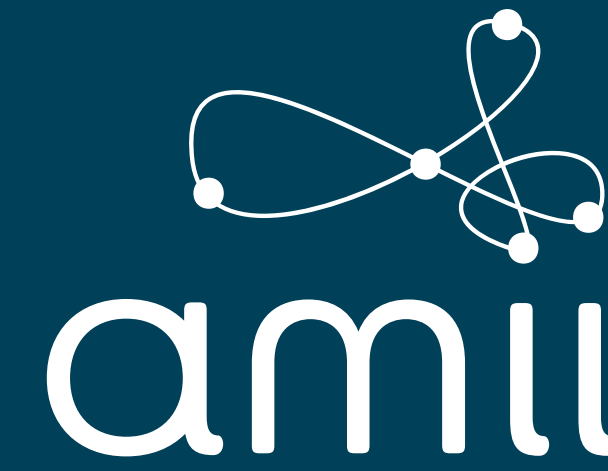


# Anchor Search: A Unified Framework for Suboptimal Bidirectional Search

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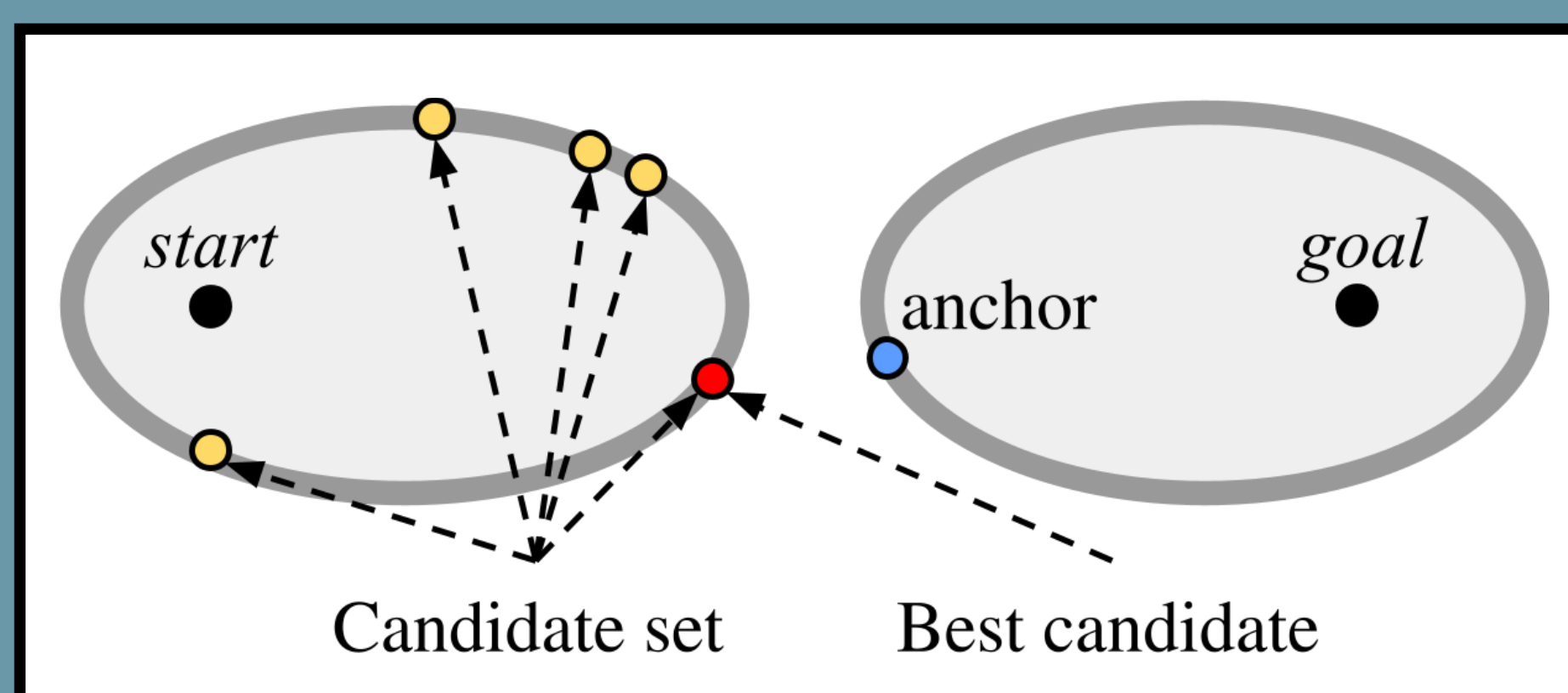


## Questions:

- Is bidirectional heuristic search worthwhile?
- Where do we get bidirectional heuristics?

**Anchor search is a framework for suboptimal bidirectional search.**

## Anchor Search Framework



Main anchor search params:

- Anchor selection (target)
  - *temporal, rand, fixed*
- Candidate selection (open)
  - *temporal, all, random*
- Direction selection

$$AS_{\beta}^{\alpha(k)}$$

$\alpha$ : candidate selection

$k$ : candidate count

$\beta$ : anchor policy

## Bidirectional Heuristics

- Bidirectional heuristics are for arbitrary start/goal pairs
- Given single-source shortest path, using triangle inequality to infer heuristics to other states (differential heuristic)
  - Used in polynomial domains; also works for PDB heuristics

## Selected Results

4-Peg Towers of Hanoi, Random start and goal

Metrics	22 disks			24 disks		
	$AS_{AF}^{T(10)}$	GBFS	BGBFS	$AS_{AF}^{T(10)}$	GBFS	BGBFS
DH PDB(0-11)						
Expansions	<b>413,828</b>	1,349,162	1,020,929	<b>2,805,473</b>	16,686,368	9,921,693
Time (s)	<b>3.01</b>	5.98	5.84	<b>20.80</b>	74.71	63.17
Length	<b>313,951</b>	943,931	804,050	<b>1,971,953</b>	9,302,241	7,263,891
DH PDB(0-11) × 100 + DH PDB(12-15)						
Expansions	<b>3,861,445</b>	7,612,313	9,403,613	<b>60,908,811</b>	124,683,519	158,240,625
Time (s)	29.12	<b>17.28</b>	26.45	506.49	<b>345.52</b>	509.30
Length	<b>123,742</b>	558,635	540,627	<b>712,199</b>	8,053,873	8,021,651
DH PDB(0-11) × 100 + DH PDB(12-∞)						
Expansions	<b>1,157,303</b>	1,441,166	1,925,652	<b>11,216,110</b>	15,026,181	17,946,659
Time (s)	8.88	<b>4.27</b>	7.11	85.90	<b>56.63</b>	77.88
Length	11,811	<b>1,568</b>	1576	33,943	2,421	<b>2,397</b>

Metrics	DH PDB(12) + 180GB	
	26 disks	28 disks
Exp.	12,952,752	57,212,173
Time (s)	82.20	488.61
Length	9,673,562	42,792,775

Metrics	DH PDB(15) + 700GB	
	30 disks	32 disks
Exp.	47,699,620	209,124,975
Time (s)	397.93	2,659.35
Length	36,077,524	162,213,243

Anchor search scales to the largest problems