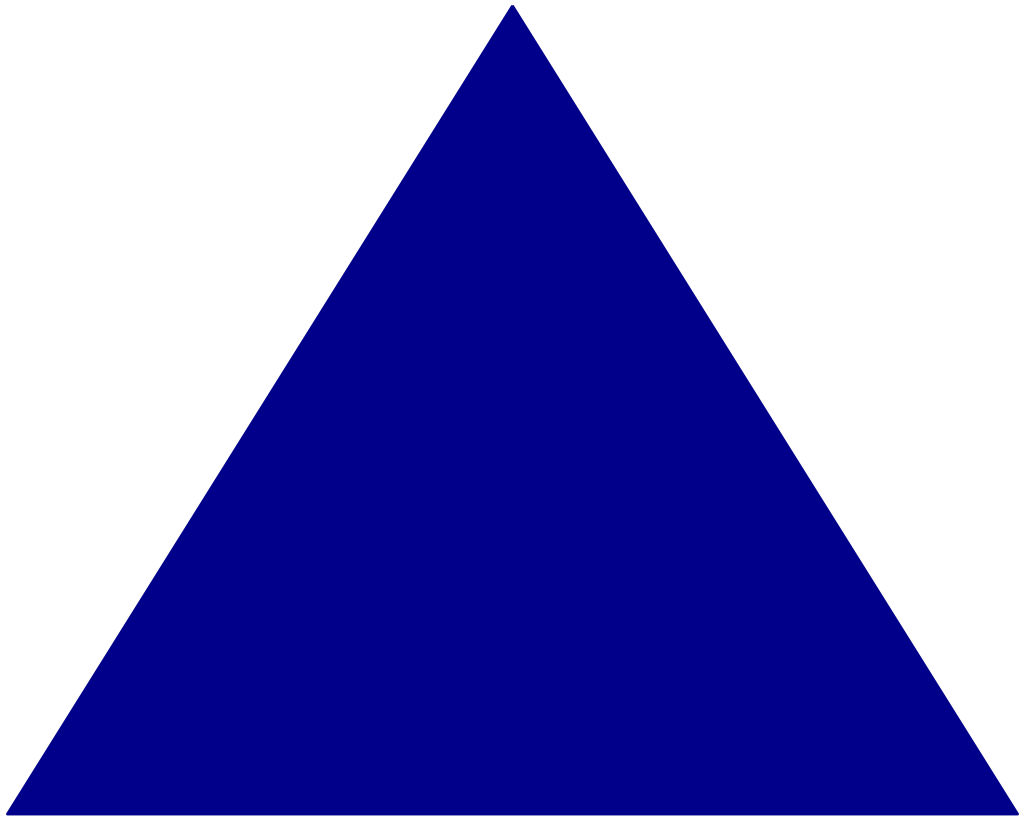

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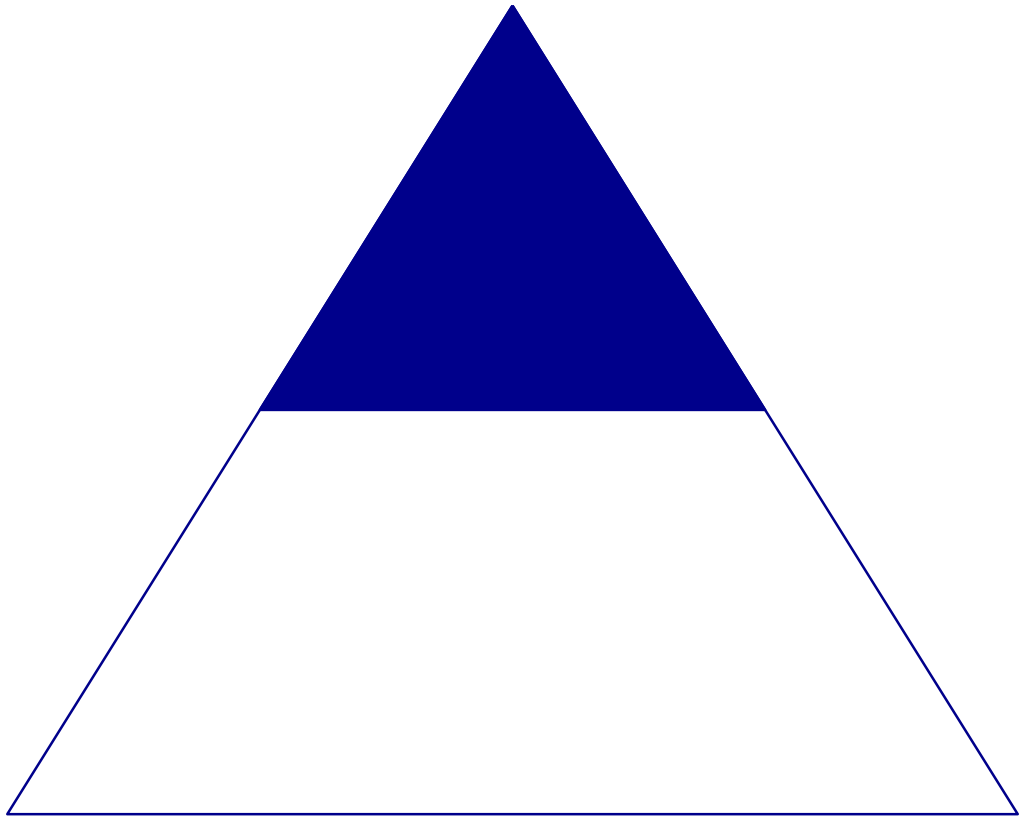

