# Finding The Shortest Path Using Reinforcement Learning

## Motivation

Path planning is widely used in modern society; for example, for navigating and logistics. According to distance and traffic situation, the optimal path between two location will be calculated. Although there are already many existing algorithms to find the best path, we shall attempt to solve this problem with reinforcement learning.

This project offers an agent which could find the shortest path between two location in a unfamiliar road network and thus reduce the cost of time and energy.

## Project description

We will draw some line on the ground as the road to formed road network with many crossroads and choose two point of them as starting point and destination. The E-Puck robot will be placed at the starting point and start to explore the road network. The robot will decide direction at every crossroad. Once the E-puck reach the destination, it will be replaced at the same starting point. After several trials, the E-puck may find the shortest path to the destination.

## Model

### State

In this project, we will choose different crossroads as the state. A preliminary plan would include a road network with 8-10 states. We are aware of difficulties in recognizing the different states.

After brainstorming, we have two tentative solution for this problem. First, we will make some different marks at crossroads and we could use the under sensor on E-puck to scan the marks to determine the current state. Alternative we could use the front cmos camera to recognition the different images we put in crossroads in order to determine the states.

report

1. project description:

somehow like a postman send the packages to the destinations or amazon roboters

a epuck will follow the line in the map, detect the atificial road, city map with different blocks,

the map have many crossroads

the map will be given previously,

e peck will find the optimal route to destination

we shall add some obtascles in the future.

2. model:

action: trun right, turn left, turn right, forward, backward(转的时候要掉头，不能直接向后转)

states: different crossroads 5-10 states

reward: when the epuck arrives at the destination, it will get 10 points, the another states are 0.

3.how to judge which state epuck is:

solution 1: use the under sensor to scan the "光电黑白编码" on the road in oder to know which 'road' the Epuck is.

solution 2: use the front cmos camera to do some pattern recognition.

e.g. detect 'A', 'B', 'C'.......

or: dectect differnt colors

4. algorithm:

q learning

calculate the different states' Q-function

5. how to avoid obstacles:

differnt from the grid world scenary, epuck will go 'into' the obstacles, namely wrong states. so how to deal with these

problems?

a question:

whether add new states for the new coming obstacles or 'blind alley'

project management:

division:

stage 0:

stage 1:

stage 2: