

# WeGotYouCovered

The Winning Solver from the PACE 2019 Implementation Challenge, Vertex Cover Track

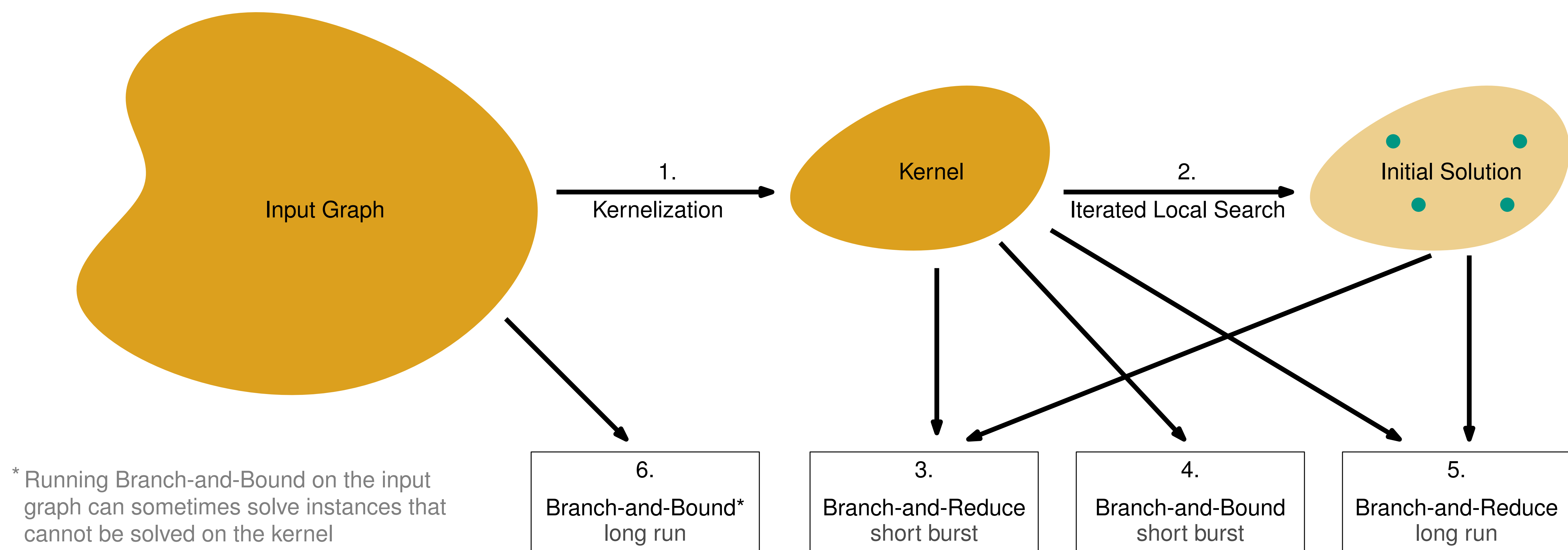