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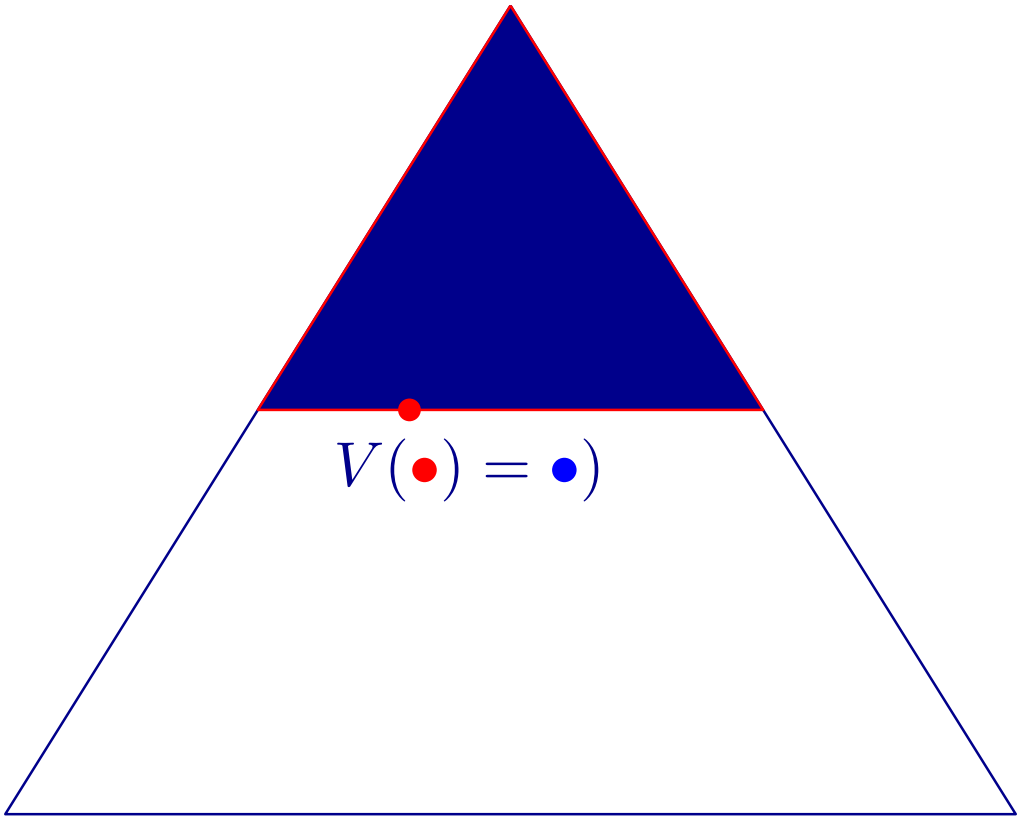

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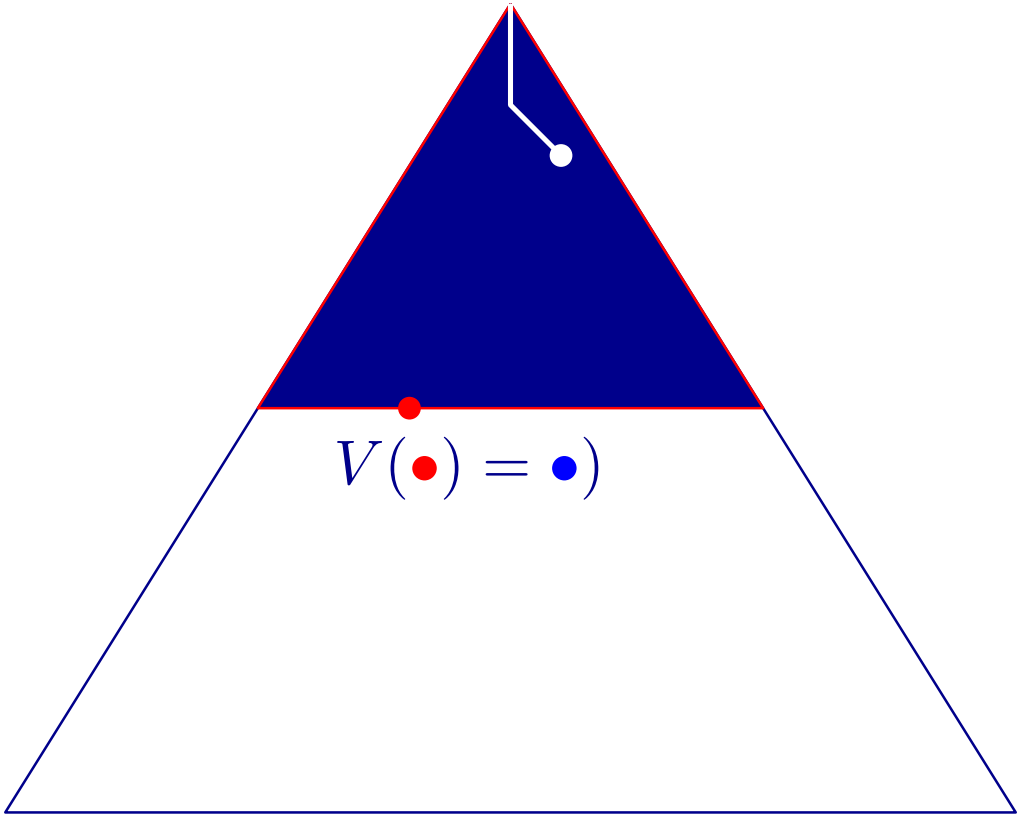

