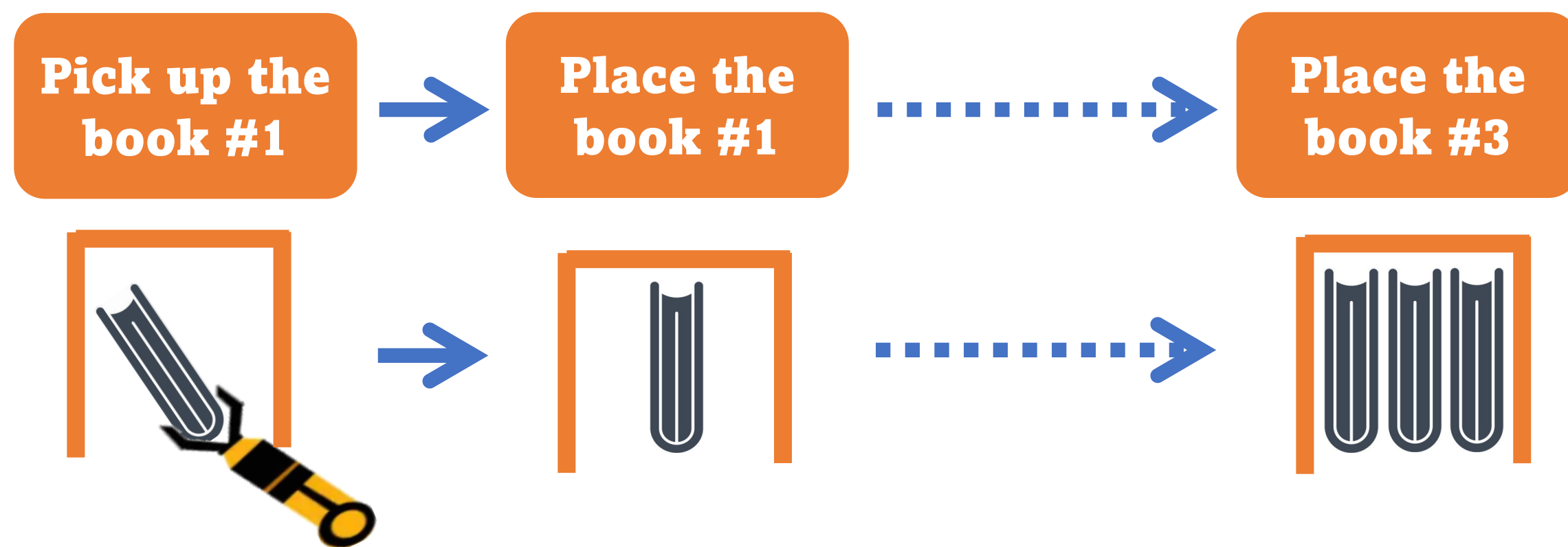# Foresight for Learning-based Task and Motion Planning

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SuperUROP

Task and Motion Planning

Task and Motion Planning (using Machine Learning):
- plan out the high level actions of the robot
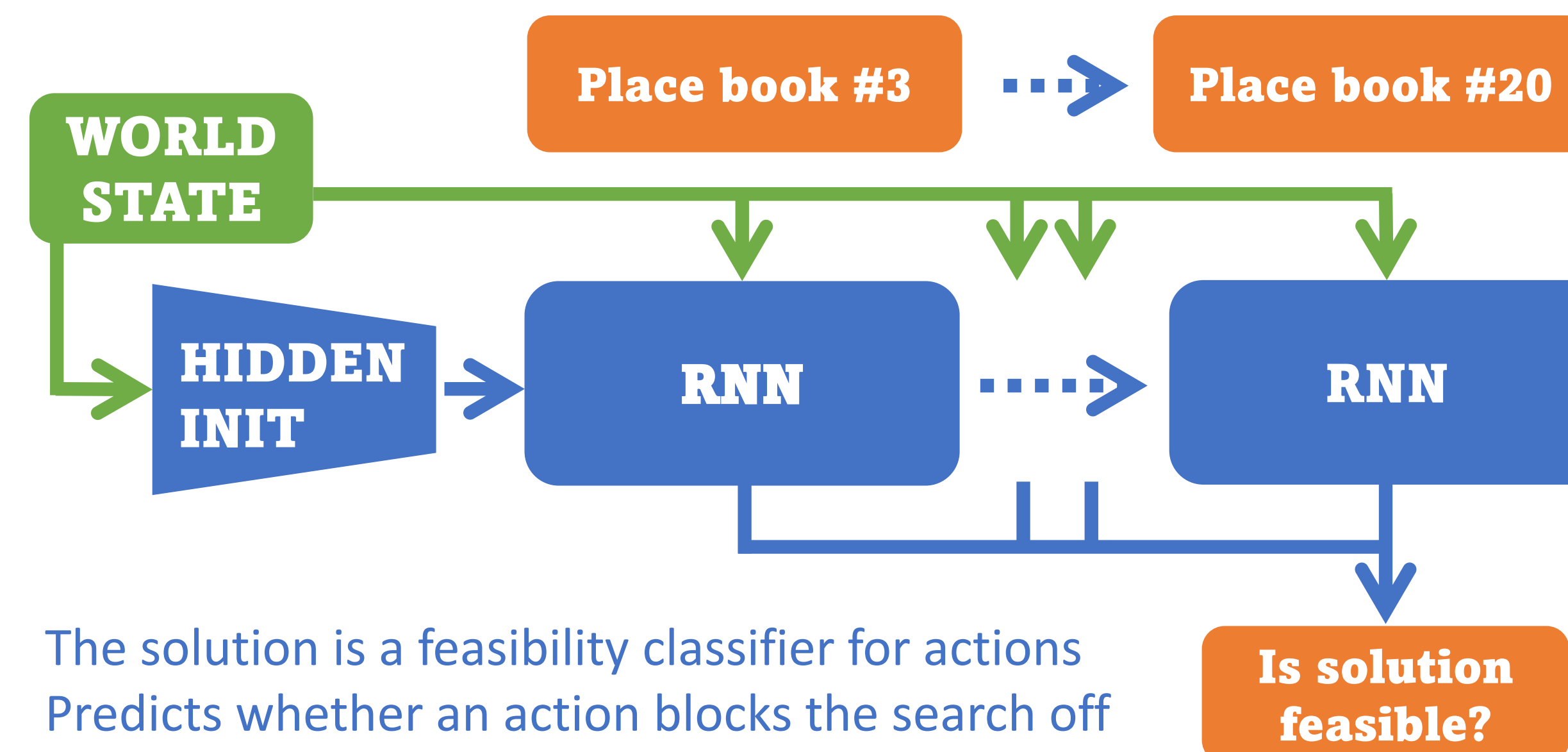- execute those actions using a separate learned policies [1, 2]

