

Heuristic under-estimating cost tends to value the settled past (tracked by cost) over an uncertain future (estimated by heuristic)

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A-star as a tweak of breadth-first:

tree with branching factor b , counted by geometric series

$$1 + b + b^2 + b^3 + \dots + b^n = \sum_{k=0}^n b^k = \frac{1 - b^{n+1}}{1 - b}$$

since $s_n + b^{n+1} = 1 + bs_n$

Shifting perspectives

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Shift:

► $b = 2 \rightsquigarrow b = 1/2$ (to discount future)

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- ▶ frontier search from start \rightsquigarrow back up from goal

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- ▶ arc \approx action, subject to a reward (contra cost)

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- ▶ frontier search from start \rightsquigarrow back up from goal
- ▶ arc \approx action, subject to a reward (contra cost)
- ▶ heuristic cost estimate h -to-minimize \rightsquigarrow
reward H -to-maximize

Shifting perspectives: from searching to learning

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Shift:

- ▶ $b = 2 \rightsquigarrow b = 1/2$ (to discount future)
 - ▶ frontier search from start \rightsquigarrow back up from goal
 - ▶ arc \approx action, subject to a reward (contra cost)
 - ▶ heuristic cost estimate h -to-minimize \rightsquigarrow reward H -to-maximize
- approximate $H = \lim_{n \rightarrow \infty} H_n$ based on look-ahead n
— learning in stages