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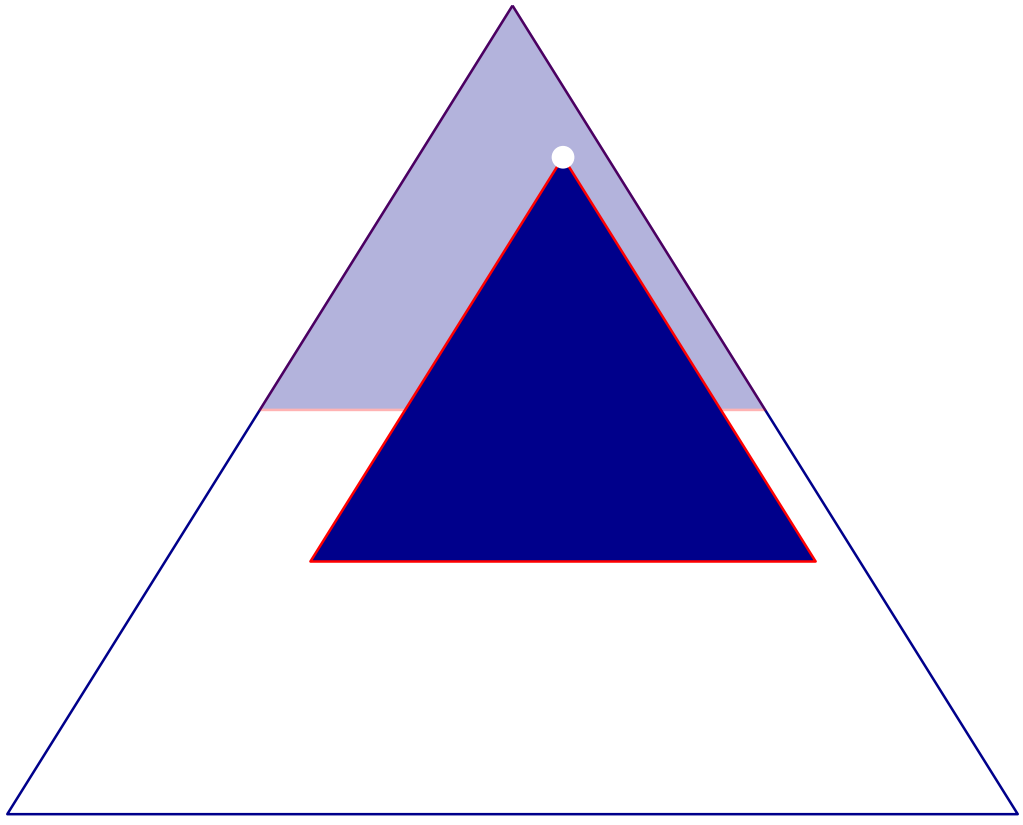

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- $10^{146}\times$ reduction of the size of the game

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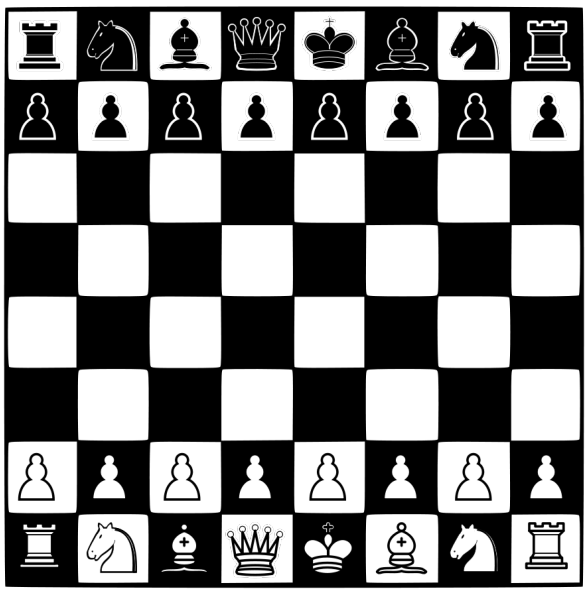

