Computer Vision
Fall 2017
Problem Set #5

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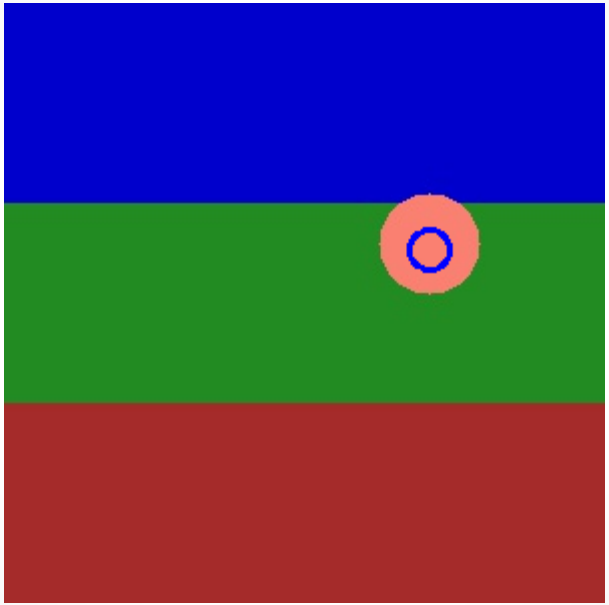
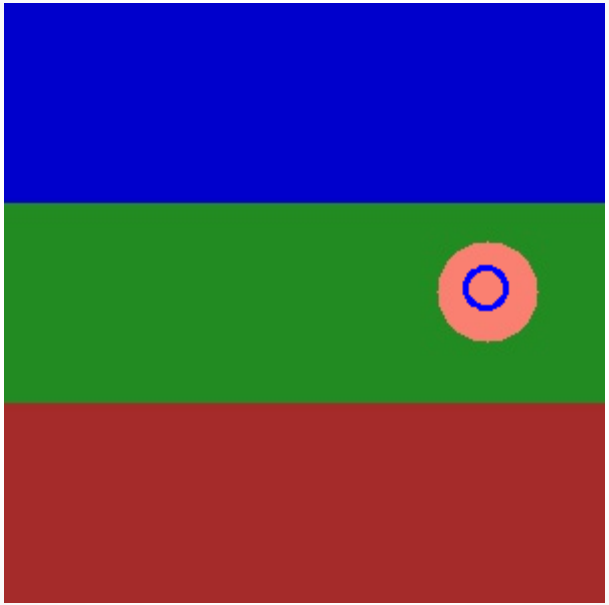
1b: KF Tracking a circle



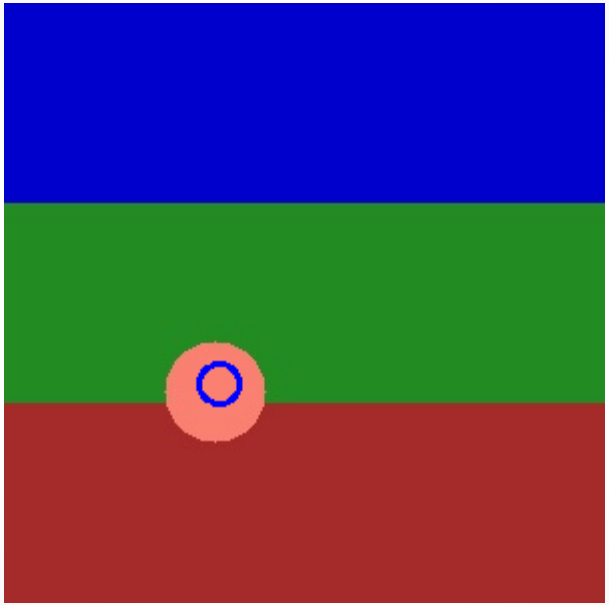
ps5-1-b-1.png

1b: KF Tracking a circle (cont.)



