# Target

The whole project is to let the signal agent use RL to find the best signal strategy.

Signal Agent – Play the Traffic Game – Get Strategy table.

[State] – [Action] – [Reward Expectations]

PS: dumb car first, smart car later.

# ABM

The aim of the ABM is to make a **game environment** for signal agents to learn what is the best strategy when it’s facing different traffic environments.

## Environment Definition

Using the grid world ([Mesa SingleGrid](https://mesa.readthedocs.io/en/stable/apis/space.html#mesa.space.SingleGrid)), patches with color present the signal agent area.

**Grid attributes:**

State – road, signal, intersection, none - string

**Grid functions:**

isRoad – return Boolean

isSignal – return Boolean

isIntersection - Return Boolean

### Single Intersection Env

A picture containing text, square, screenshot, line

Description automatically generated

### Multiple Intersection Env

A screenshot of a computer game

Description automatically generated with low confidence

## Agent Definition

### Signal Agent

**Attribute:**

ID - int

State – store the signal current state – NS or EW – string.

Reward – the reward in each step - double

**Behavior:**

Switch – change the current state to opposite state, NS to EW or EW to NS

### Car Agent

**Attribute:**

Speed – how far a car can go in a step – double.

Tips – the reward which cars give to signal agent – double

Head – the cars heading – string

\* For model extension

Path – contain the direction in each intersection – list

Position – local position in the path – string

**Behavior:**

Move – move the car to his head based on its speed

Stop – set the speed in 0

SpeedUp – increase the speed

SpeedDown – decrease the speed

CostReward – Calculate the tips

GiveReward – give the reward to signal agent

Die – delete this car

### Generation Agent

This agent is used to generate cars from the out of intersection system.

Or add cars into the intersection system.

**Attribute:**

Code – The identification code – string? Or int

Location – its location relative to the intersection system – (X,Y)

GenSpeed – the speed that it creates car agent – int/ double

Behavior:

CreateCar – place a new car with attribute.

### Recycling Agent

Clean the car agent who left the system.

**Attribute:**

Code – The identification code – string? Or int

Location – its location relative to the intersection system – (X,Y)

**Behavior:**

DestoryCar – Return Boolean.

## Data Collector

Environment Data Collection:

Traffic flow in four directions – in tuple (N, S, W, E) - int

Average waiting time – double

Average speed – double

Current Reward – double

Expectation Reward Table – in tuple or matrix? – [State, Action, Reward]

# RL

Mainly using the Q Learning