This file contains all of the hypothesis spaces learned by all of the DQNs in all of our test PMSIs, arranged in the following order: the multi-domain PMSI, the language queries PMSI, the mathematics PMSI, and the robot planning PMSI.

The hypothesis spaces learned by our test PMSI for all domains at once. Useful primitives for the Language Queries, Equation Solving, and Robot Planning domains are orange, blue, and green, respectively. Notice how it's learned action chunks mostly separate domains. We did not explicitly tell it to do this.

DQN #6 (lowest level)

1. (after_to_before)

2. (in-back-of_to_in-front-of)

3. (because_to_before)

4. (chain_before_relations)

5. (in-front-of_to_before)

6. (years_to_after)

7. (check_if_solution_is_explicit)

8. (simplify_products)

9. (simplify_fractions)

10. (add_like_terms)

11. (divide_by_relevant_multiple)

12. (apply_quadratic_formula)

13. (update_innerese_world_representation)

14. (attempt_to_place_x_on_y)

15. (unstack_item_above_x_to_reach_x)

16. (unstack_item_above_y_to_make_room_for_x)

DQN #5

1. (in-back-of_to_in-front-of)

2. (because_to_before)

3. (simplify_fractions)

4. (unstack_item_above_y_to_make_room_for_x **=>** update_innerese_world_representation)

5. (add_like_terms **=>** divide_by_relevant_multiple **=>** check_if_solution_is_explicit)

6. (in-front-of_to_before **=>** chain_before_relations)

7. (unstack_item_above_y_to_make_room_for_x **=>** attempt_to_place_x_on_y)

8. (unstack_item_above_x_to_reach_x **=>** attempt_to_place_x_on_y)

9. (apply_quadratic_formula **=>** check_if_solution_is_explicit)

10. (simplify_products **=>** add_like_terms)

11. (after_to_before **=>** chain_before_relations)

12. (years_to_after **=>** after_to_before)

DQN #4

1. (in-front-of_to_before **=>** chain_before_relations)

2. (after_to_before **=>** chain_before_relations)

3. (years_to_after **=>** after_to_before)

4. (simplify_products **=>** add_like_terms **=>** apply_quadratic_formula **=>** check_if_solution_is_explicit)

5. (unstack_item_above_y_to_make_room_for_x **=>** attempt_to_place_x_on_y **=>** unstack_item_above_y_to_make_room_for_x **=>** update_innerese_world_representation **=>** because_to_before)

6. (unstack_item_above_y_to_make_room_for_x **=>** attempt_to_place_x_on_y **=>** unstack_item_above_x_to_reach_x **=>** attempt_to_place_x_on_y)

7. (simplify_fractions **=>** simplify_products **=>** add_like_terms)

8. (attempt_to_place_x_on_y **=>** in-back-of_to_in-front-of **=>** because_to_before)

9. (simplify_fractions **=>** add_like_terms **=>** divide_by_relevant_multiple **=>** check_if_solution_is_explicit)

DQN #3

1. (years_to_after **=>** after_to_before)

2. (simplify_products **=>** add_like_terms **=>** apply_quadratic_formula **=>** check_if_solution_is_explicit)

3. (unstack_item_above_y_to_make_room_for_x **=>** attempt_to_place_x_on_y **=>** unstack_item_above_y_to_make_room_for_x **=>** update_innerese_world_representation **=>** because_to_before)

4. (attempt_to_place_x_on_y **=>** in-back-of_to_in-front-of **=>** because_to_before **=>** in-front-of_to_before **=>** chain_before_relations)

5. (simplify_fractions => simplify_products => add_like_terms => simplify_fractions => add_like_terms => divide_by_relevant_multiple => check_if_solution_is_explicit)

6. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y)

7. (attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => after_to_before => chain_before_relations)

DQN. #2

1. (simplify_products => add_like_terms => apply_quadratic_formula => check_if_solution_is_explicit)

2. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => update_innerese_world_representation => because_to_before)

3. (simplify_fractions => simplify_products => add_like_terms => simplify_fractions => add_like_terms => divide_by_relevant_multiple => check_if_solution_is_explicit)

4. (attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => after_to_before => chain_before_relations)

5. (years_to_after => after_to_before => attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => in-front-of_to_before => chain_before_relations)

6. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y)

DQN #1 (top level)

1. (simplify_products => add_like_terms => apply_quadratic_formula => check_if_solution_is_explicit)

