

Aggregation - Example solution

The example solution for the aggregation exercises follow the *Sense-Think-Act* pattern. The *Think* part of the pattern is structured as a finite-state machine. The states in the finite-state machine describe the actions that the robot will take in the *Act* part. Transitions between the states are triggered by environmental conditions that the robot perceives in the *Sense* part.

One-spot aggregation

For this experiment, the control software is defined in the file (`aggregation_1.lua`). The robot moves randomly through the arena, using a random walk behavior. If the robot perceives an obstacle, it enters an avoid behavior and at the end of the avoid behavior, it returns to the random walk state. When the robot detects the black floor, it continues moving forward for a short time. This is to avoid to form a barrier on the outside of the black spot that would prevent other robots from entering the spot. After the robot enters the black spot, it stops and it will never leave this state for the rest of the experiment.

Two-spot aggregation

The finite-state machine for the two-spot aggregation (`aggregation_2.lua`) follows a similar structure as for the one-spot aggregation. The main difference is that a recovery behavior is needed, otherwise the robots would split randomly between the two available spots. Instead of stopping indefinitely on a spot, the robots now enter a sleeping behavior. At a certain frequency, the robot checks its number of neighbors. It then performs a random experiment to decide to leave the black spot, where the probability to leave the spot is inversely proportional to the number of neighbors. That is, the more neighbors a robot perceives, the less it is interested in leaving the black spot. When a robot decides to leave the spot, it enters a special leaving behavior that is similar to the random walk, but ignores the floor color (to avoid that the robot immediately stops again). After some time, the robot returns to the random walk behavior.

No-spot aggregation

The finite-state machine for the no-spot aggregation experiment (`aggregation_0_rb_taxis.lua`) works similar to the two-spot aggregation scenario. Instead of entering the sleep state on finding the black spot, the robot now starts sleeping when a sufficient number of robots are detected. As an additional measure to speed up the formation of clusters, the robots will use their range-and-bearing board to approach clusters with at least two robots in them.