Homework 5 – ECE 594E

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Due Tuesday 25$^{\text{th}}$ November, 2014

1 Particle Filter for non-linear system

1.1

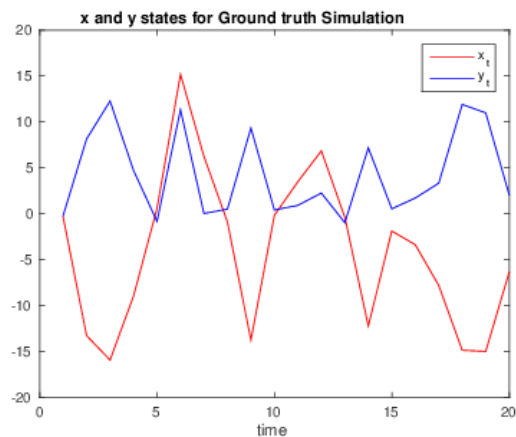We plot two sample trajectories in figures 1 and 2.

Figure 1: First sample trajectory

1.2

The full implementation code can be found at `https://github.com/stevenjlm/ML-code/tree/master/bootstrap`

1.3

For $N = 100$ particles, using measurements y_t, $t = 1$ to $t = T = 100$ we plot the conditional mean and the actual state in figure 3. The mean square
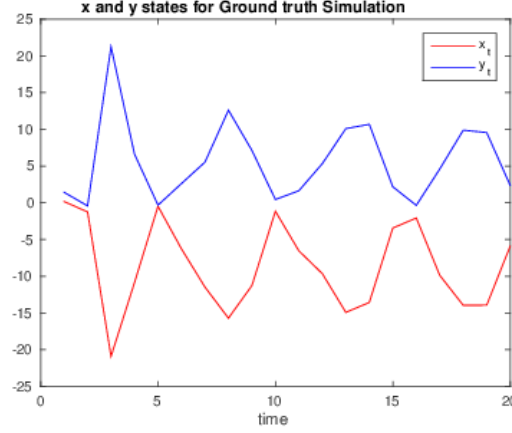
Figure 2: Second sample trajectory

error between estimate and actual state is in figure 4.

In figures 5, 6, and 7 we plot $p(x_t|y_{1:T})$ at times 10, 50, and 100. Only the plot at time 100 is bimodal, this mostly coincidence though. You can see in figure 6 that the peak is very close to zero. The distribution is a mixture of two Gaussians, it's just that their means are too close to produce distinguishable peaks. And, for figure 5 the value is so extremely low that the state must have been in a downward slope already and the step function didn't produce particles at the other mode peak.
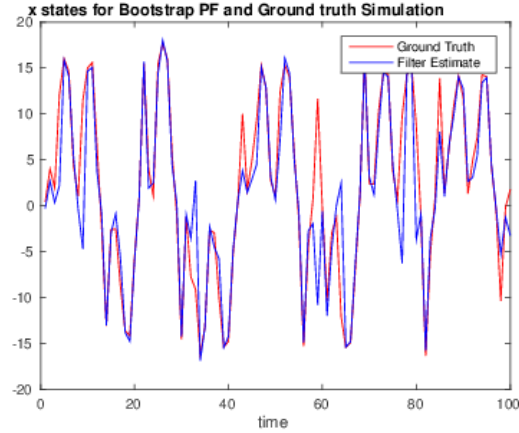

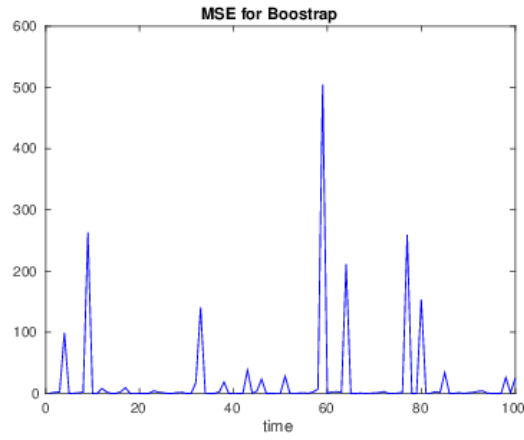Figure 3: Particle Filter estimate and actual state

Figure 4: Mean square error of estimate

1.4

For $N = 10$ we have the same plots as above in figures 8, 8, 9, 10, 11, and 12.