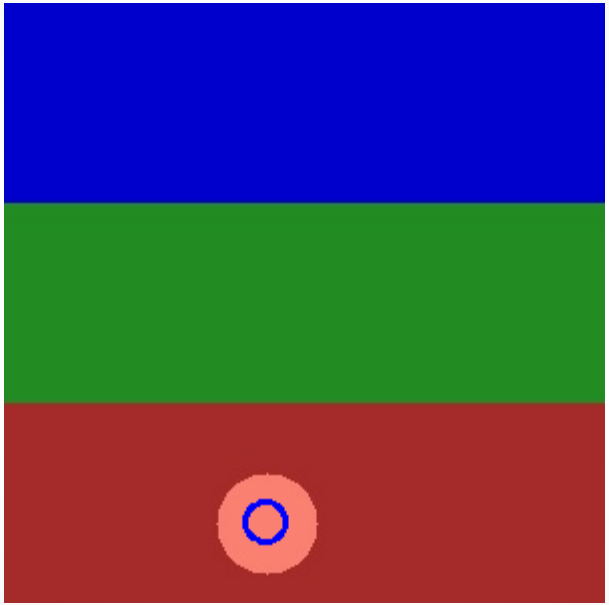
ps5-1-b-2.png

1b: KF Tracking a circle (cont.)



ps5-1-b-3.png

1b: KF Tracking a circle (cont.)



ps5-1-b-4.png

1c: KF Tracking pedestrians

ps5-1-c-1.png

1c: KF Tracking pedestrians

ps5-1-c-2.png

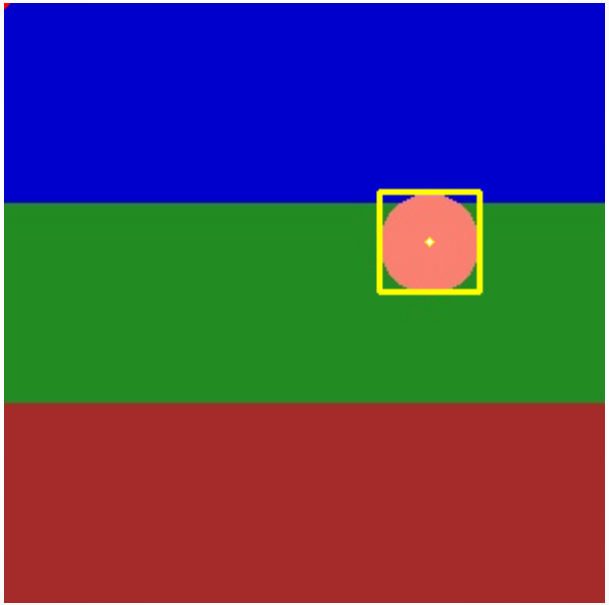
1c: KF Tracking pedestrians

ps5-1-c-3.png

1c: KF Tracking pedestrians

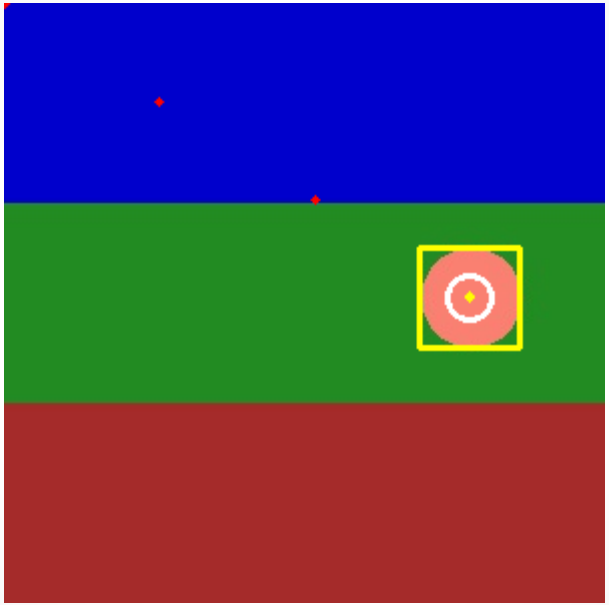
ps5-1-c-4.png

2a: PF Tracking a circle



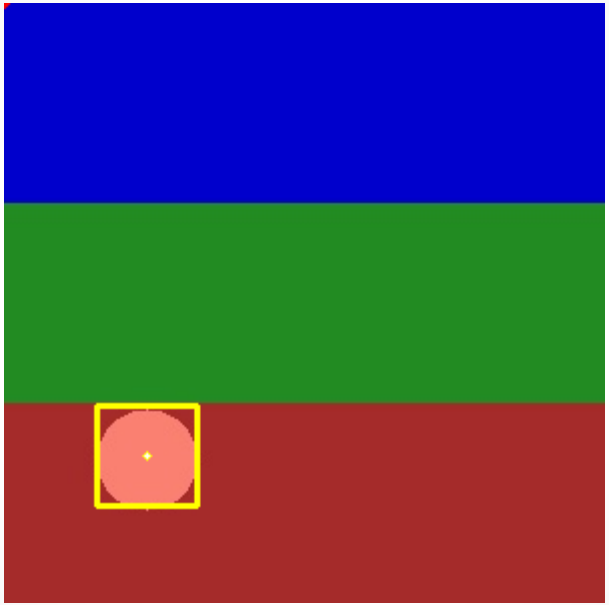
ps5-2-a-1.png

2a: PF Tracking a circle (cont.)