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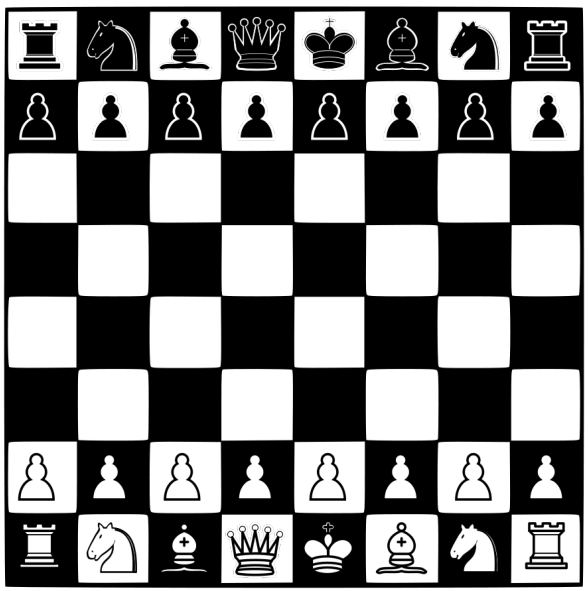
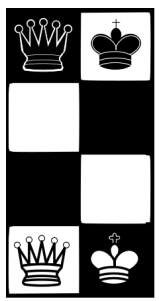
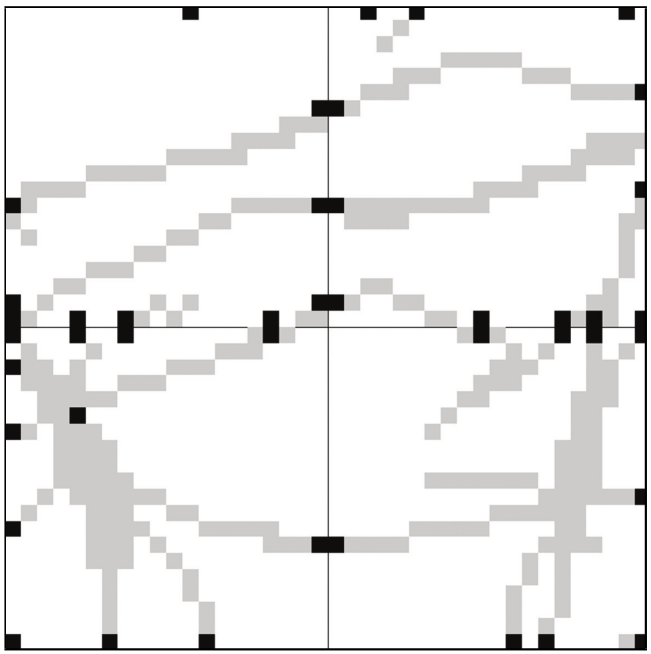




PAWS Problem

[17, 17] 0	[17, 18] 0	[17, 19] 0	[17, 20] 0	[17, 21] 0	[17, 22] 0	[17, 23] 0	[17, 24] 0	[17, 25] 0	[17, 26] 0	[17, 27] 0
[18, 17] 0	[18, 18] 0	[18, 19] 0	[18, 20] 45674.43	[18, 21] 0	[18, 22] 0	[18, 23] 0	[18, 24] 0	[18, 25] 0	[18, 26] 0	[18, 27] 0
[19, 17] 0	[19, 18] 0	[19, 19] 27093.188	[19, 20] 0	[19, 21] 0	[19, 22] 49578.441	[19, 23] 0	[19, 24] 65040.983	[19, 25] 40007.654	[19, 26] 0	[19, 27] 0
[20, 17] 0	[20, 18] 0	[20, 19] 0	[20, 20] 0	[20, 21] 0	[20, 22] 0	[20, 23] 0	[20, 24] 0	[20, 25] 51151.326	[20, 26] 0	[20, 27] 0
[21, 17] 0	[21, 18] 44413.754	[21, 19] 34789.209	[21, 20] 36087.548	[21, 21] 0	[21, 22] 0 base	[21, 23] 0	[21, 24] 34990.466	[21, 25] 61964.373	[21, 26] 48798.449	[21, 27] 0
[22, 17] 0	[22, 18] 0	[22, 19] 31887.188	[22, 20] 34007.866	[22, 21] 0	[22, 22] 0	[22, 23] 0	[22, 24] 40449.729	[22, 25] 0	[22, 26] 0	[22, 27] 0
[23, 17] 0	[23, 18] 0	[23, 19] 0	[23, 20] 0	[23, 21] 0	[23, 22] 0	[23, 23] 42169.577	[23, 24] 35476.933	[23, 25] 0	[23, 26] 0	[23, 27] 0
[24, 17] 0	[24, 18] 0	[24, 19] 0	[24, 20] 0	[24, 21] 48194.022	[24, 22] 0	[24, 23] 0	[24, 24] 44917.983	[24, 25] 0	[24, 26] 0	[24, 27] 0
[25, 17] 0	[25, 18] 0	[25, 19] 0	[25, 20] 0	[25, 21] 49346.414	[25, 22] 0	[25, 23] 0	[25, 24] 0	[25, 25] 0	[25, 26] 0	[25, 27] 0
[26, 17] 0	[26, 18] 0	[26, 19] 0	[26, 20] 0	[26, 21] 0	[26, 22] 0	[26, 23] 0	[26, 24] 0	[26, 25] 0	[26, 26] 0	[26, 27] 0
[27, 17] 0	[27, 18] 0	[27, 19] 0	[27, 20] 0	[27, 21] 0	[27, 22] 0	[27, 23] 0	[27, 24] 0	[27, 25] 0	[27, 26] 0	[27, 27] 0



