# Particle-based Probabilistic Algorithm for Odor Source Localization in Obstacle Full Realistic Environment

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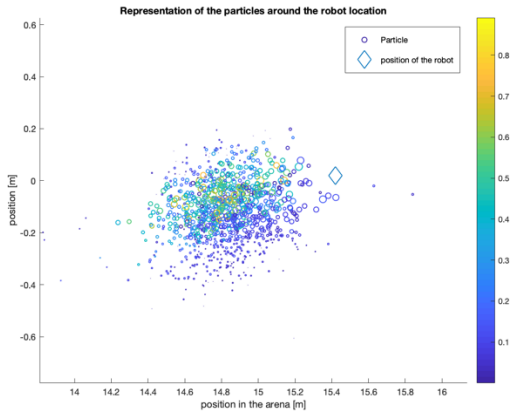
Odor source localization (OSL), a part of machine olfaction is in effect the technique or process that enables a robot to find the location of the source of a volatile chemical in a certain environment. Odor source localization in robotics have been used mainly in the attempt to replace animal intervention in tasks such as detection or rescue in potentially hazardous environments.

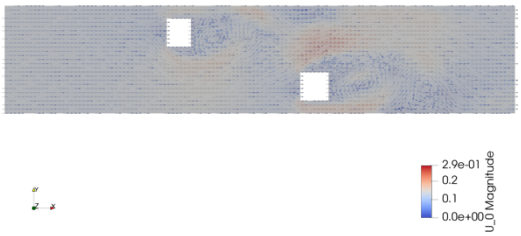
Particle -based algorithm are efficient because they discretize the surrounding space in dimensionless points and evaluates a strategy through the management of the particles.
This work focuses on one particular algorithm developed in the lab. In the case of this algorithm, the robot estimates the probability of finding the plume in its surroundings, given the sensors information and a previously defined plume model. In essence, the robot estimates over 1024 particles, which one is the most likely to be the source of the odor, given that at its location, the robot measures a given odor concentration.




*Representation of the particles (circle), their weight (size of the circle) and their predicted weight (colour) during one step of a simulation. In this situation the robot (diamond) is walking upstream to the source of the odor located (from right to left). The pack of particle is well grouped because the robot is inside of the plume and infers that the position of the source is very likely to be in front of it.*

Previous work have shown that this particle based algorithm performed well in the wind tunnel of the lab (both simulated and actual) in the case of a laminar flow of air through the tunnel.

This performance was challenged by a framework for testing the algorithm under a series of three arenas with simulated real world-like characteristics. Each arena has a different set of obstacles that provide for different mobile robotic navigation challenges and influences the propagation of the odor in the arena.
The physics of the air velocity in the tunnel have been modeled with OpenFoam and imported to a Webots environment where the DISAL laboratory's physics plugin handles the simulated propagation of the odor in the environment.
Then a Khepera III robot had the task of navigating the arena to find the source of the odor. It is mounted with an odor sensors and a wind sensor.




*Fluid simulation of the speed of the wind throughout one of the proposed arenas. The source of the odor is positioned initially on the left end of the arena and the robot to the right end, at approximately 16m of the source.*

The results of measuring the performance of the robot in the three environments emphasize the lack of navigation strategy and obstacle avoidance. The robot does not manage to get through any of the arenas where obstacles are added. This leaves plenty of room for algorithmic improvement, testable in this work set-up.