Localization and Mapping

Deep Patel and Akash Desai

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1 Particle Filter for Robot Localization

We had to implement a Sequential Importance Resampling algorithm for a particle filter approach to the localization problem. We were successfully able to localize the robot and this can be clearly seen in the images below. As we had to sample for different noises and different number of samples. We sampled for three different noise categories, low, mid and high. The low category had: scan noise: .01, rotation noise: .05, translation noise .01, The mid category had scan noise: .07, rotation noise: .1, translation noise: .075. The high category had: scan noise: .124, rotation noise: .19, translation noise: .14. The number of samples we tested with are: 50, 100, 250. For the SIR algo we first sampled n points and then in order to weight the points we used the follow equation, which relies on the distance to the closest obstacle and standard deviation of all the sampled points.

$$\frac{1}{\sqrt{2\pi}\sigma}\exp(-\frac{d^2}{2\sigma^2})$$

The likelihood probability

For performance of the graphs, we observed that the lower noise for the scan data and higher the number of particles, resulted in the highest accuracy. The performance of the varying noise data and different number of particles is clearly seen in the error graphs below.

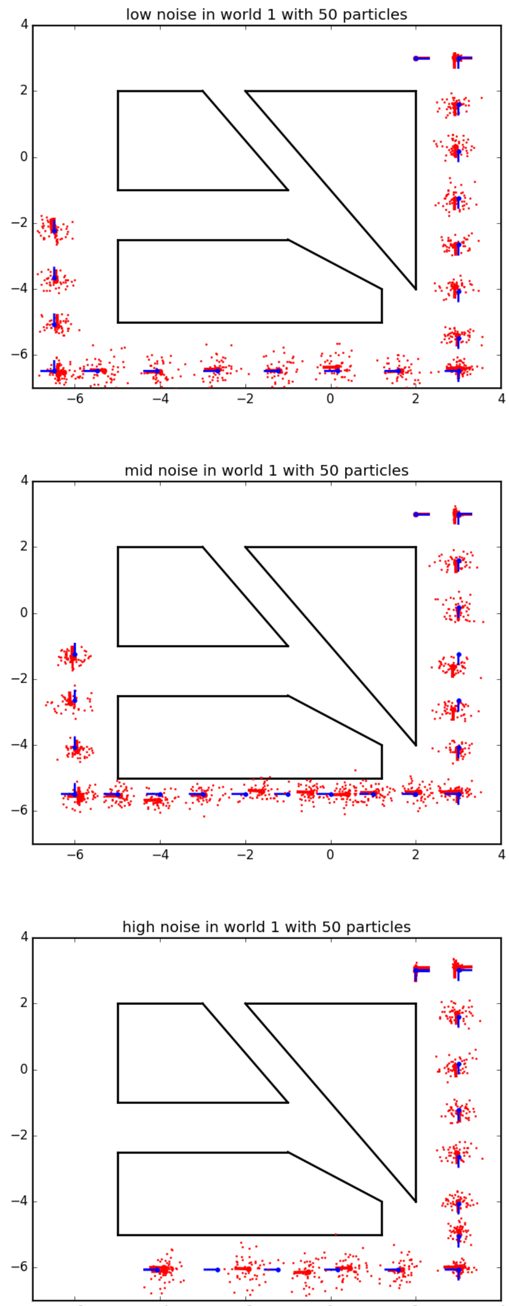

Figure 1: Low, Medium and High Noise for world 1 with 50 samples

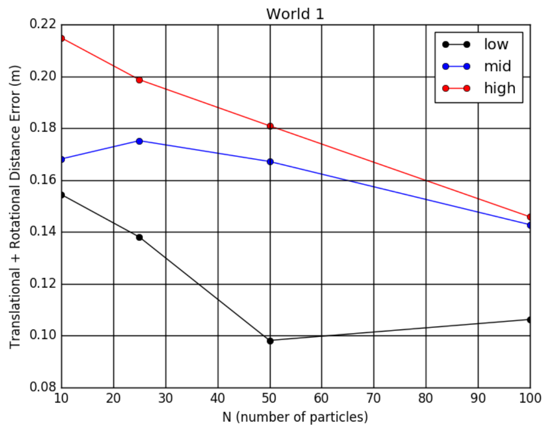

Figure 2: Performance for World 1 for 10, 25, 50, 100 samples at varying noise

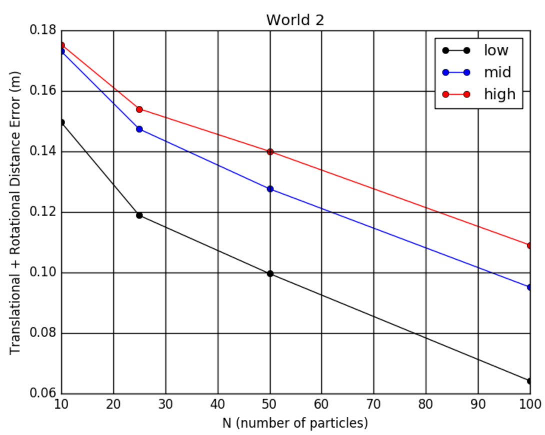

Figure 3: Performance for World 2 for 10, 25, 50, 100 samples at varying noise