Problem: Lack of Foresight

- Two rows of books on a bookshelf
- A robot not conditioned on the entire task plan will randomly block itself off
- How do we condition the motion planner on the entire task plan so that it allows for training?
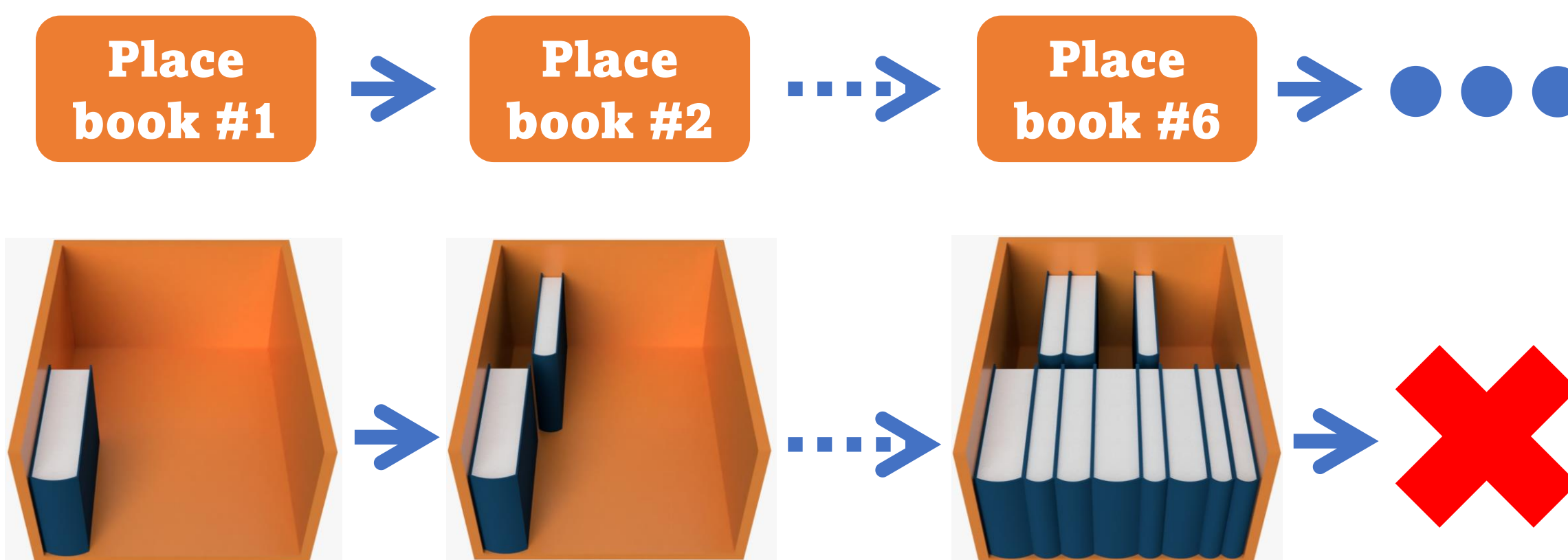
Method – Feasibility Classifier

