

TRANSFER LEARNING IN REINFORCEMENT LEARNING WITH STABLE BASELINES3 AND GYM / **PART 2**

-
- Research by: Stephen Polin



Recap

Frozen Lake

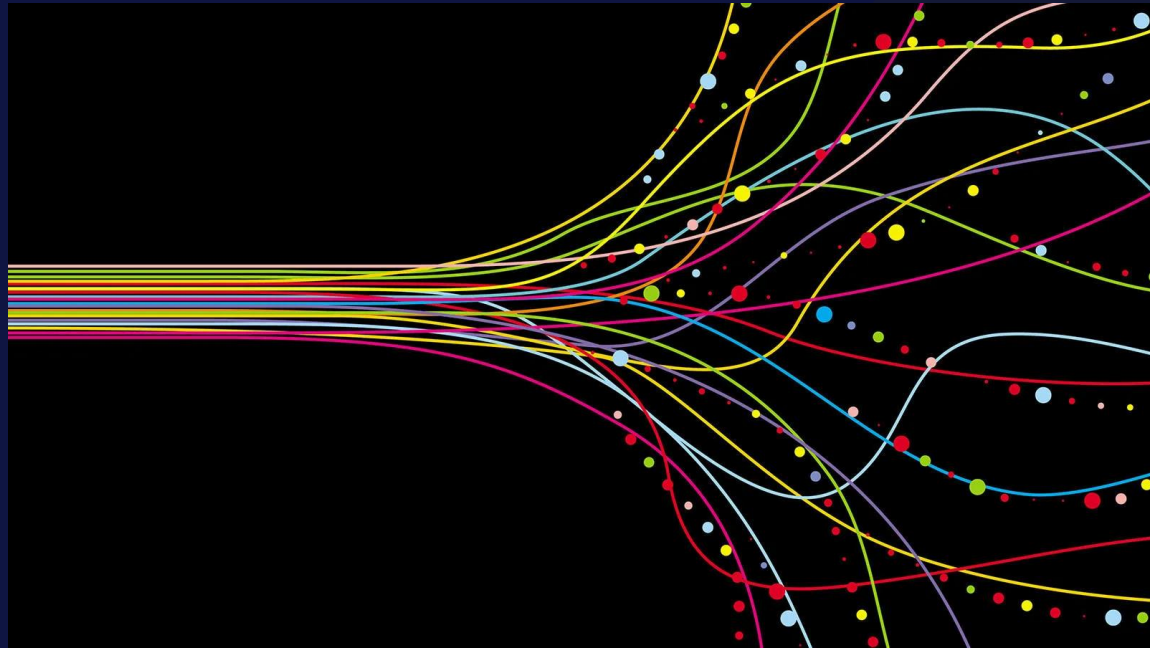
- Game where AI agent plays in square grid
- Wins once reaching the present
- Loses once landing on a hole
- Slippery Effect



Recap

Vectorized Environments

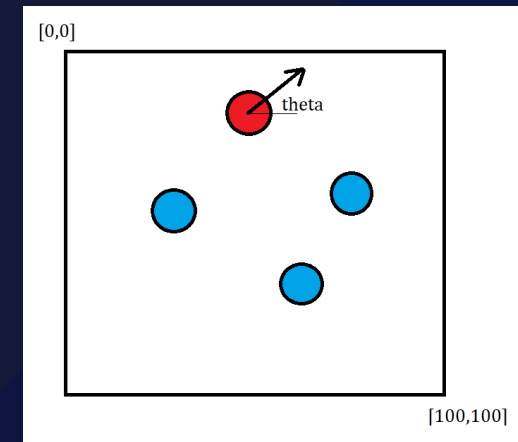
- Allows for multiple environments to train synchronously



Recap

TL Issues

- Environments with differing Observation Spaces
 - Where the agent can move
- Environments with differing Action Spaces
 - How the agent can move



