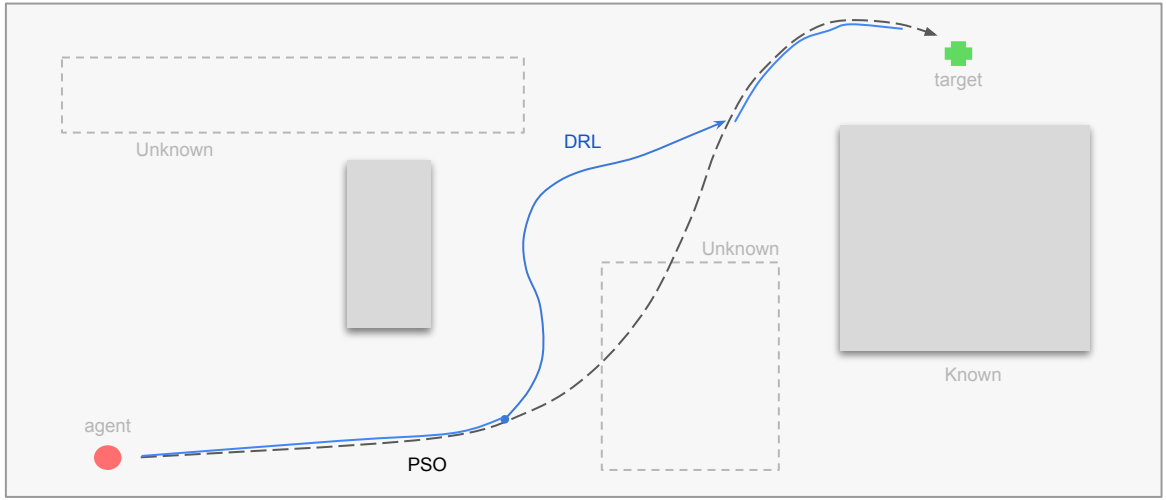
# DRL Model

Definition Phase

# Problem: DRL model lets the agent follows a pre-defined trajectory

| | **Stand-alone** | **Optima** |
|---|---|---|
| **Pre-defined Trajectory** | Straight line<br>( Updated by time) | PSO |



# Domains

## Action Space

### Discrete

- Move forward
- Move backward
- Move Left
- Move Right

} Fix angle step

### Continuous

- Move forward
- Move backward
- Move Left
- Move Right

} Vel. Magnitud

} Vel. Vector

## State Space

### Raw

- (x, y)
- Heading
- velocity
- Goal *wp*

### Preprocessed

Discarded
agent - guide line Angle

- Distance to the goal
- Distance to the guide line
- Heading angle error
- Distance to the Obstacle

## Reward Space

- Reach the Goal
- Reach *wp*

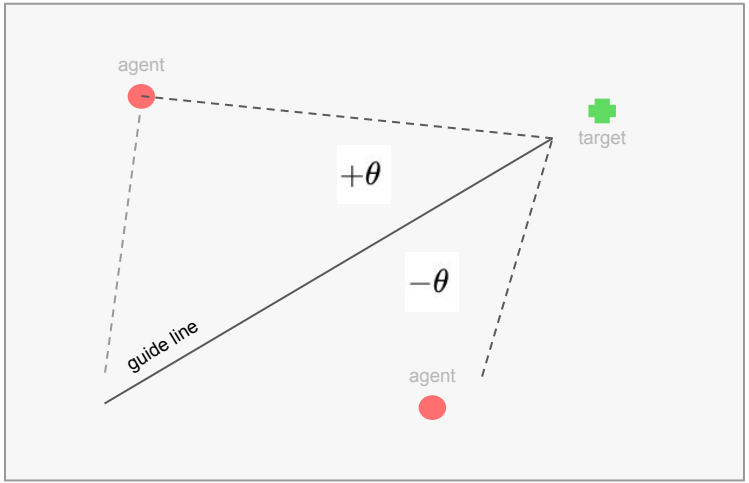
| | |
|---|---|
| Inverse to Angle | [-1, 1] |
| Inverse to Distance | [0, 1] |