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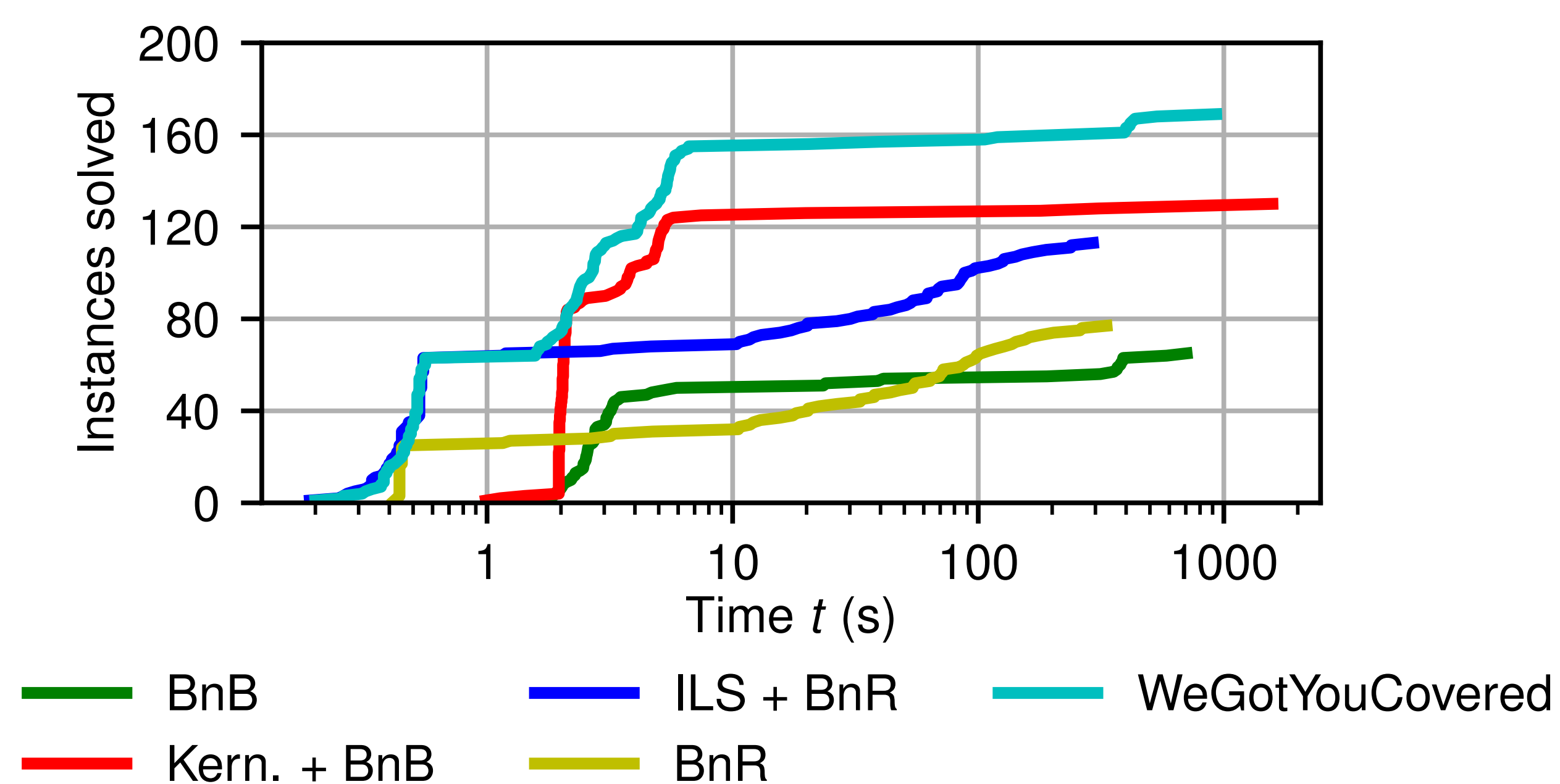
<sup>3</sup> Hamilton College, Department of Computer Science, Clinton, New York, USA