- The solution is a feasibility classifier for actions
- Predicts whether an action blocks the search off
- For each action there is a separate Recurrent Neural Network (RNN) cell that is fed the world state and predicts the feasibility after that action

Testing Environment

- Put all the boxes into the right shelves and the cover top or bottom
- While different from the bookshelf environment, the robot also won't be able to complete it unless the policies are conditioned on the goal

(Expected) Results

- My method is able to scale linearly in time with the size of the environment
- It accounts for the goal of the task so the search is less explosive
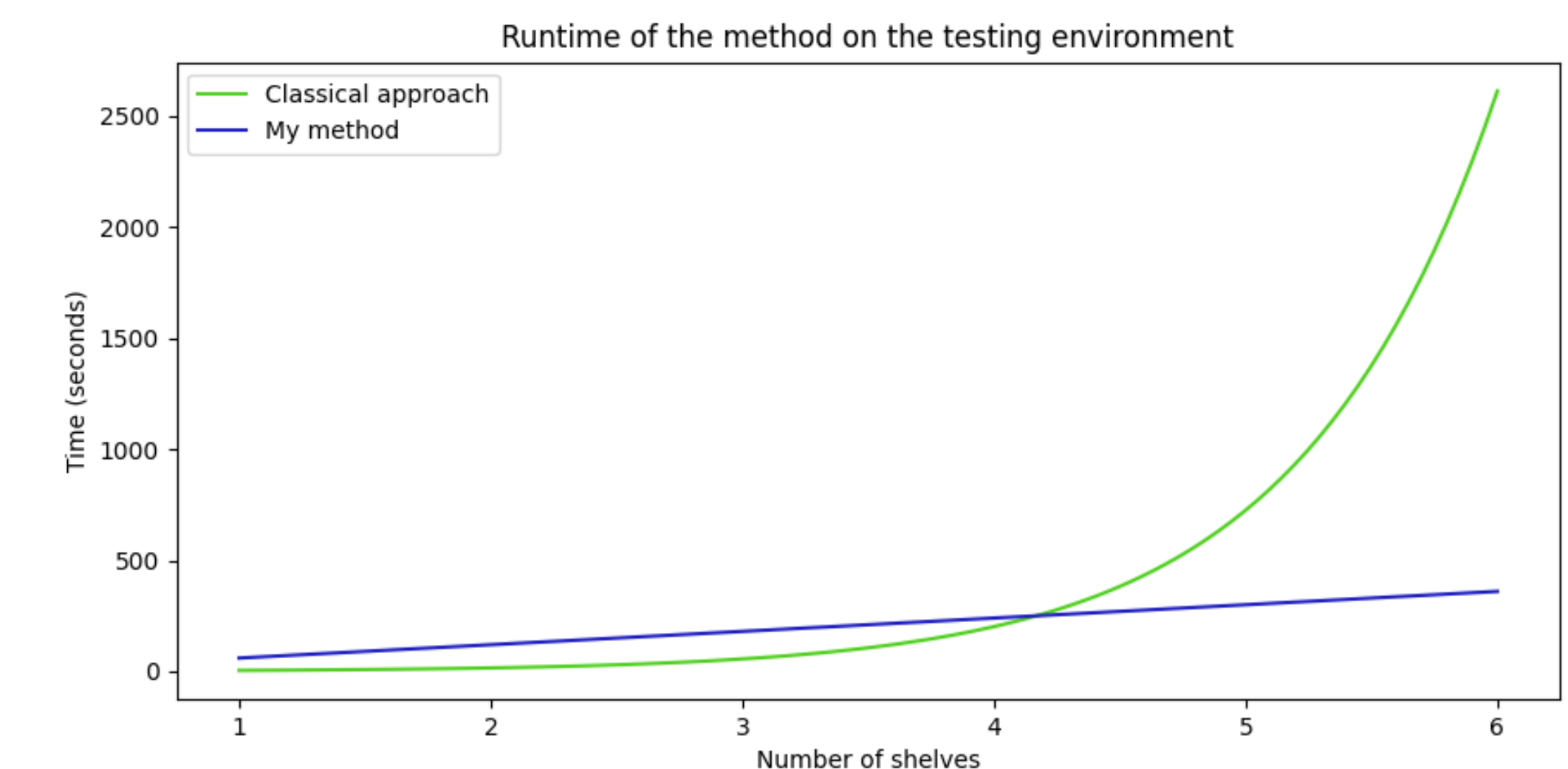
Conclusion

- Foresight for Task and Motion Planning is necessary for environments that have long-range dependencies not captured by task planning
- The solution is to condition the motion planning on the entire task plan using a feasibility classifier.
- Current work focuses on testing out the idea and comparing it to the performance of existing solutions.

[1] Garrett, Caelan Reed, et al. "Integrated task and motion planning." *Annual review of control, robotics, and autonomous systems* 4 (2021): 265-293.

[2] Chitnis, Rohan, et al. "Learning neuro-symbolic relational transition models for bilevel planning." *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE, 2022.