SSY191 - Sensor Fusion and Nonlinear Filtering
Peer-Review of Home Assignment 04

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1 Smoothing

A) Good explanation about the difference of smoothing and filtering, pointing out the backward pass and how the access of future measurements helps the smoother to decrease its covariance at some time instant. In my opinion you could have showed the equations for the backward pass. You could then make a deeper analysis about how it is calculated and the differences of $Cov[x_k|y_{1:T}] = P[k|T]$ in comparison to $Cov[x_k|y_{1:k}] = P[k|k]$.

B) Nice and concise explanation about how the filter and the smoother deal with the outlier. Plots are clean, easy to understand.

2 Particle filters for linear and Gaussian systems

A) Good explanation about the problem of degeneracy when there is no resampling. I just think that it is strange that you need so many particles to approximate the Kalman filter results. You said 20.000 particles, but I got very similar results with only 100 particles. I suggest you to double-check you functions to see if you have not made any mistake.

I think the easiest way to compare the filters would have been to plot the true state and the filter outputs over time (you could have also included the 3-sigma level plots), the same way we did in previous assignments.

The posterior approximation without resampling looks also strange for me. I think you have chosen a very low value for the parameter "alpha" when plotting. You would then have seen that the posterior approximation is not so bad, since the covariance is often similar to the one from the Kalman filter, but the mean has a bit of offset.

B) Nice explanation about the divergence and degeneration effect when implementing particle filter without resampling.

To be more fancy, you could have plotted the particle lines with color proportional to their weights. It is nice to see that after 15 seconds only 1 or 2 particles have weight that is not negligible.

C) I know that you tried to be short in words, but I think it is a bit strange to summarize the resampling procedure as "making copies of particles". Actually I would say that it solves the degeneracy problem by "replacing particles with low probability by particles with high probabilities".

3 Bicycle tracking in a village

I will make a general comment about this question because it seems that your algorithm did not work properly.

First, it is strange that you have so many particles inside the buildings. After each iterations you should check if a particle not on road and set its weight to zero. It follows that after resampling, those particles with zero weight would be certainly replaced by other particles on the road.

Another point is that if we don't have any prior information about the vehicle position, you should sample the particles equally around the village.

As a last remark, you should have made more smooth trajectories. The trajectory you generated is not compatible with a constant velocity motion model. The turns are too sharp and happen suddenly.