For $N = 1000$ we have the same plots as above in figures 13, 13, 14, 15, 16, and 17.
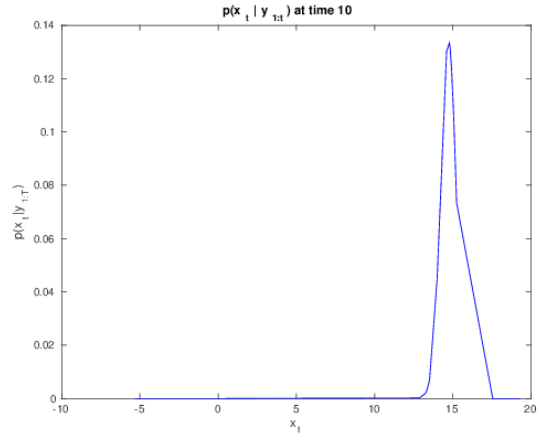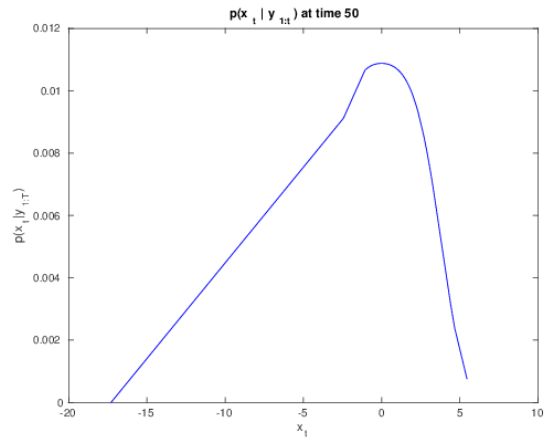
Figure 5: Filtering density at $t = 10$

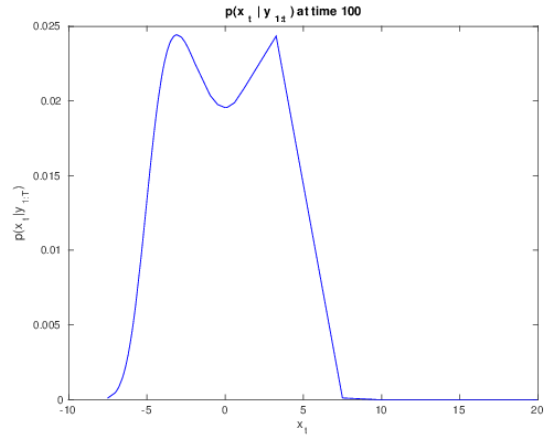Figure 6: Filtering density at $t = 50$
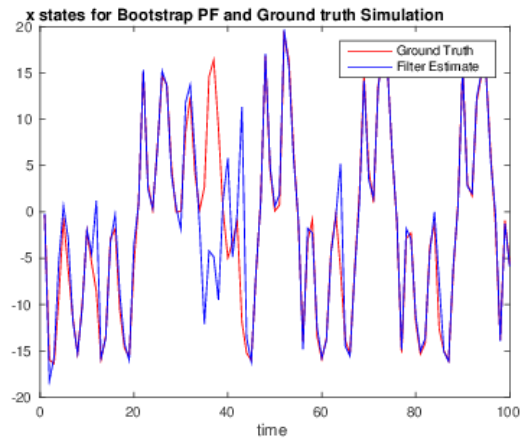
Figure 7: Filtering density at $t = 100$

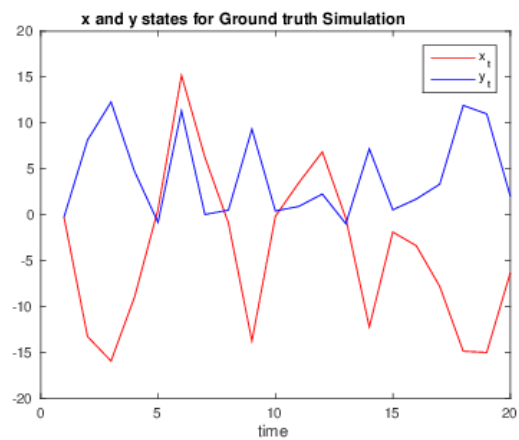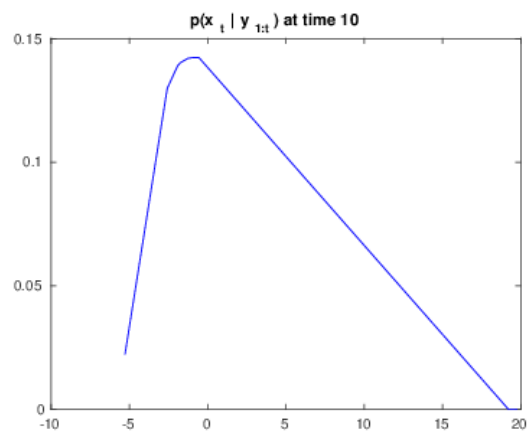Figure 8: Particle Filter estimate and actual state

