Modeling Assistance for Hierarchical Planning: An Approach for Correcting Hierarchical Domains with Missing Actions

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Motivation and Objective

Hardness of modeling planning domains is a major obstacle for deploying planning techniques broadly.

- The demand of tools for modeling support arises.
  - No such tools exist for *hierarchical* planning.

Objective

We want to develop an approach for correcting potential errors in a hierarchical domain.

Background

Hierarchical Planning

A high level abstract (compound) task is accomplished by decomposing it into sub-tasks and completeing them.

- Start with one compound task c_I.

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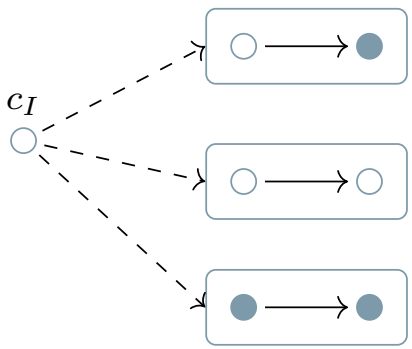

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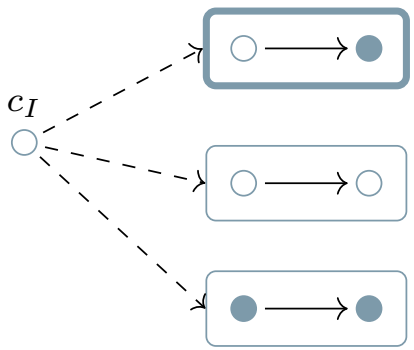

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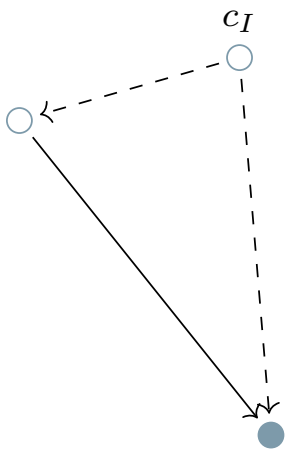

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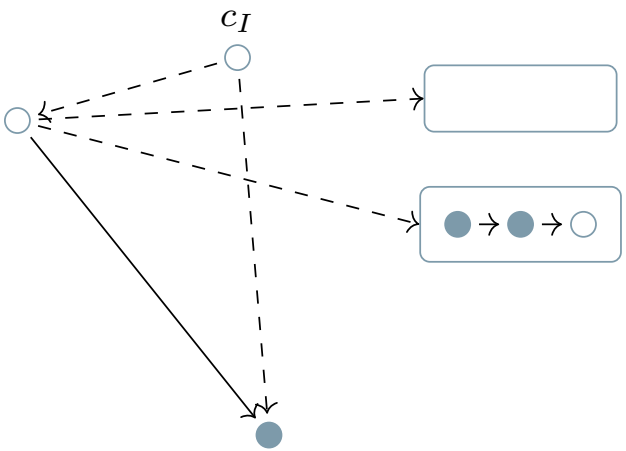

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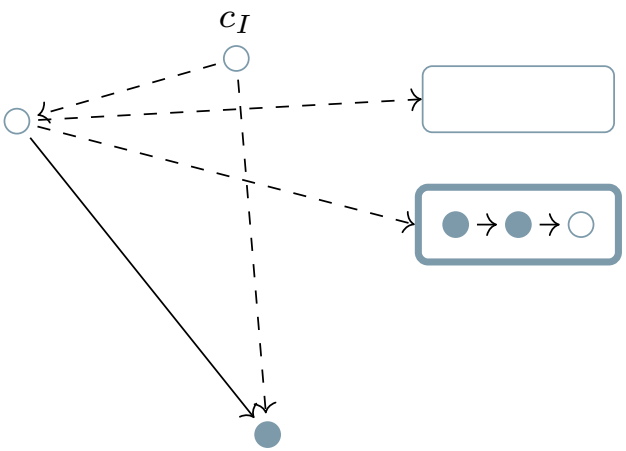

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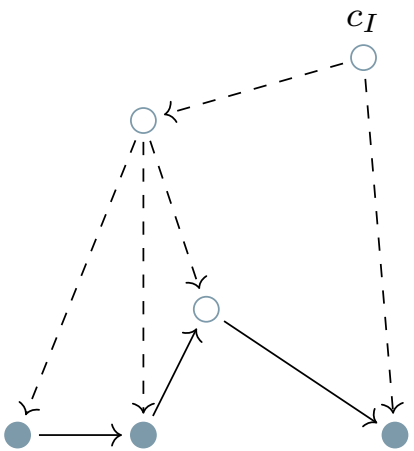

