

## CIBot Square Agent Description

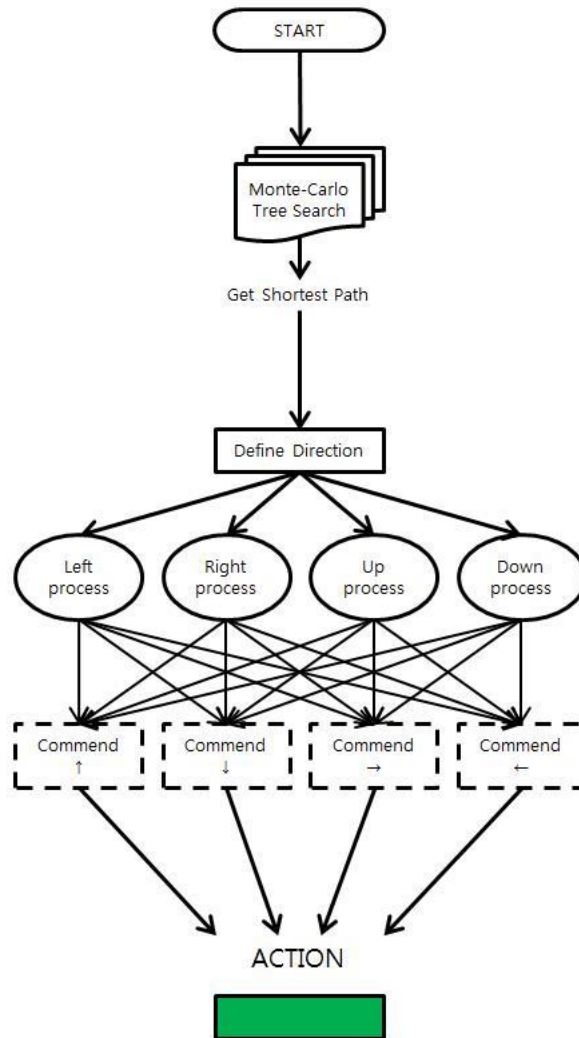


Figure 1. Agent Flow Diagram

The Square Agent uses Monte-Carlo Tree Search (MCTS) Algorithm basically. At first, agent analyzes each obstacle of the map and identifies whether it is possible to move or not. Directed graph with shape-assigned edge connected with all movable paths (in figure 2) was represented using obtained information. The reason why we build this graph is that it is difficult to understand agent can move specific areas and to identify the characteristic of map for changing a square agent's shape. Finally, this defined directed graph is converted into tree structure for searching optimal path that can get all diamonds in a short time. We adopted MCTS to get planning agent can get whole diamonds except some specific cases (e.g. hanging on the corner of obstacle).

Using MCTS, the square agent search the best path that get all diamonds before agent act initially. This path is maybe not the optimal route, but MCTS return the path like the optimal route if MCTS more search well. In previous work, we employ A-star Algorithm to find shortest path from agent to one diamonds. this previous work excessively used A-star to find path and fall into local-optima problem in this game. However, in current approach, we consider whole diamonds before agent act with planning by using directed graph with MCTS.

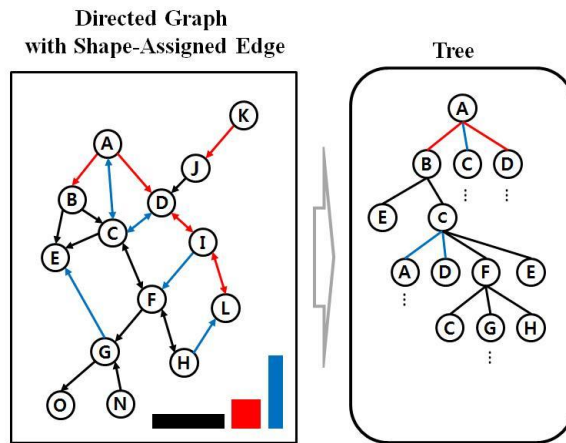


Figure 2. The conversion of the directed graph into tree structure for MCTS  
(color means the type of shape)