Experiments in swarm robotics

– Observations –

– Intelligent Robotic Systems –

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Observations – Unbiased case (no spots)

- Parameter tuning is crucial
- The higher the number of robots, the better the result
- There might not be a constant situation: groups appear and disappear slowly but continuously (this is in principle not a bad behaviour, as it means that the swarm could adapt its formation depending on the environmental condition). In the long run, we expect one or just a few big cluster will form, with floating boundaries as robots along the external perimeter have a higher chance to move away from the group.
- A check on the stability of the aggregation behaviour consists in initializing the simulation with all the robots confined in a small area: if the group remains more or less compact, then we might expect a stationary situation with a small number of rather stable clusters.
- The wandering behavior has a considerable impact: rather than being just a random walk, it should explore the arena such that robots have a high chance to meet large clusters.
- Observe that robot's behaviour is blind to the position of the surrounding robots: a more informed strategy may exploit the density of nearby robots and set the direction toward the place where the highest density is detected.

- Question: how could we assess the performance of the swarm? (some hints: number and size of clusters, number areas of a discretized representation of the arena, center and dispersion of the clusters, ...).

Observations – 'One spot' case

- Maybe easier than previous task.
- Lesson learned: if we add a bias toward a specific area for the aggregation, the previous control software works better (guided positive feedback is extremely powerful).
- The proper tuning of D_s and D_w makes it possible to balance the tendency to stop inside the spot and that of occupying just the border.
- A non-collective solution with robots just halting when they are on the spot don't work very well.

Observations – 'Two spots' case

- If we use the controller devised for the previous task, the robots are likely to stop at the first spot they encounter. Therefore, if they are initially placed at random, the most probable final outcome is an even distribution of robots between the spots. How could we change the behavior such that a swarm consensus can be achieved?