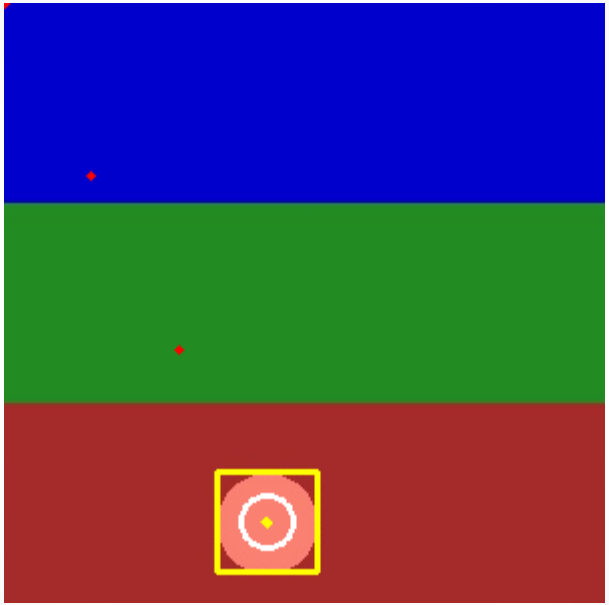
ps5-2-a-2.png

2a: PF Tracking a circle (cont.)



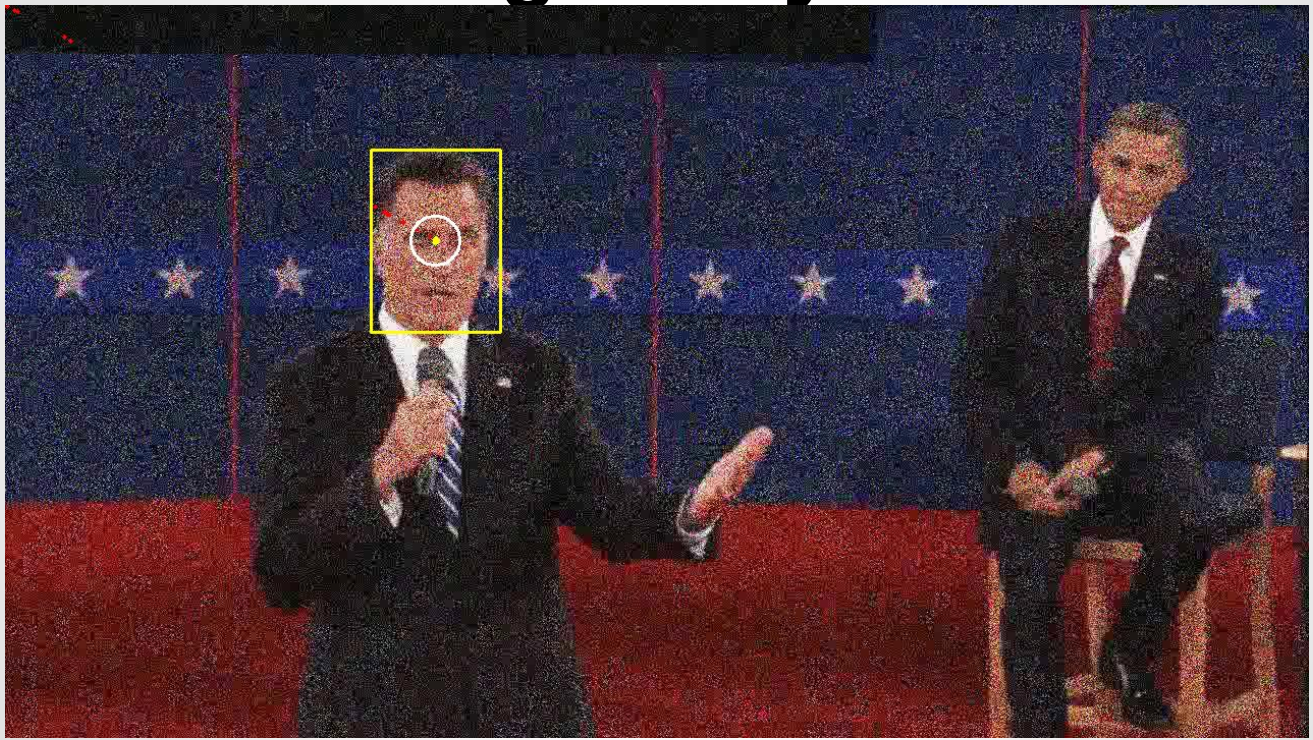
ps5-2-a-3.png

2a: PF Tracking a circle (cont.)