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- use DeepStack ideas on different domains than poker
- replace neural network with handmade heuristics

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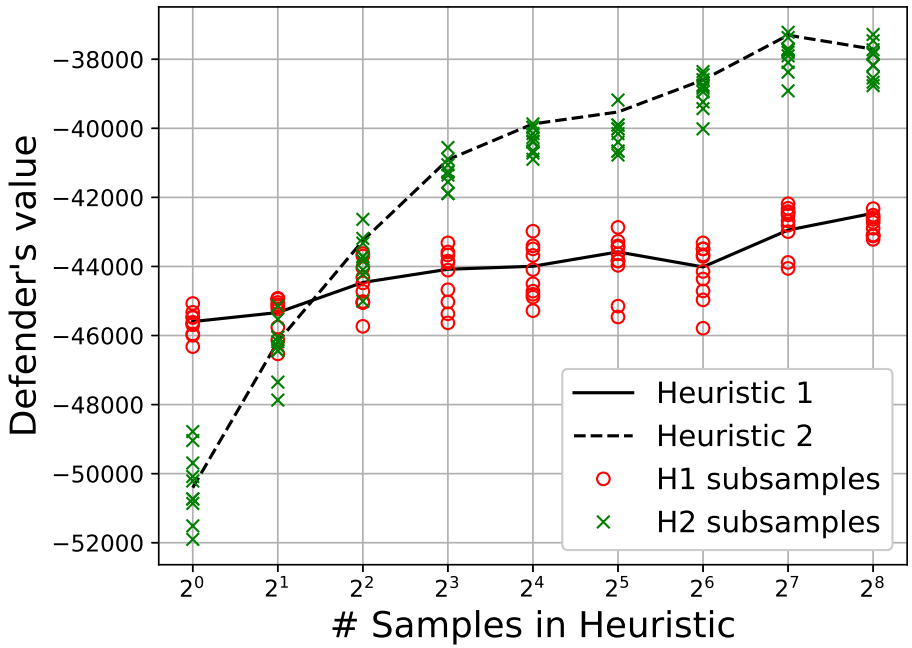

Single attack

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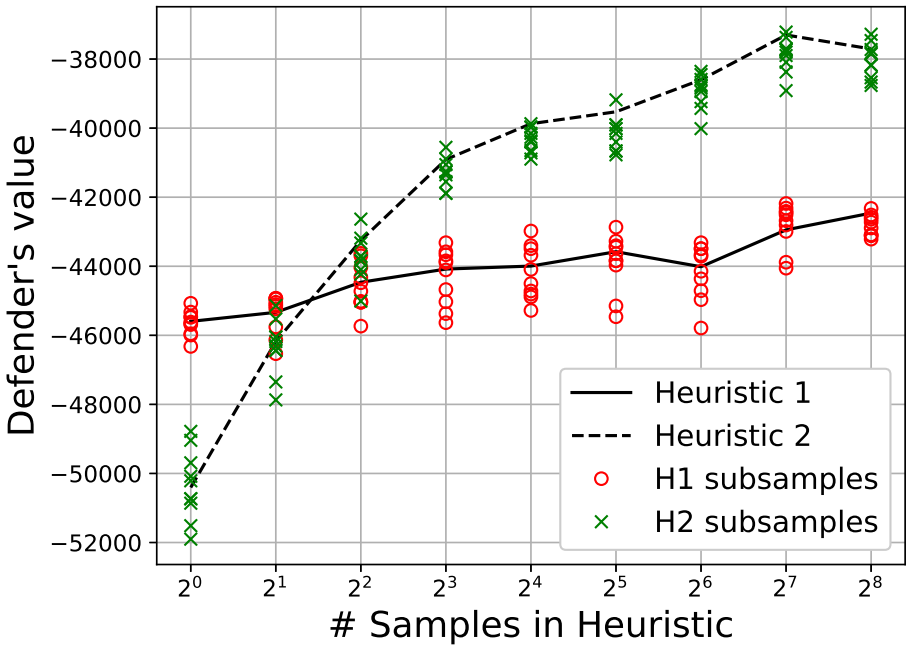

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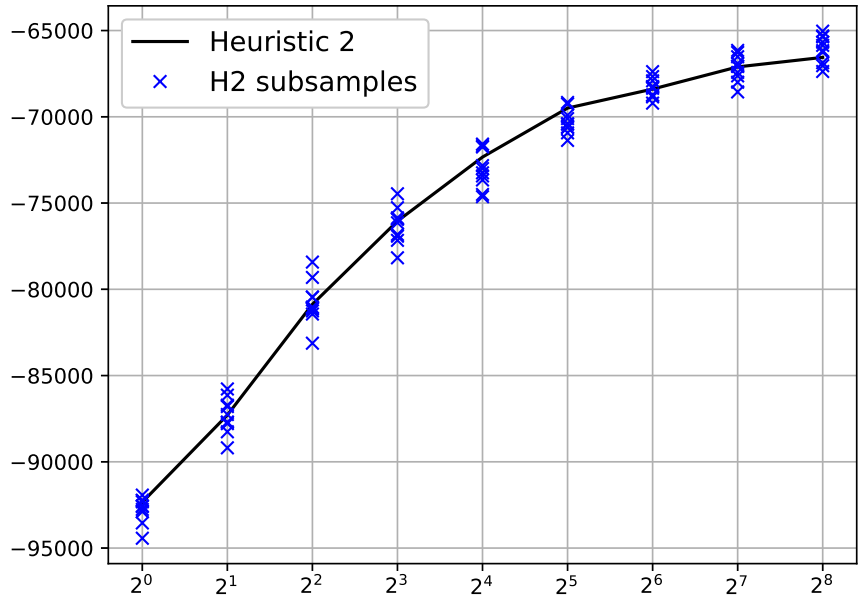