TL Solutions

Similar Transfer

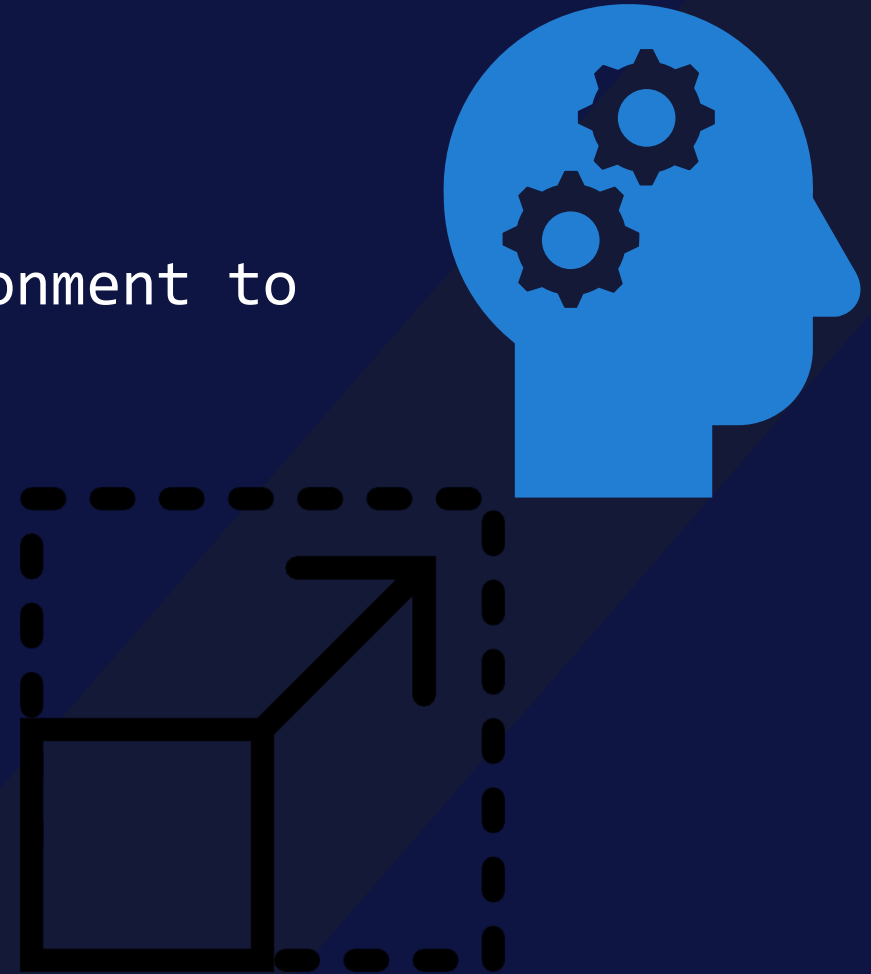
- Use environments within same Action/Observation space
- Environments have different metadata/properties



TL Solutions

Map Resizer

- Algorithm that allows an environment to make predictions on different observation spaces



Map Resizer

- Shrink/Enlarge
- Start = Current Position
 - Basic Transfer
 - Alternating Transfer

```
class FrozenLakeResizer:
    def __init__(self, map: list[str], size: int) -> None: ...

    def set_map(self, map: list[str]) -> None: ...

    def set_size(self, size: int) -> None: ...

    def _find_start_goal(self) -> Tuple[Coord, Coord]: ...

    def _map_has_floor(self, map: list[str]) -> bool: ...

    def _map_has_start(self, map: list[str]) -> bool: ...

    def _map_has_goal(self, map: list[str]) -> bool: ...

    def _center_shruken_map(self) -> list[str]: ...

    def _get_floor_coords(self, map: list[str]) -> list[Coord]: ...

    def _shrink_map(self) -> list[str]: ...

    def _grow_map(self) -> list[str]: ...

    def convert_map(self) -> list[str]: ...

    def set_start(self, obs: int): ...
```

Map Resizer

Shrink

- Grab smaller map that with focus on current position
 - If no goal, replace with closest frozen tile
-