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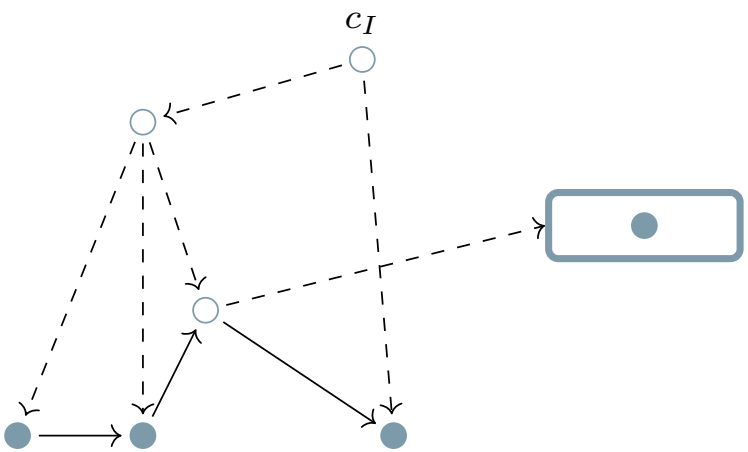

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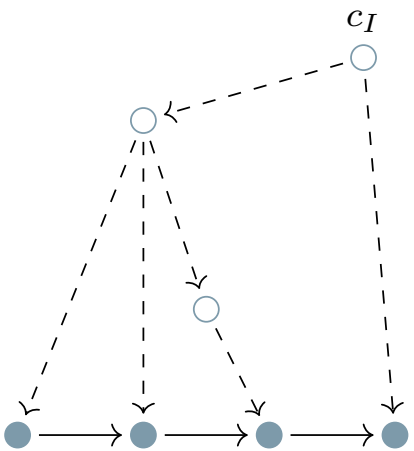

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- Keep decomposing compound tasks.
- Stop until all tasks are primitive.

Problem Formalization

Problem Definition

- **Input**: A hierarchical planning problem and a plan.
  - The plan is supposed to be a solution but is actually not due to the errors.
- **Output**: Changes (corrections) to the domain which turn the plan into a solution.

- A planning problem consists of a domain, an initial compound task, and an initial state.
  - The domain specifies the compound and primitive tasks and the methods.
  - The initial compound task specifies which abstract task needs to be solved.

Limitations

- We find such corrections by compiling this problem into another hierarchical planning problem.

Limitations

- Corrections are restricted to inserting missing actions to methods.
- The approach only works for total order hierarchical planning in the grounded setting.

Encoding

For each action in the given plan and each location in methods to which actions can be inserted:

- We construct a compound task controlling whether the action is inserted to that position.

Input Plan

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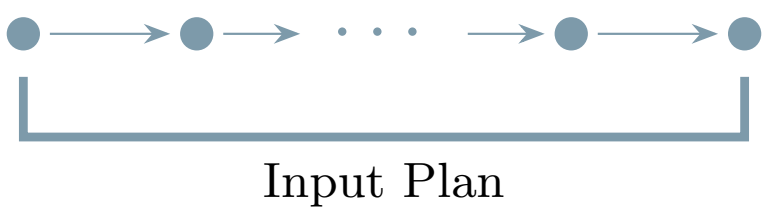

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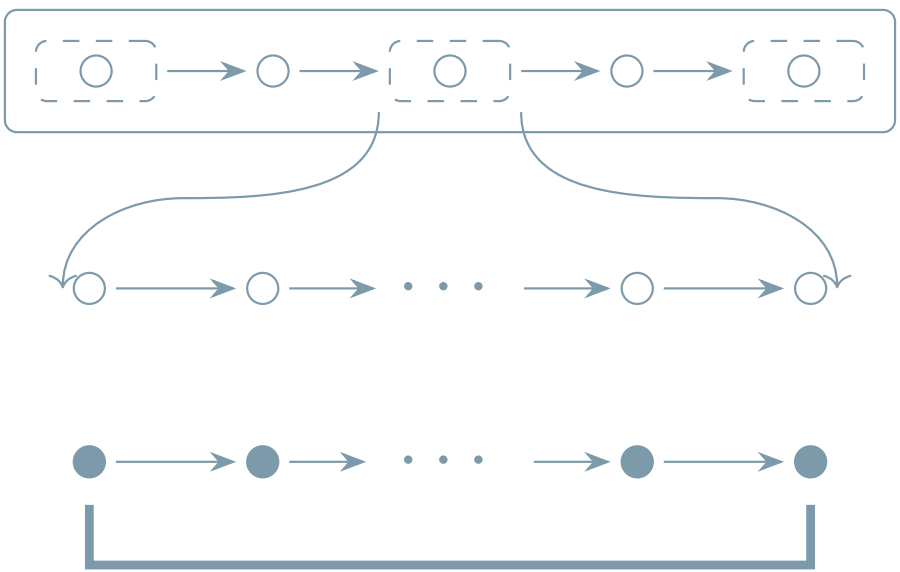