## Algorithm Overview (WeGotYouCovered)

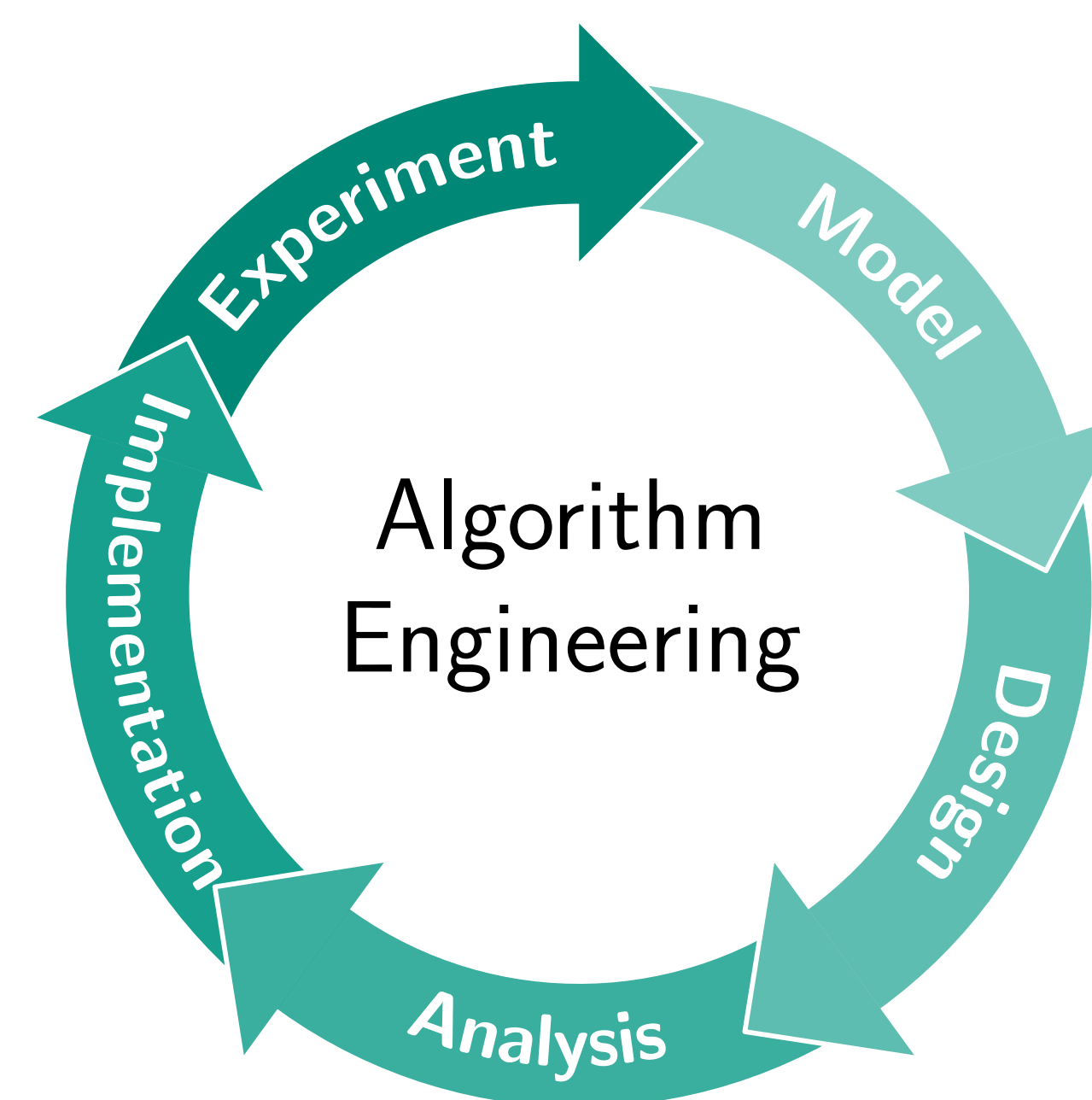


[HLSS2019]