Figure 9: Mean square error of estimate

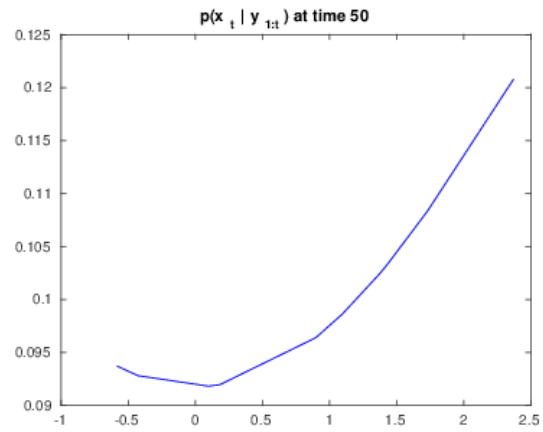
Figure 10: Filtering density at $t = 10$
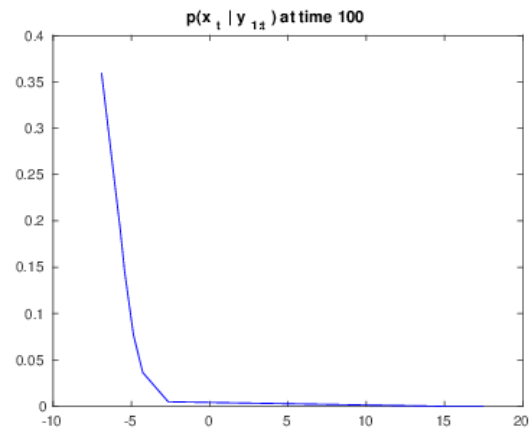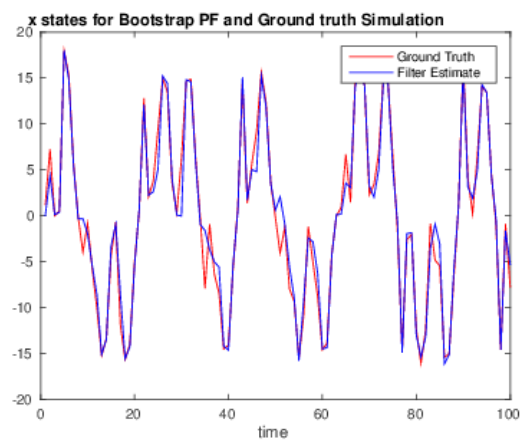
6

Figure 11: Filtering density at $t = 50$

Figure 12: Filtering density at $t = 100$

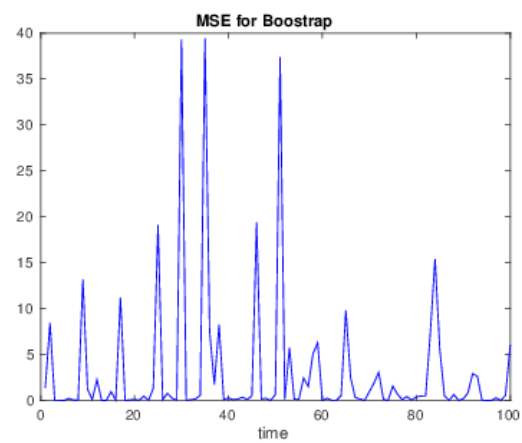Figure 13: Particle Filter estimate and actual state

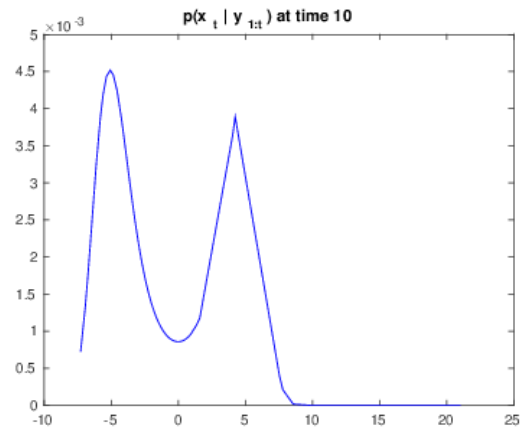

Figure 14: Mean square error of estimate

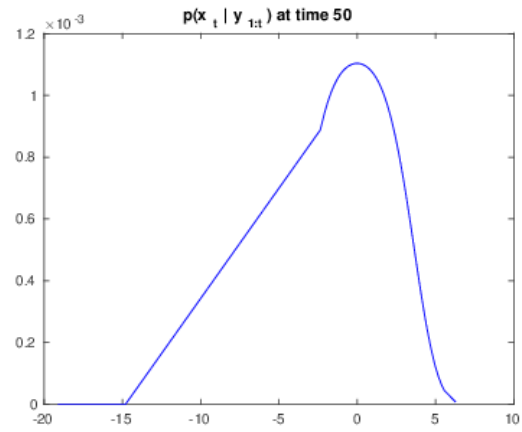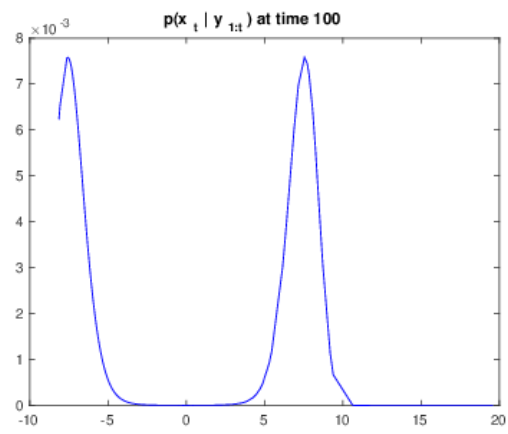Figure 15: Filtering density at $t = 10$

Figure 16: Filtering density at $t = 50$

Figure 17: Filtering density at $t = 100$