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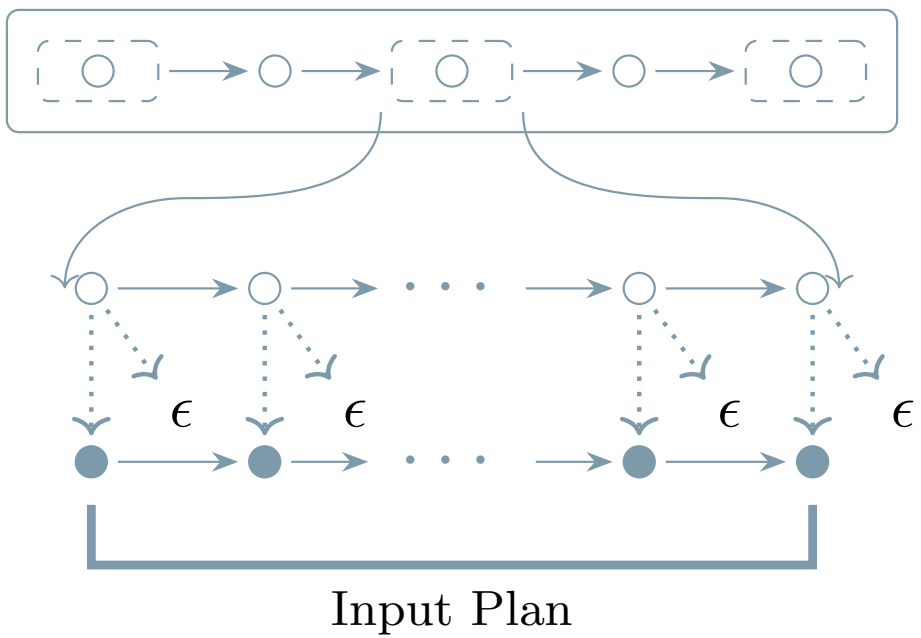
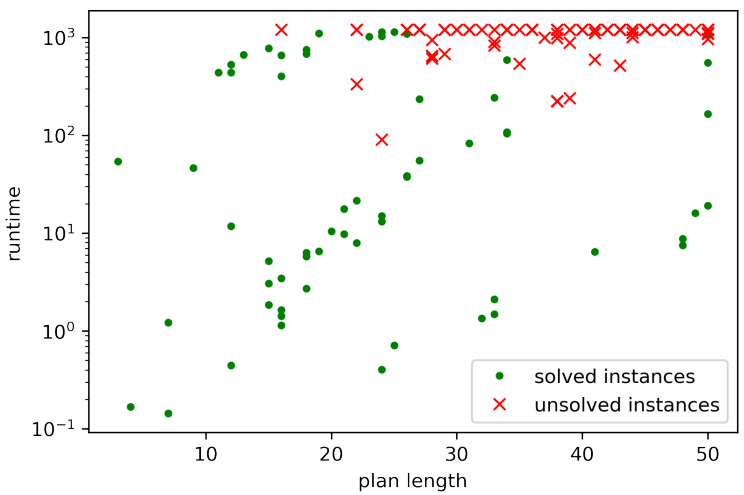


Empirical Evaluation

For each action in a method from a (grounded) domain in IPC 2020 on Hierarchical Planning:

- We let it have 30% chance of being discarded.



	Total	Solved	Plan Length	
			Min	Max
Hiking	20	0	26	45
Transport	20	0	16	50
Entertainment	10	10	24	50
Rover	20	13	16	49
Monroe (FO)	20	9	3	48
Depots	20	4	15	50
Woodworking	9	7	4	24
Satellite	13	10	12	50
Blocksworld	5	1	21	40
Monroe (PO)	20	5	11	48
Childsnack	10	3	50	50
	167	**62**		

Conclusion and Future Work

- We developed an approach for correcting potential errors in a hierarchical planning domain.
  - It works for grounded and totally ordered domains.
  - It can only address errors due to missing actions in methods.

Future Work

We would like to improve the approach by addressing the mentioned limitations.