## Instances Solved Over Time

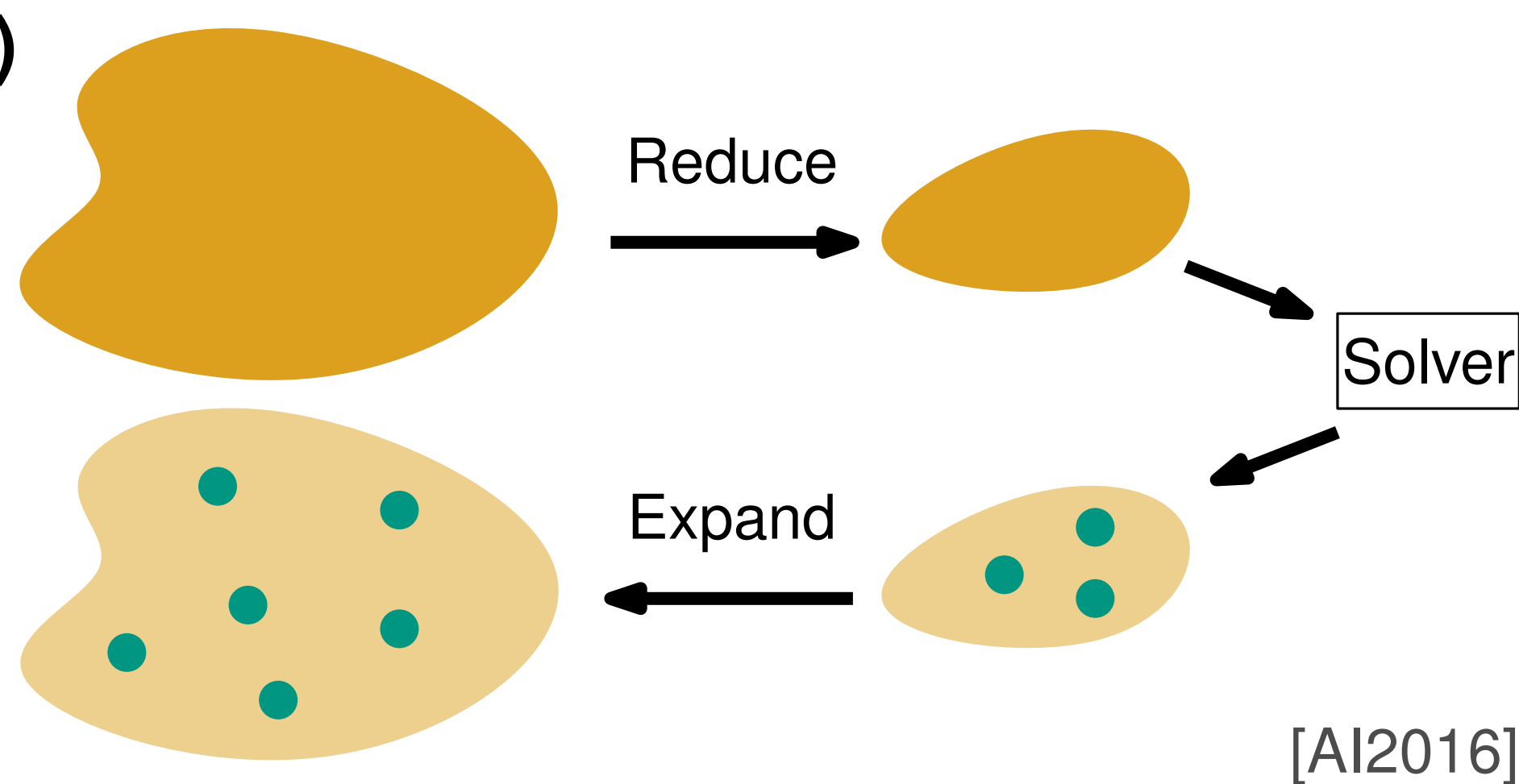


## Methodology



## Kernelization (Kern.)

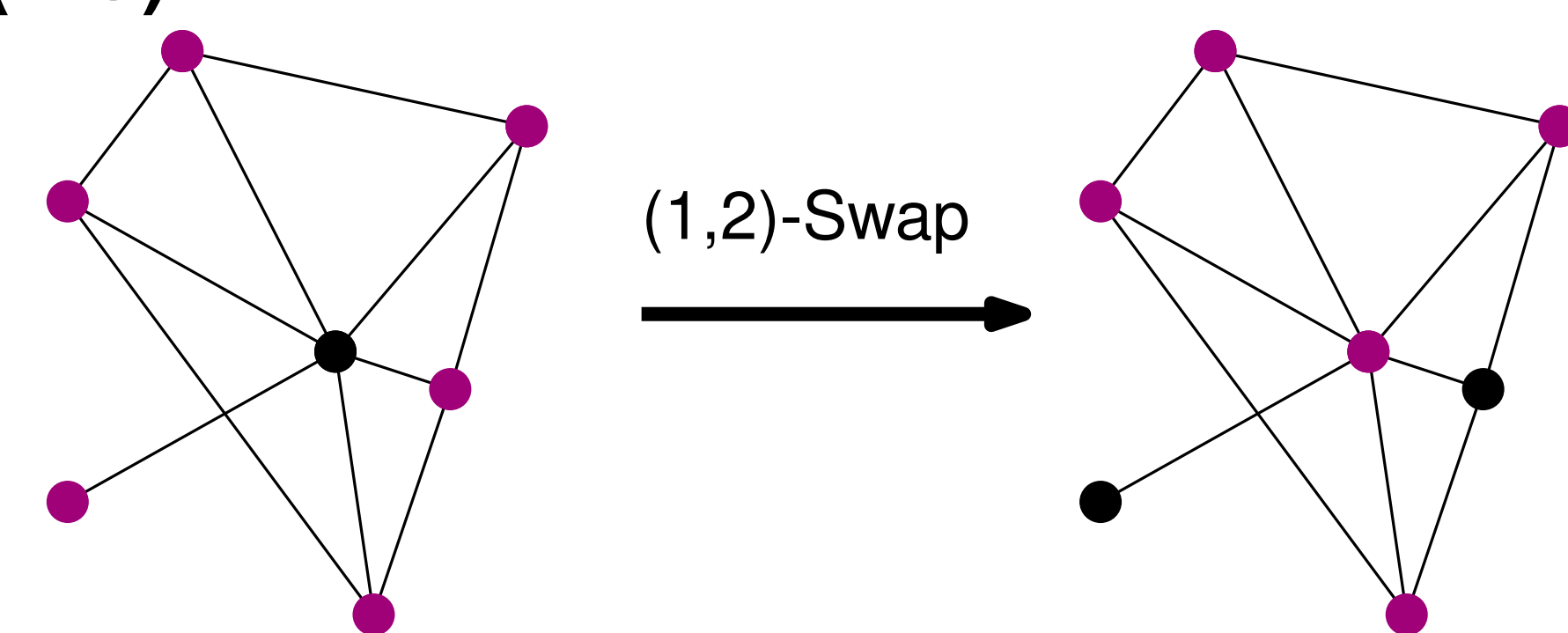
- Technique from FPT algorithms
- Applies rich set of reduction rules
- Significantly reduces graph size



[AI2016]