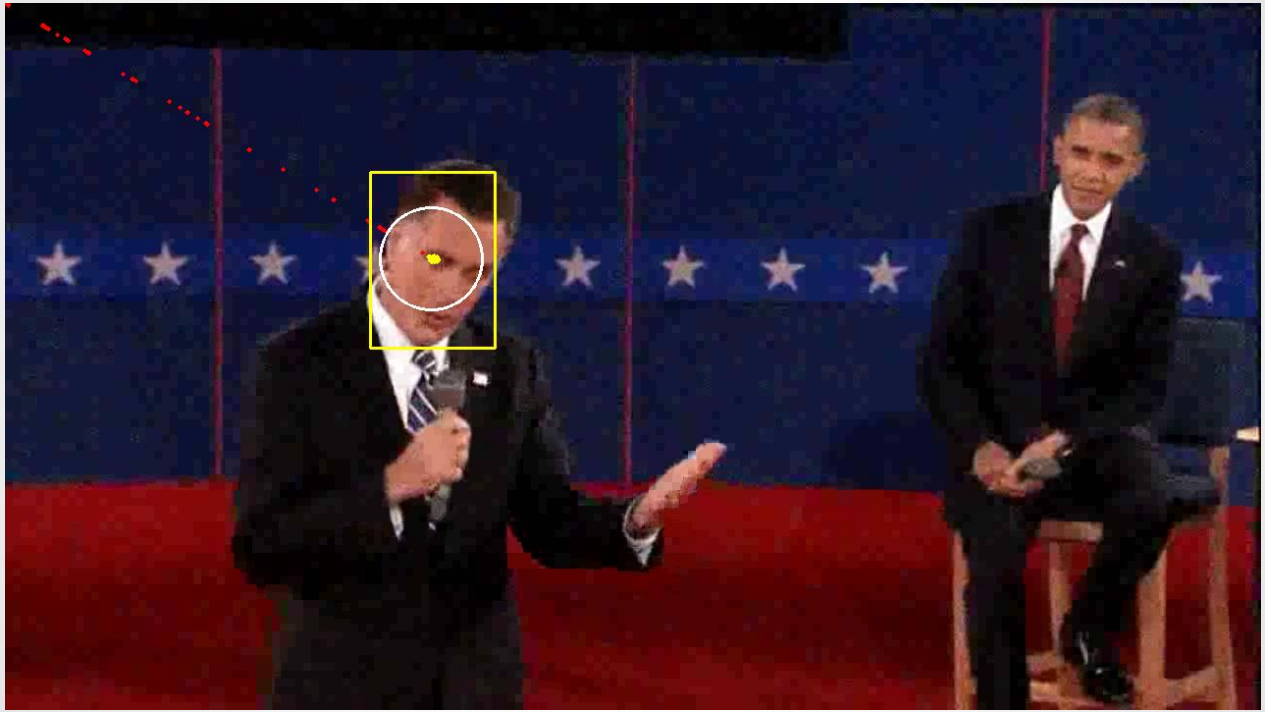
ps5-2-a-4.png

2b: PF Tracking noisy video