Map Resizer

Enlarge

- Smaller map shifted to top left
 - Empty spaces filled with holes
-

Reward Shaping

The process of modifying the base rewards to bias the agent's exploration

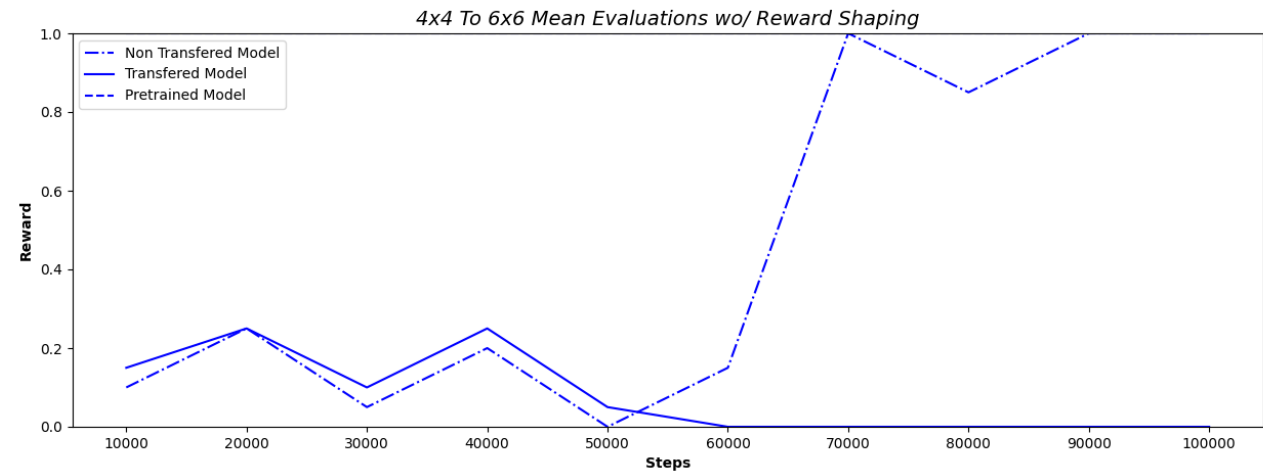
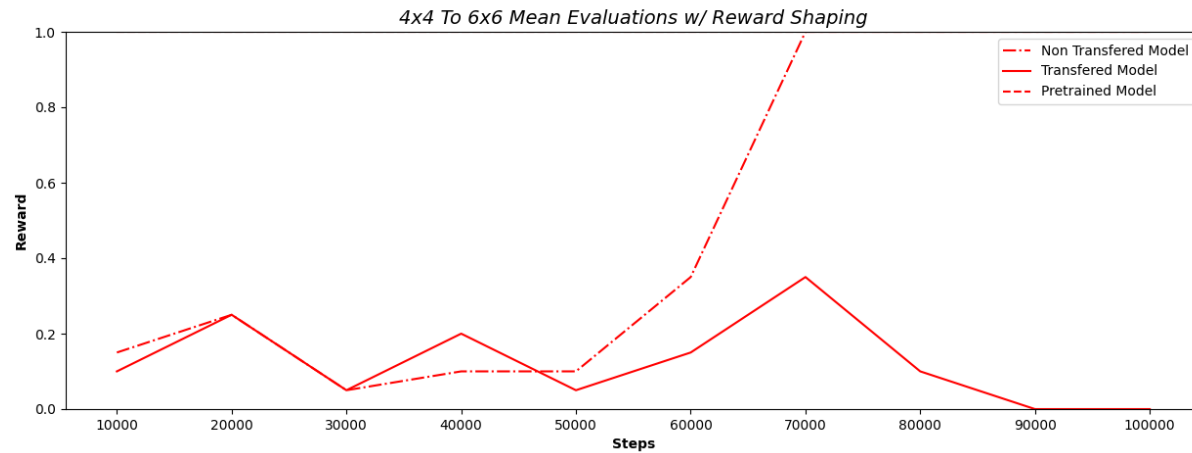
Source: <https://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=D24F03C6A8042512E1F6DAA99DEE1B63?doi=10.1.1.725.155&rep=rep1&type=pdf>