## Iterated Local Search (ILS)

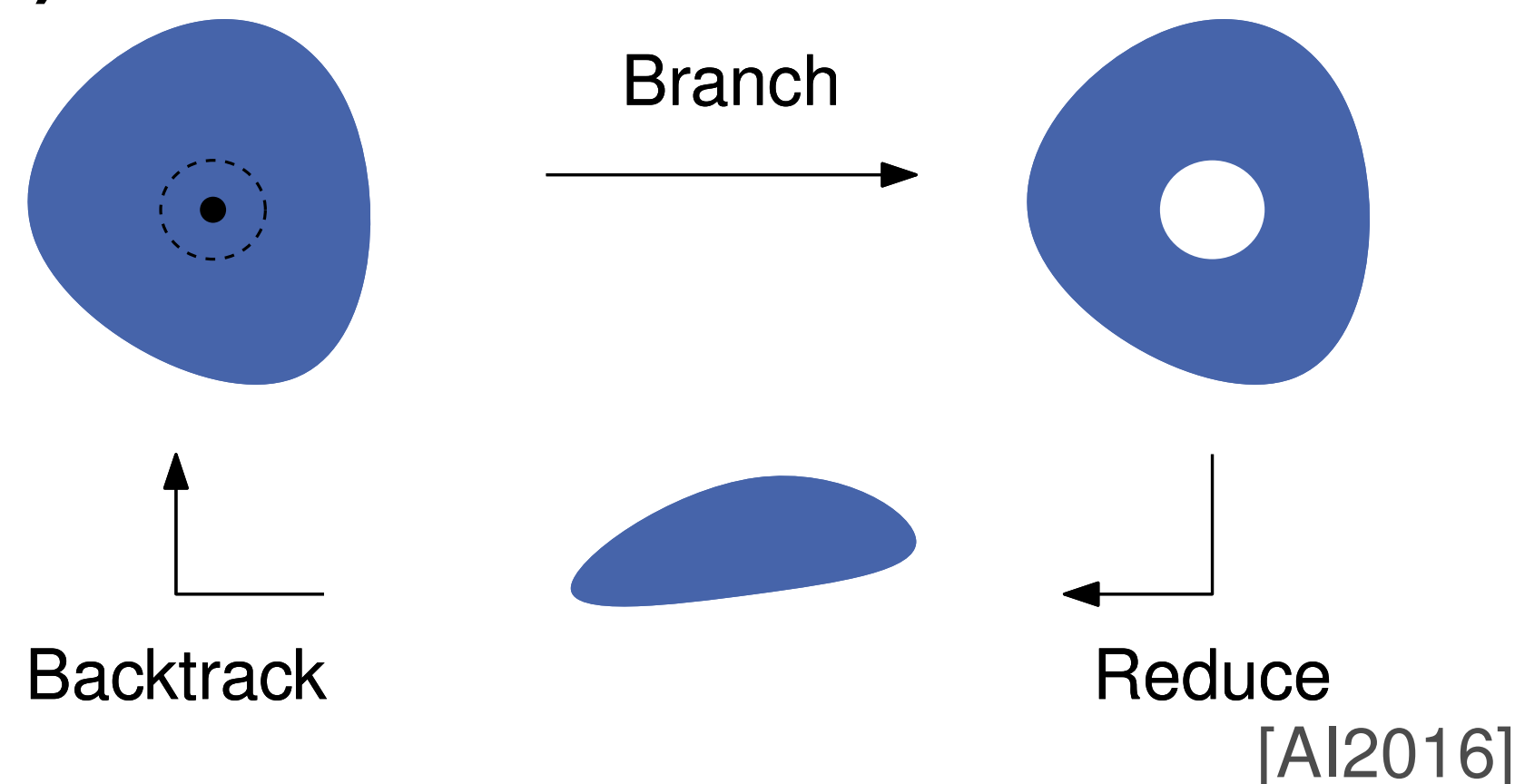
- Originally developed for independent sets
- Perturbation to escape local optima
- Can often find (near-)optimal solutions



[ARW2012]