Multiple attacks

Should everyone use continual resolving?

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Well, not really

Heuristics producing strategies

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Poker:

PAWS:

Heuristics producing strategies

Poker:

- large game tree

PAWS:

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Heuristics producing strategies

Poker:

- large game tree
- too complex strategies

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Heuristics producing strategies

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PAWS:

- large game tree
- not so complex strategies

Improvement during on-line play

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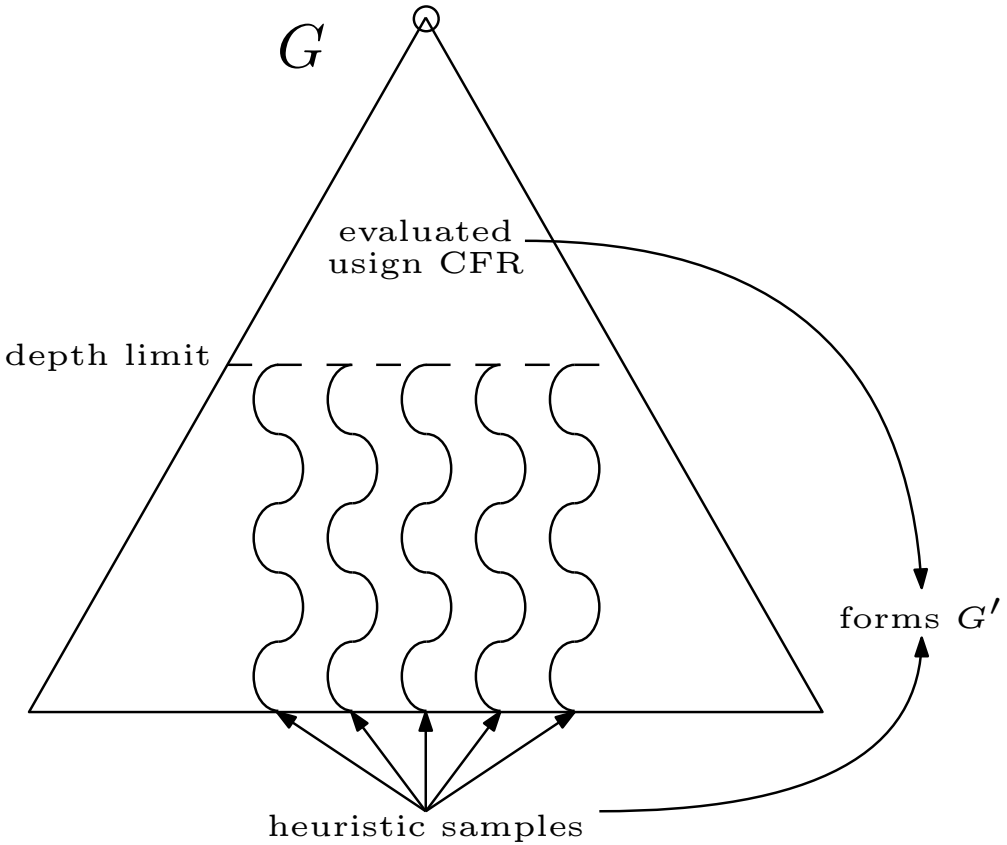

