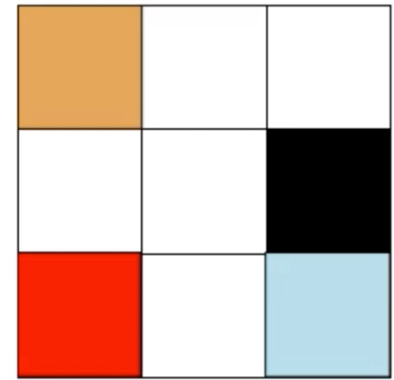


# Summer research opportunity

**Project:** program and compare control methods and deep reinforcement learning methods in solving **Maze** problem (with Masahiro Konishi)



**Duration:** 2 weeks in August—September

**Location:** basically remote

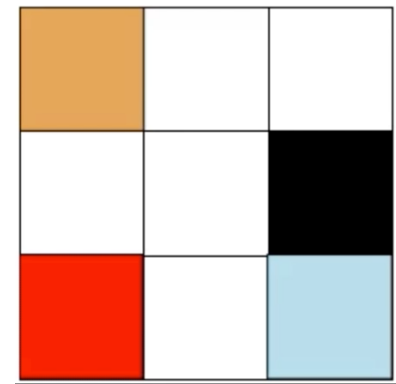
**Contact:** [cai@omu.ac.jp](mailto:cai@omu.ac.jp)

**Deadline:** August 5, 2022

(max 2 名)

# Problem description

Consider a robot in a maze.



The maze has a start location (yellow), an exit location (blue), some obstacles (black), and some dangerous locations (red). See an example in the figure above.

The robot tries to go from start location to exit location. The robot can only see its current location and four neighboring locations (up, down, left, right). So initially the robot does not know where the exit, obstacles, and dangers are. The robot can only move in four directions (up, down, left, right).

Design an algorithm for the robot to solve the maze.

# Project 1 (learning method)

We have already coded a reinforcement learning algorithm, called Q-learning, to solve this maze problem. The code is available.

- 1.1. Test this code with enlarging size of the maze. Verify how large size the maze this code can handle.
- 1.2. Develop a “deep Q-learning” algorithm to solve large maze that cannot be handled by Q-learning.
- 1.3. Design another reinforcement learning algorithm, called policy-learning, to solve the maze problem.

## Project 2 (control method)

If the robot knew everything about the maze, we have already coded a supervisory control algorithm to solve this maze problem. The code is available.

1.1. Modify the code so that it can handle the case where the robot only knows local information of the maze.

1.2. Test the modified code with enlarging size of the maze. Verify how large size the maze this modified code can handle.