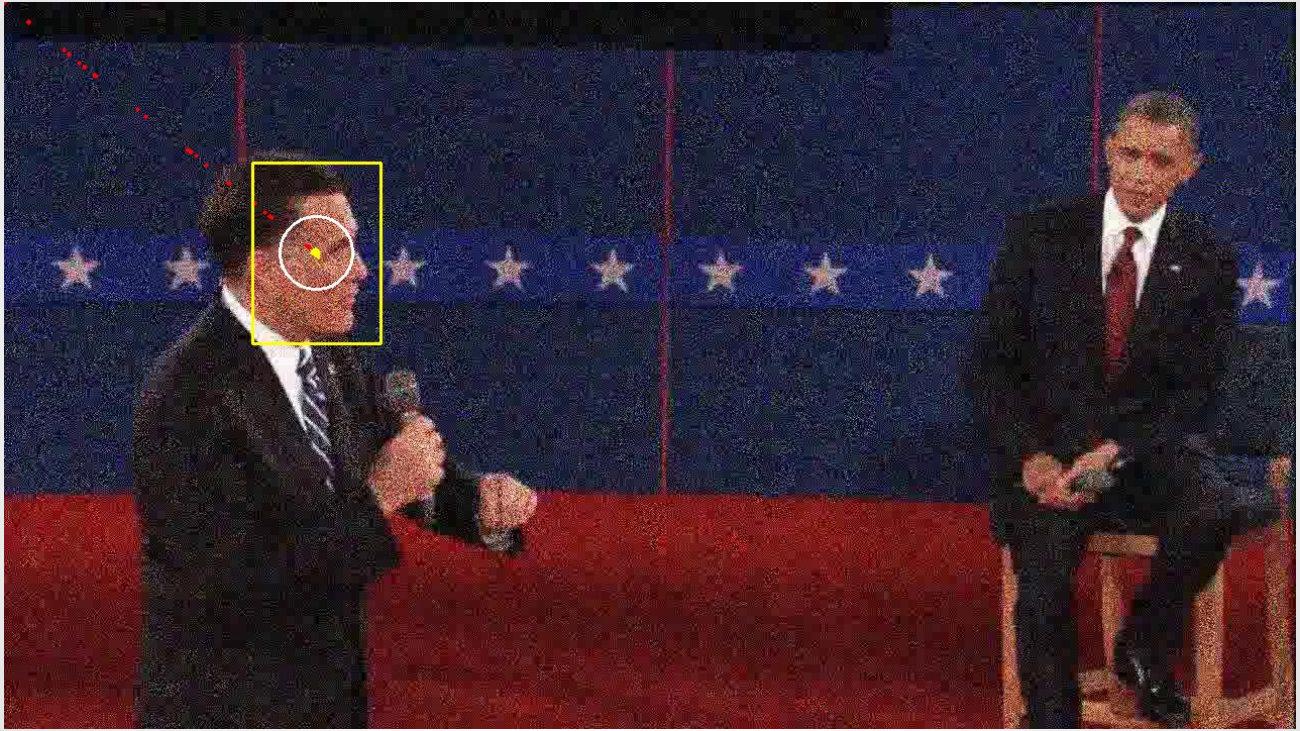
ps5-2-b-1.png

2b: PF Tracking noisy video (cont.)