Bright colors are chosen for this Iteration

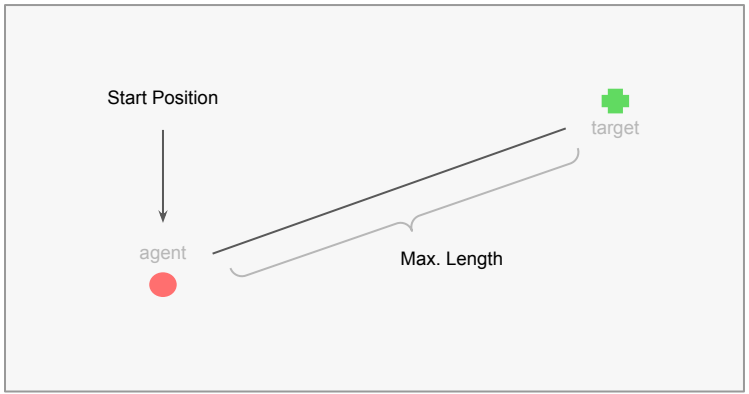
## STATE

Discarded

agent - guide line Angle

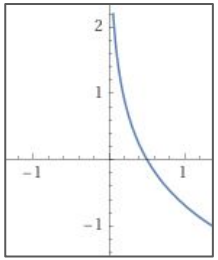



Distance to the goal




## REWARD

$$r = -log(\theta) + log(\,0.5\,[grad]\,)$$




*r is normalized [-1, 1]

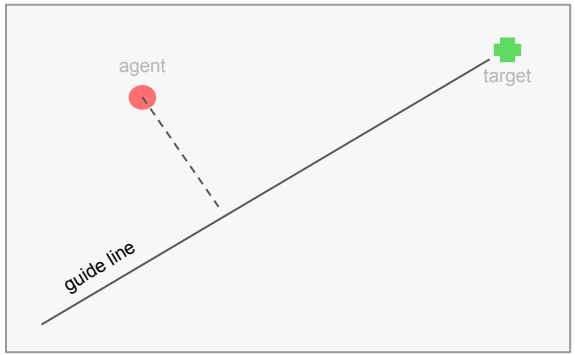
$$r = \frac{max.\,distance\ -\ current\,distance}{max.\,distance}$$

Reward value [-1, 1]

State goes from 1 to 0

# STATE

Distance to the guide line



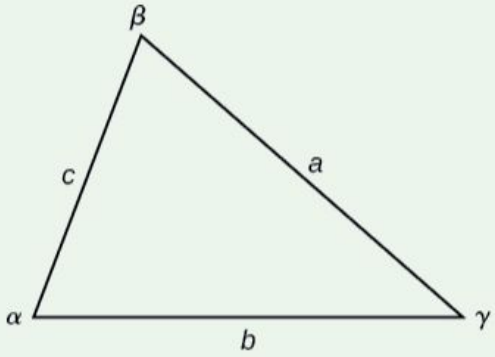
# Notes

1. Include penalty for collision
2. Share weights between actor and critic models

# End

For triangles labeled as in the figure on the right, the Law of Cosines is given as three equations.

$$a^2 = b^2 + c^2 - 2bc\cos\alpha$$
$$b^2 = a^2 + c^2 - 2ac\cos\beta$$
$$c^2 = a^2 + b^2 - 2ab\cos\gamma$$




To solve for a missing side measurement, the corresponding opposite angle measure is needed.

When solving for an angle, the corresponding opposite side measure is needed. We can use another version of the Law of Cosines to solve for an angle.

$$\cos\alpha = \frac{b^2 + c^2 - a^2}{2bc} \qquad \cos\beta = \frac{a^2 + c^2 - b^2}{2ac} \qquad \cos\gamma = \frac{a^2 + b^2 - c^2}{2ab}$$