Reward Shaping

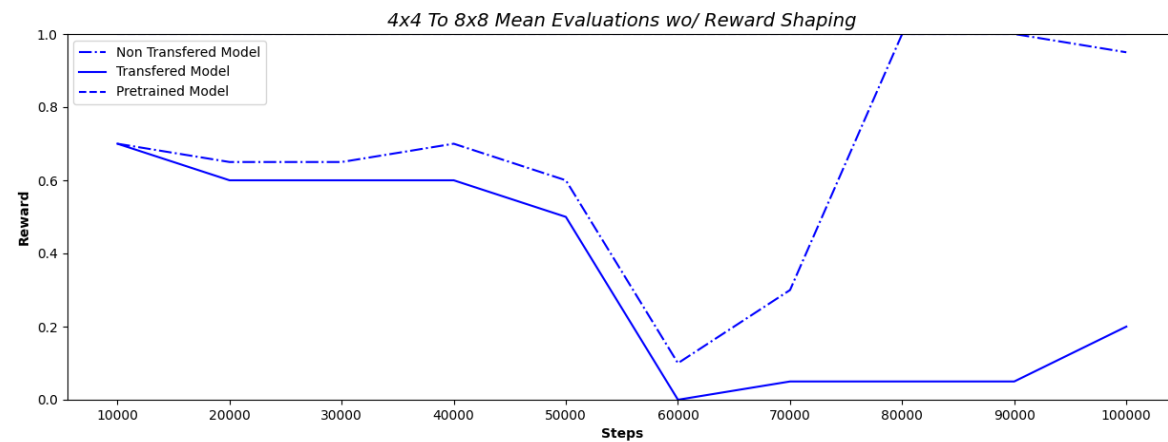
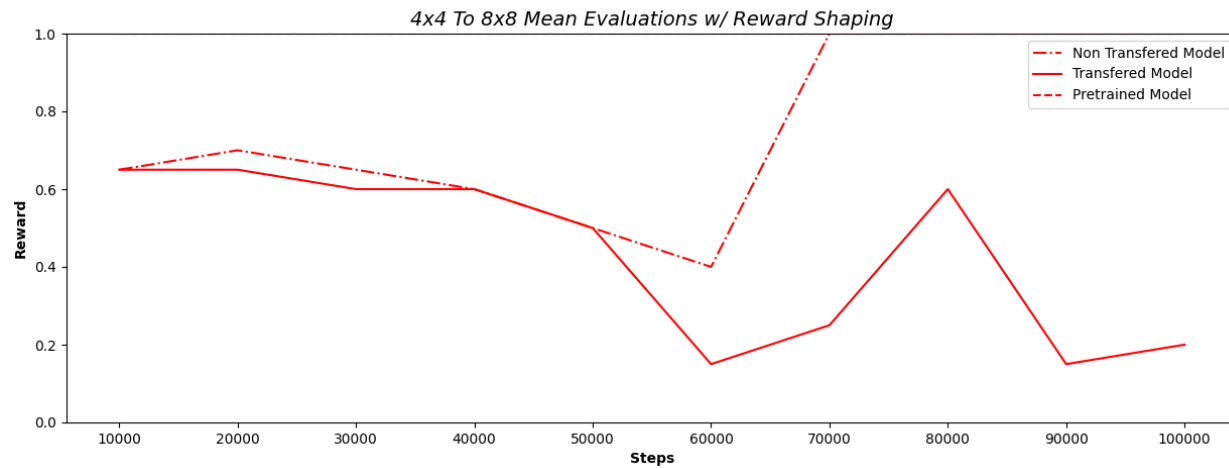
Basic Re-Shaping Frozen Lake

- Base Rewards
 - Goal = +1
 - Other = 0
 - Modified Rewards
 - Goal = +1
 - Frozen = 0
 - Hole = -1
-