## Branch-and-Reduce (BnR)

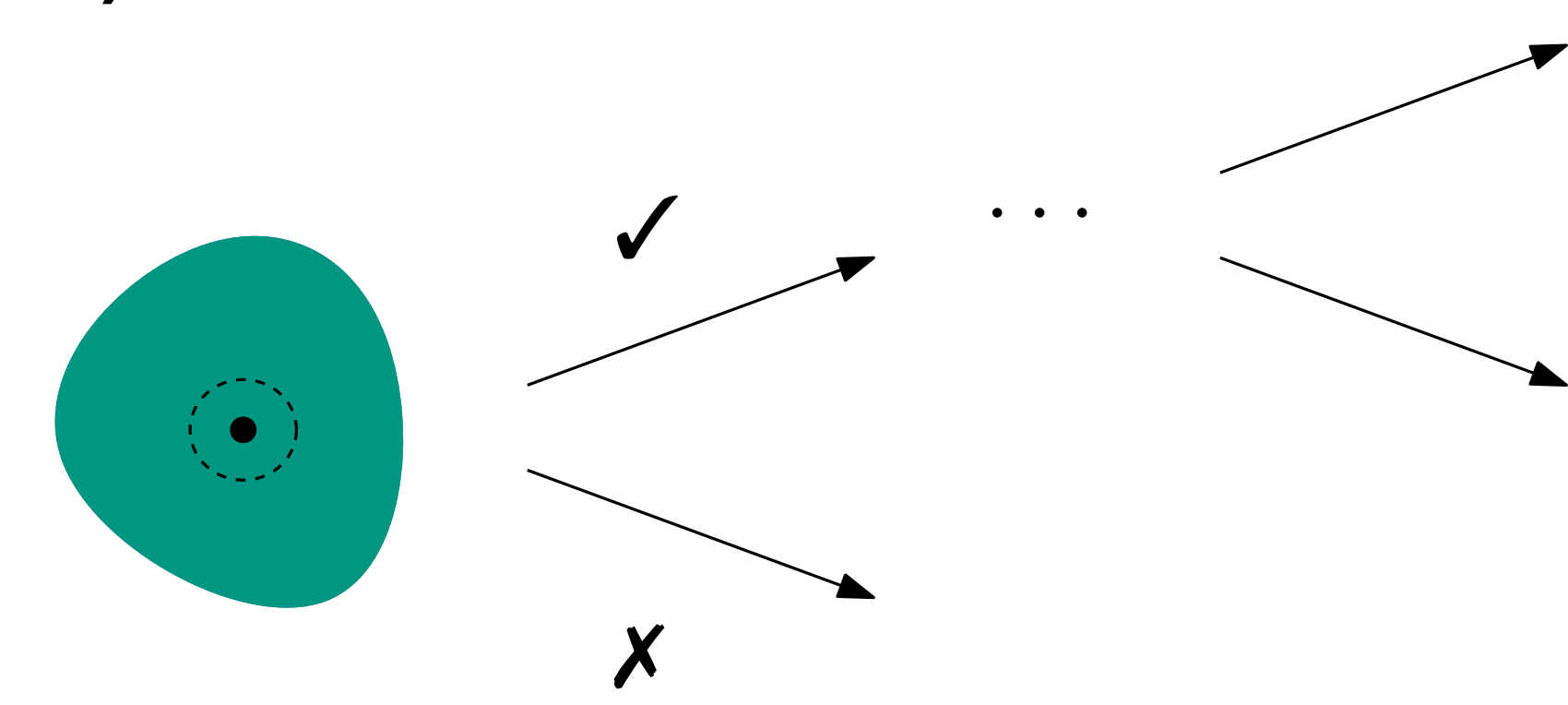
- Reduce graph after each branch
- Additional branching rules to reduce graph size
- Prune search based on lower bounds



[AI2016]

## Branch-and-Bound (BnB)

- Originally developed for maximum cliques
- Incremental MaxSAT reasoning to prune search
- Combination of static and dynamic vertex ordering



[LJM2017]

## References

Akiba, Takuya, and Yoichi Iwata. "Branch-and-reduce exponential/FPT algorithms in practice: A case study of vertex cover." *Theoretical Computer Science* 609 (2016): 211-225.

Andrade, Diogo V., Mauricio G. C. Resende, and Renato F. Werneck. "Fast local search for the maximum independent set problem." *Journal of Heuristics* 18.4 (2012): 525-547.

Hesse, Demian, Sebastian Lamm, Christian Schulz and Darren Strash "WeGotYouCovered: The Winning Solver from the PACE 2019 Implementation Challenge, Vertex Cover Track." *arXiv preprint arXiv:1908.06795* (2019).

Li, Chu-Min, Hua Jiang, and Felip Manyà. "On minimization of the number of branches in branch-and-bound algorithms for the maximum clique problem." *Computers & Operations Research* 84 (2017): 1-15.