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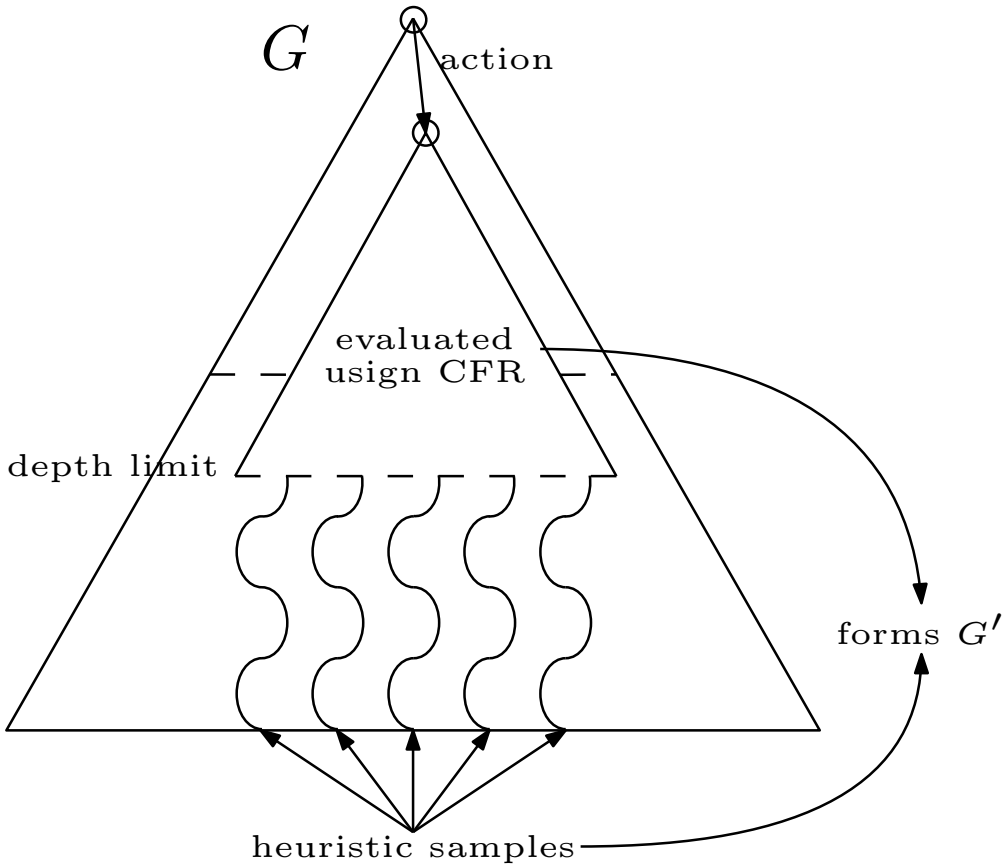

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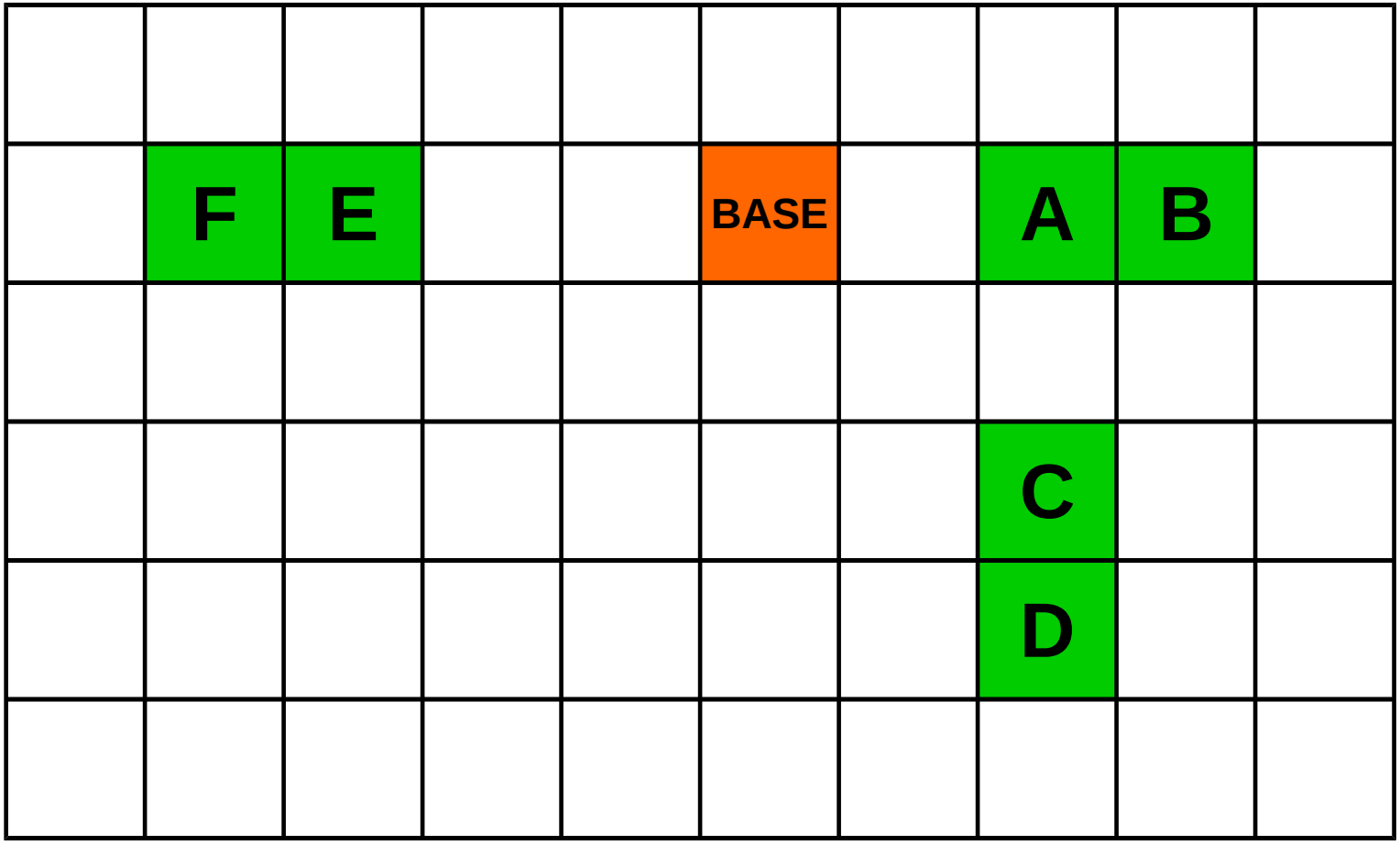