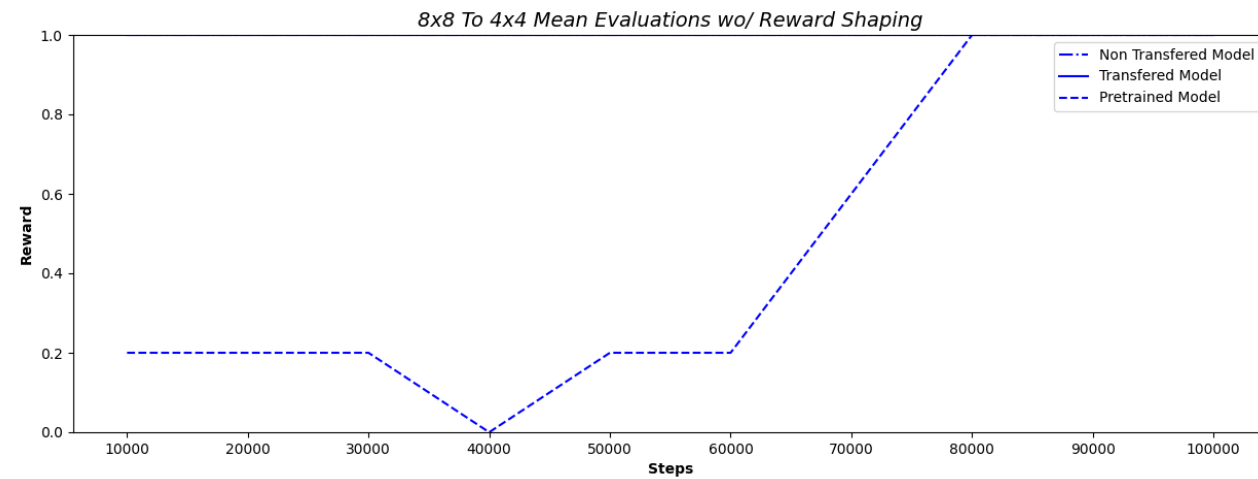
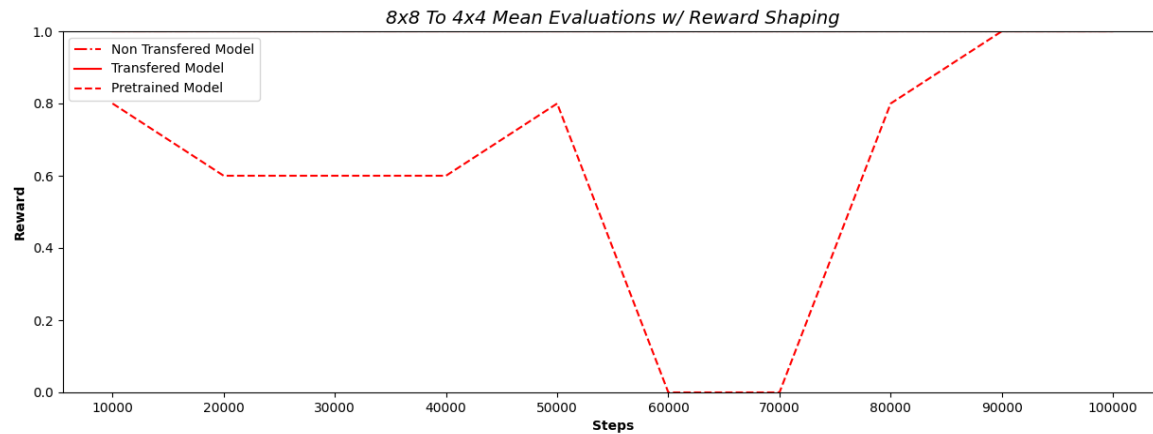
Results



