Unscented Kalman Filter

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1 Edited Files

agotterba_ukf_writeup.pdf   **This Document**

src/   **Edited code**

      ukf.cpp

      ukf.h

      tools.cpp

2 Notes

This project doesn't ask for a writeup, but I wanted to include some notes, for my future self, if nothing else.

2.1 Normalizing Angles

After being told to normalize angles so many times, I had an insidious bug when predicting the values for each sigma point, as I was normalizing the anglies before predicting the new values, and this understandably created problems when switching between +pi and -pi.

2.2 Coordinate System

The coordinate system the simulator uses seems to be objective, but in the context of a self driving car, it would make more sense to be if it were subjective, with the car always at the origin, and the x-axis running down the center of the car. That way, we wouldn't have to track the car's position in addition to other objects. We could easily add the car's acceleration and movement to the filter for more accurate predictions of their positions and velocities of other objects, relative to the car.

2.3 Process Noise Values

I found the values for process noise by trial and error based on the NIS (how many samples exceeded the 5% limit), but I could imagine some code that adapts them based on past performance. Getting that right would be tricky, since you'd want a strong low pass filter. Also, I think accuracy would improve if we vary std_a_ and std_yawdd_ so that std_yawdd_ is

smaller when velocity is high (since we can't turn tightly at high speed- a measurement off the current path is more likely due to noise than a real turn), and likewise, if std_a_ is smaller when yaw is high (since a vehicle can't accelerate heavily when turning tightly). Getting that right would take some experimenting, and I'd be more confident of it working if I knew where the data came from.