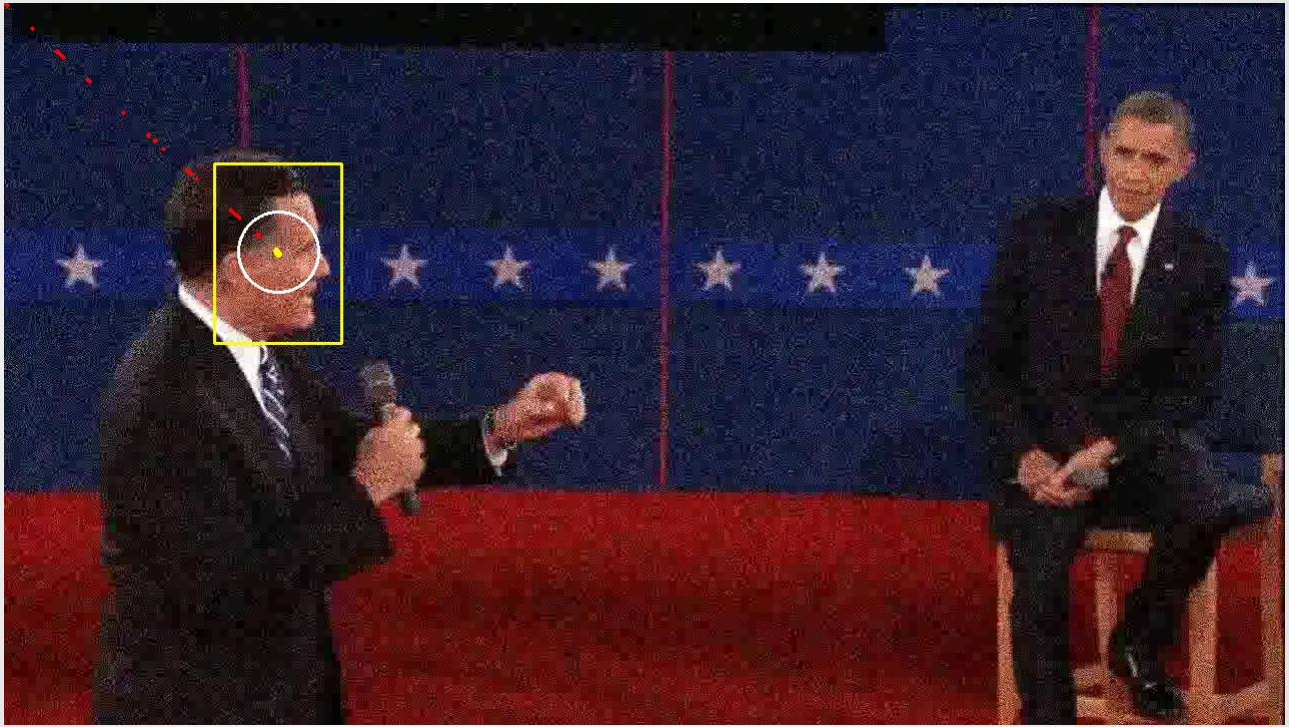
ps5-2-b-2.png

2b: PF Tracking noisy video (cont.)



ps5-2-b-3.png

2b: PF Tracking noisy video (cont.)

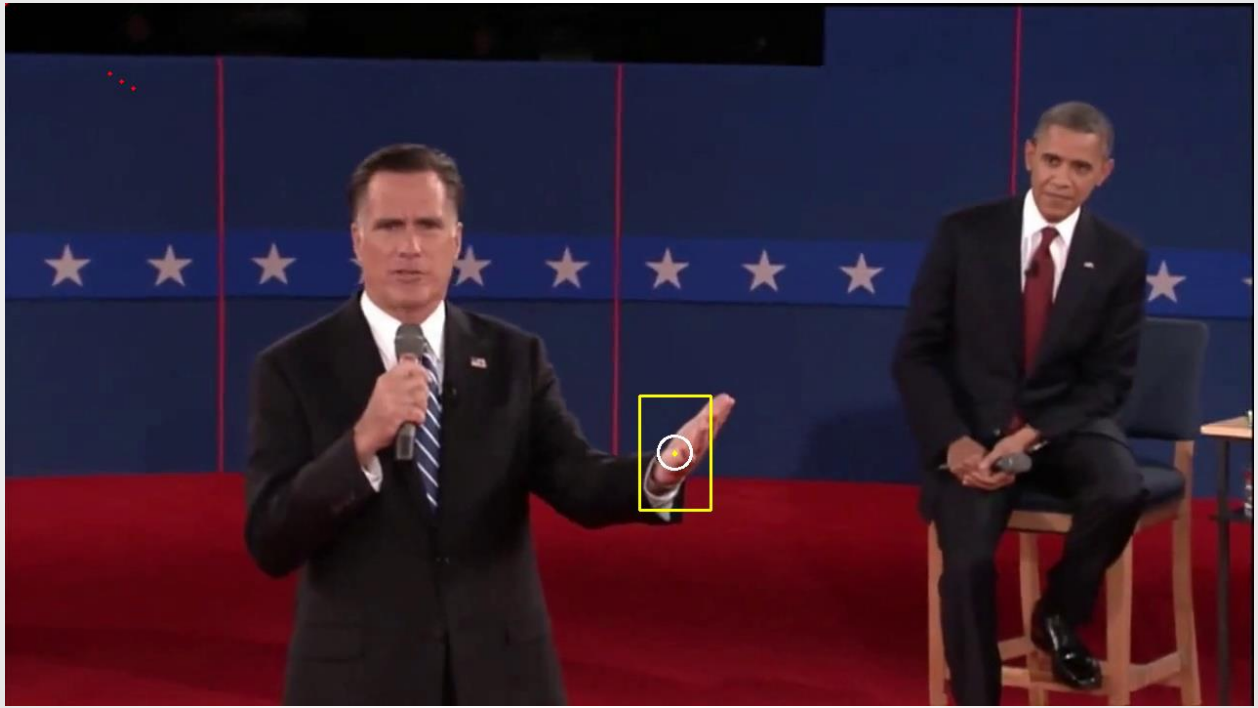


ps5-2-b-4.png

3a: PF Changes in Appearance

ps5-3-a-1.png

3a: PF Changes in Appearance (cont.)