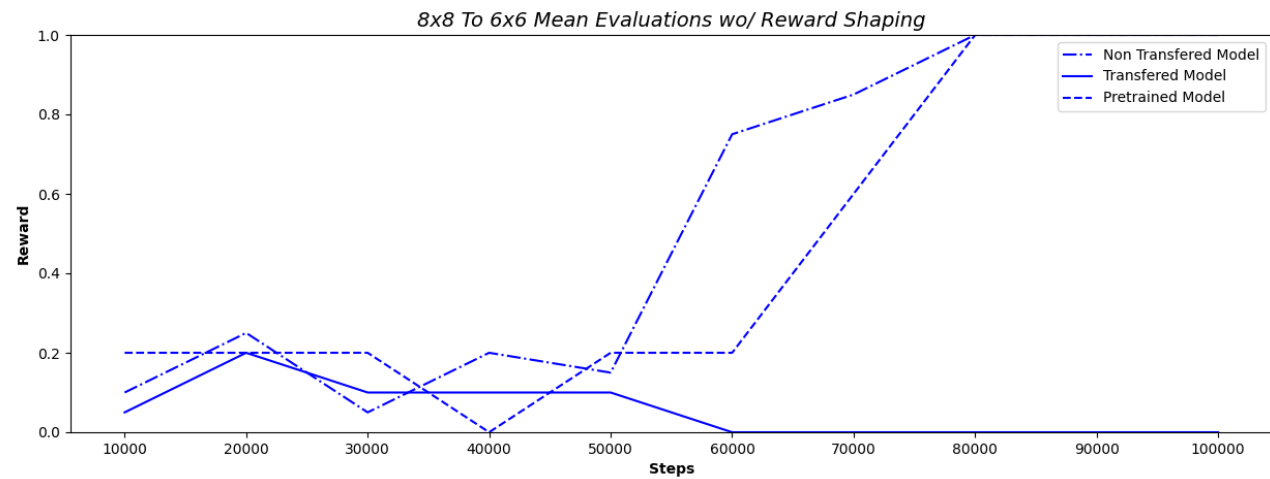
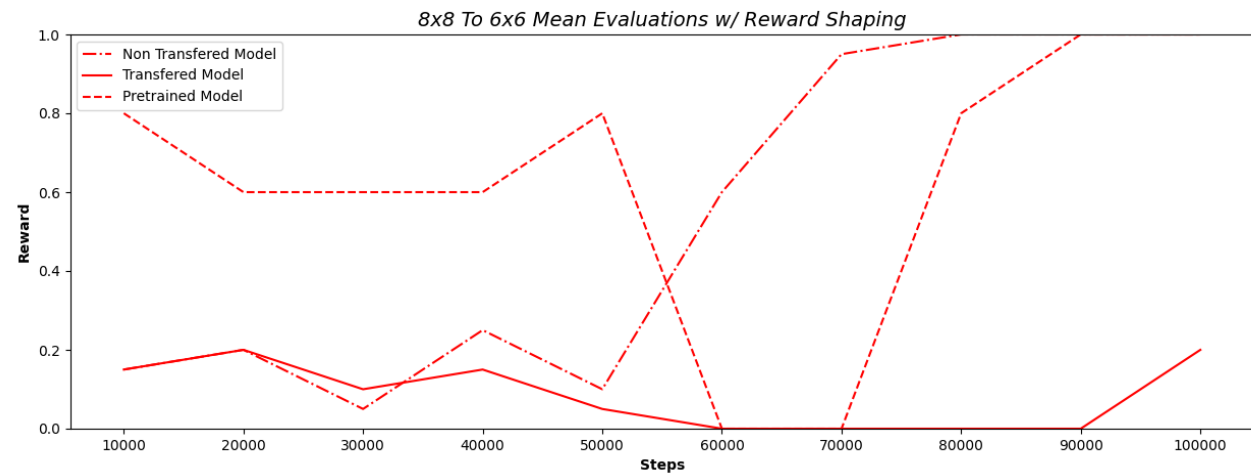
Results



Results



Results



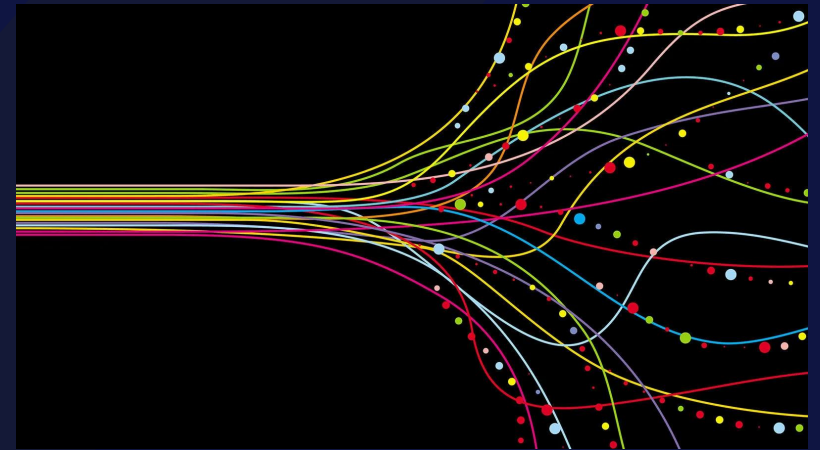
Conclusions

- Map Resizing is not a successful TL method
- Reward shaping had no effect



Future Goals

- Use more advanced TL and RS methods
- Transfer agent from one game to another
- Transfer agent from Discrete Space to Non-Discrete Space



Thank You!