2. (simplify_fractions => simplify_products => add_like_terms => simplify_fractions => add_like_terms => divide_by_relevant_multiple => check_if_solution_is_explicit)

3. (attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => after_to_before => chain_before_relations)

4. (years_to_after => after_to_before => attempt_to_place_x_on_y => in-back-of_to_in-front-of => because_to_before => in-front-of_to_before => chain_before_relations)

5. (unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => update_innerese_world_representation => because_to_before => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y => unstack_item_above_x_to_reach_x => attempt_to_place_x_on_y => unstack_item_above_y_to_make_room_for_x => attempt_to_place_x_on_y =>

unstack_item_above_x_to_reach_x **=>** attempt_to_place_x_on_y **=>**
unstack_item_above_y_to_make_room_for_x **=>** attempt_to_place_x_on_y **=>**
unstack_item_above_y_to_make_room_for_x **=>** attempt_to_place_x_on_y **=>**
unstack_item_above_x_to_reach_x **=>** attempt_to_place_x_on_y)

The hypothesis spaces learned by our test PMSI for the Language Queries domain.

DQN #4 (lowest level)

1. (years_to_after)

2. (after_to_before)

3. (because_to_before)

4. (in-back-of_to_in-front-of)

5. (in-front-of_to_before)

6. (chain_before_relations)

DQN #3

1. (in-front-of_to_before **=>** chain_before_relations)

2. (because_to_before **=>** chain_before_relations)

3. (after_to_before **=>** chain_before_relations)

4. (years_to_after)

5. (in-back-of_to_in-front-of)

DQN# 2

1. (in-back-of_to_in-front-of **=>** in-front-of_to_before **=>** chain_before_relations)

2. (chain_before_relations **=>** because_to_before **=>** chain_before_relations)

3. (after_to_before **=>** chain_before_relations)

4. (years_to_after)

DQN #1 (top level)

1. (in-back-of_to_in-front-of **=>** in-front-of_to_before **=>** chain_before_relations)

2. (chain_before_relations **=>** because_to_before **=>** chain_before_relations)

3. (years_to_after **=>** after_to_before **=>** chain_before_relations)

The hypothesis spaces learned by PMSI for the Equation Solving domain.

DQN #2 (lowest level)

1. (add_like_terms)

2. (simplify_fractions)

3. (simplify_products)

4. (apply_quadratic_formula)

5. (divide_by_relevant_multiple)

6. (check_if_solution_is_explicit)

DQN #1 (top level)

1. (divide_by_relevant_multiple **=>** check_if_solution_is_explicit)

2. (apply_quadratic_formula **=>** check_if_solution_is_explicit)

3. (simplify_fractions **=>** simplify_products)

4. (add_like_terms)

The hypothesis spaces learned by PMSI for the Robot Planning domain.

DQN #4 (lowest level)

1. (attempt_to_place_x_on_y)

2. (unstack_item_above_x_to_reach_x)

3. (unstack_item_above_y_to_make_room_for_x)

4. (update_innerese_world_representation)

DQN #3

1. (unstack_item_above_x_to_reach_x **=>** attempt_to_place_x_on_y)

2. (unstack_item_above_y_to_make_room_for_x **=>** attempt_to_place_x_on_y)

3. (unstack_item_above_y_to_make_room_for_x **=>** unstack_item_above_x_to_reach_x)

4. (update_innerese_world_representation)

DQN #2

1. (unstack_item_above_y_to_make_room_for_x **=>** unstack_item_above_x_to_reach_x **=>** unstack_item_above_y_to_make_room_for_x **=>** attempt_to_place_x_on_y)

2. (unstack_item_above_y_to_make_room_for_x **=>** unstack_item_above_x_to_reach_x **=>** unstack_item_above_x_to_reach_x **=>** attempt_to_place_x_on_y)

3. (update_innerese_world_representation)

DQN #1 (top level)

1. (unstack_item_above_y_to_make_room_for_x **=>** unstack_item_above_x_to_reach_x **=>** unstack_item_above_y_to_make_room_for_x **=>** attempt_to_place_x_on_y **=>** unstack_item_above_y_to_make_room_for_x **=>** unstack_item_above_x_to_reach_x)

2. (unstack_item_above_y_to_make_room_for_x **=>** unstack_item_above_x_to_reach_x **=>** unstack_item_above_x_to_reach_x **=>** attempt_to_place_x_on_y)

3. (update_innerese_world_representation)