ps5-3-a-2.png

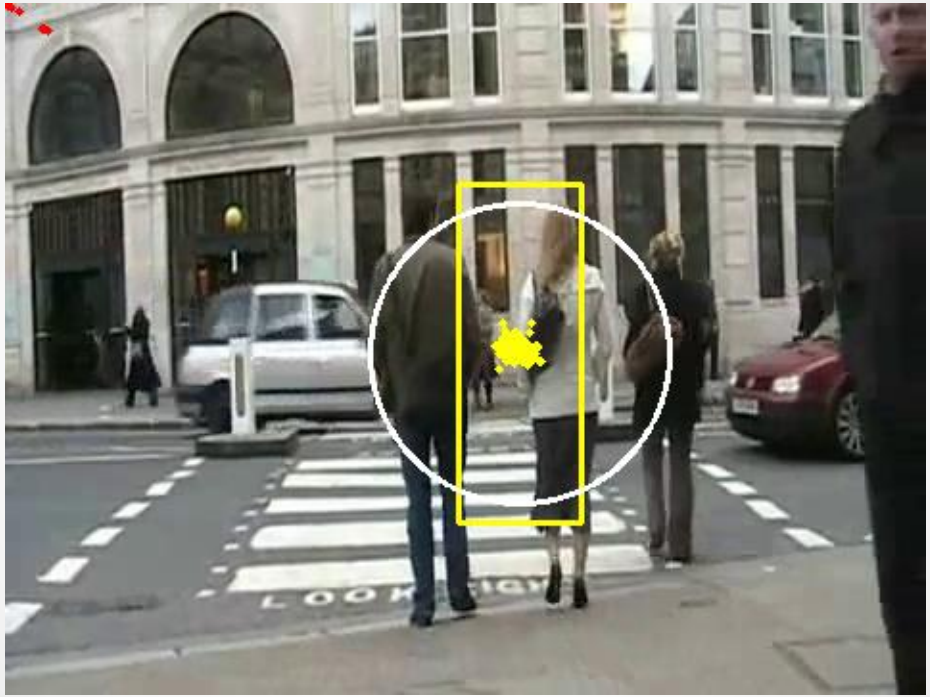
3a: PF Changes in Appearance (cont.)

ps5-3-a-3.png

4a: PF Occlusions

ps5-4-a-1.png

4a: PF Occlusions (cont.)



ps5-4-a-2.png

4a: PF Occlusions (cont.)

ps5-4-a-3.png

4a: PF Occlusions (cont.)

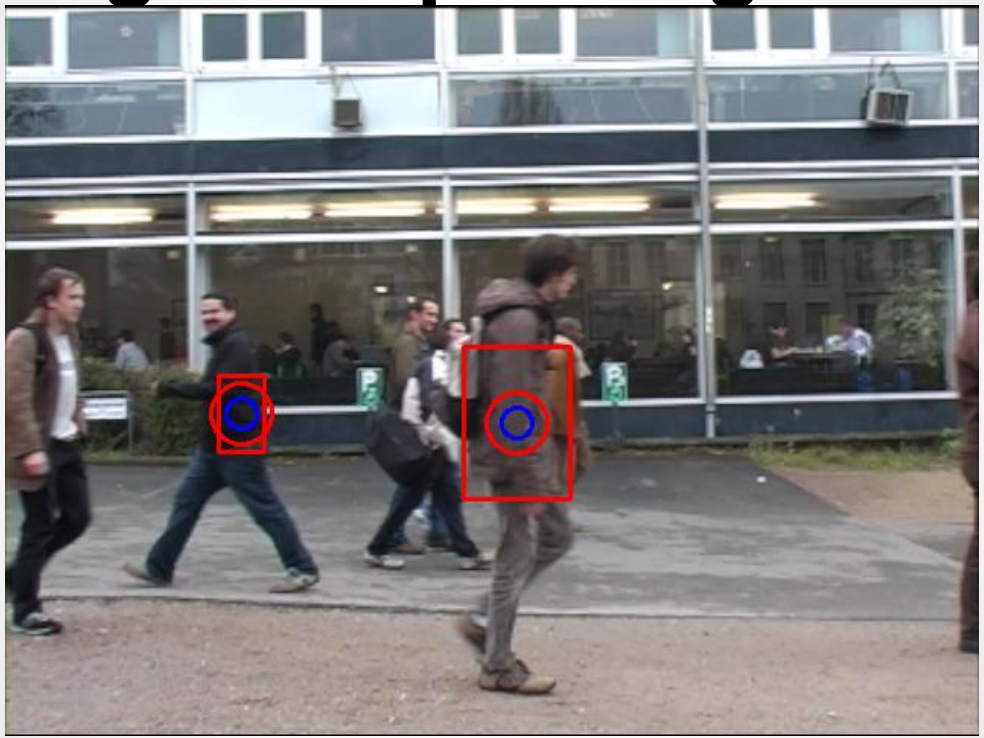
ps5-4-a-4.png

4: Text response

Describe what you did. How did you modify the Particle Filter class to continue tracking after occlusions?

