Lab 03 - Particle filter

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1. Implementation and issues

The objective of this lab is to implement a particle filter to a robot that is moving inside a room.
There were three main parts, *predict*, *weight* and *sampling*.
The problems that appeared during the implementation of the algorithm for *predict* part, where to understand what was represented by each particle and why they were moving randomly. Each particle was a possible robot and they move following a direction. The important part was to measure the odometry with some noise, updating the relative position and orientation for the robot.
In *weight* the difference for each particle between the real walls, given by the map, and the detected walls, given by the odometry of the robot was measured. The statistics of these differences, that were measured for angles and ranges, where used to get the weights of each particle and for each line with normal distributions. To combine both of the weights into a global one it was necessary to multiply them (the addition would have been wrong because probability of some points of these distribution could have been greater than one). The problems were related with the calculation of the maximum that will represent the weight of each particle.
For *resampling* it was necessary to understand the algorithm pretty well. The main idea was to split the possible probability space in equal parts (this will represent each particle) and check how often each of these cases could happen. The use of the cumulative array to measure the frequency of each particle and the comparison between each of its values and the one for each particle was the most difficult part. This problem was much more related with the understanding that the implementation itself. Last problem to remark was to put the weights of each particle to $1/particles$ at the end of resampling.