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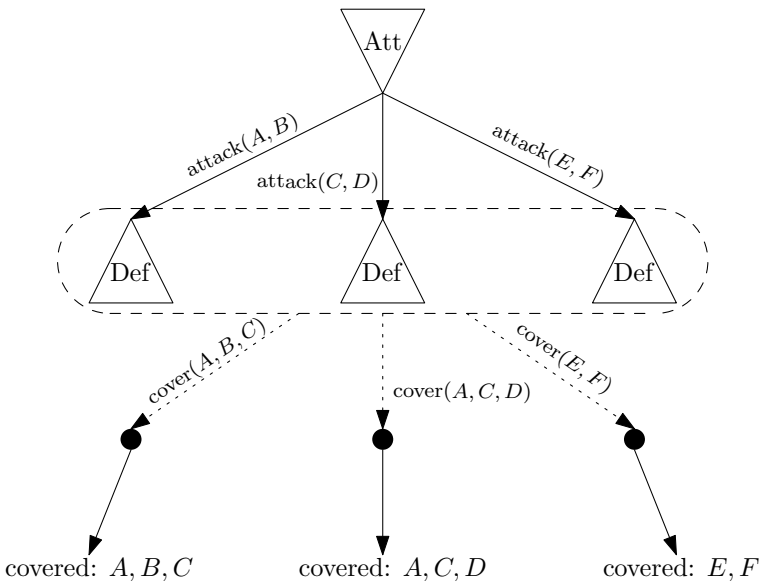

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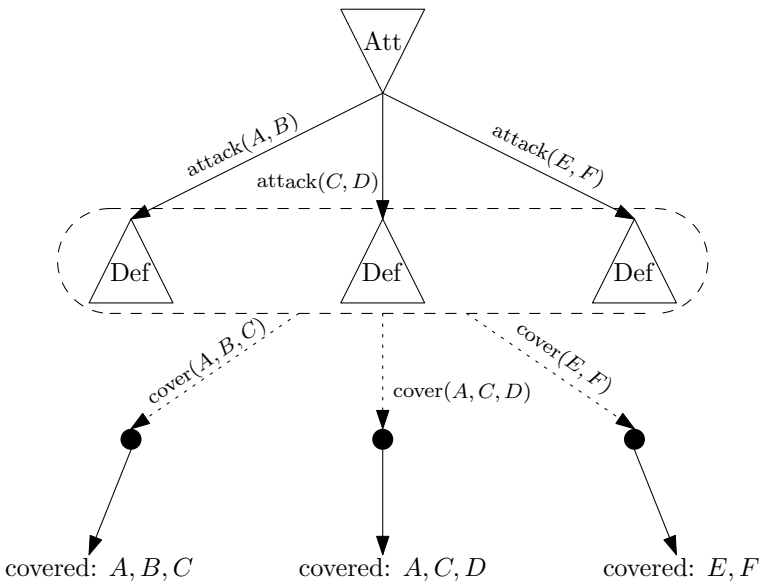

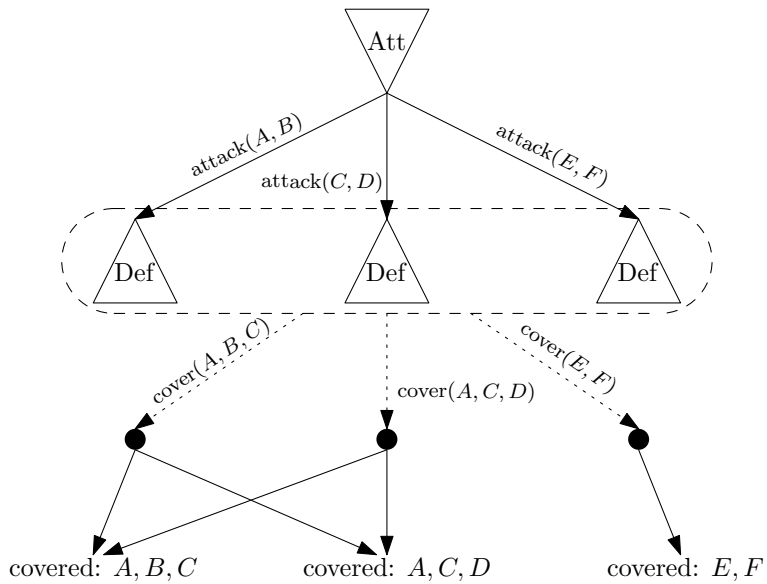

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[1] Fang, Fei, et al. — Deploying PAWS: Field Optimization of the Protection Assistant for Wildlife Security. AAAI (2016)

[2] Moravčík et al. — Deepstack: Expert-level artificial intelligence in heads-up no-limit poker. Science, 356(6337):508–513 (2017)

Thank You!