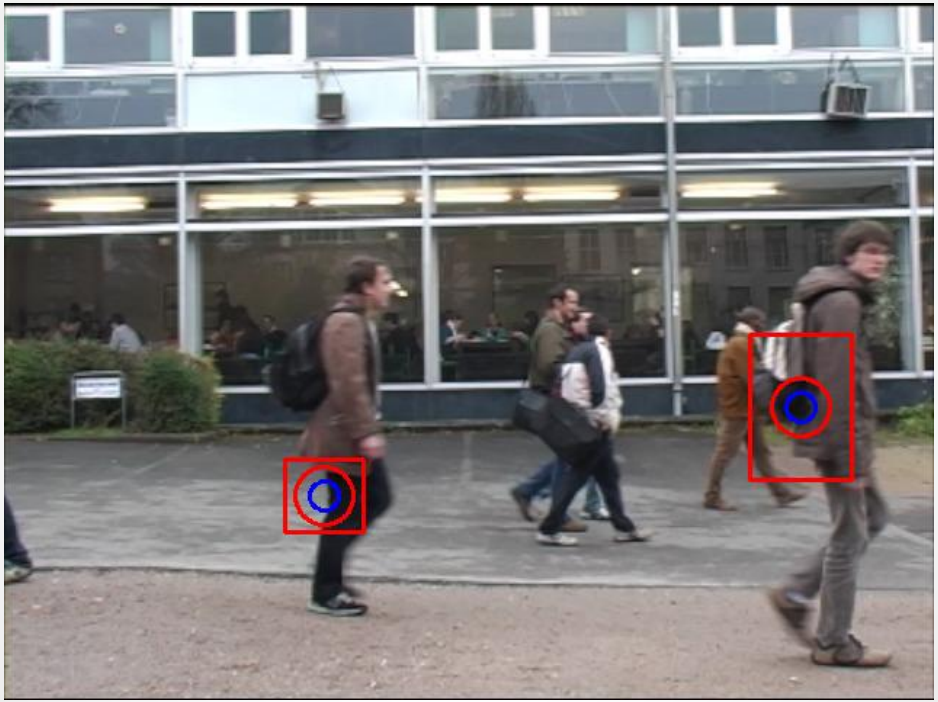
What I did is adding a third dimension scale factor (0 – 1) to the particles, so this scale factor will be used to resize the template and proposed template for every particle then calculating the probability, and just like the (x, y), the scale factor for the most weighted particles will be similar after resample the particles. I also perturbed the scale factor with a small Gaussian noise, so this noise will be applied on the dynamics model allowing the scale factor become smaller and smaller. About the occlusions, I had done something basically to output every frame's average or median MSE and use it to decide a threshold value, if the current MSE is bigger than that threshold, then I will skip resample the particle, and if it's smaller than it, then I will go back to normal process.

5: Tracking multiple targets



ps5-5-a-1.png

5: Tracking multiple targets (cont.)



ps5-5-a-2.png

5: Tracking multiple targets (cont.)

ps5-5-a-3.png

5: Text response

Describe what you did. How different it was to use a KF vs PF? Which one worked best and why? Include details about any modifications you had to apply to handle multiple targets.
Based on my results, the KF works better, the PF seems not work very well, no matter I tried all the tricks I used before. As for KF, I adjusted the noise, and also controlled what frame number expected for that person. KF is more like a linear dynamical models with Gaussian noise, which is often optimal to track multiple targets in a relative simple situation, but particle filter is more like a sequential dynamic approach, which is more general and good for complex situations.

6: Challenge Problem

ps5-6-a-1.png

6: Challenge Problem (cont.)

ps5-6-a-2.png

6: Challenge Problem (cont.)

ps5-6-a-3.png

6: Challenge Problem Text response

Text Answer: Describe what you did. Did this task present any additional challenges compared to the previous sections? Include details about any modifications you had to apply.
I combined the KF and PF, because KF is good at beginning when the target moving towards the right, but PF is more adapted the situation the camera zoomed in and out, I also adjusted the noise sigma and created threshold to cutoff the particles that fall too far out of predicated value.