

Problem Set 6
CS4495 - Fall2014
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Part 1: Particle Filter Tracking
Part 1.1 - pres_debate.avi (FACE)



Face template



Frame 28



Frame 84



Frame 144

Part 1.2 - Different Window Sizes

Smaller Window Size:

- Using windows sizes significantly smaller (up to around $\frac{1}{4}$ of original size), the algorithm performed unexpectedly well. Basically, the smaller window would always end up on the face, although misplaced, because there was always a small part of the face visible.
- A smaller window is better if it needs to work through occlusion. Basically, it is easier to mess up the tracking with bigger windows because occlusion can easily get in the way of the window/template. However, it can also lead to the template not being very precise.
- A smaller window makes computation easier/faster.

Bigger Window Size

- Using windows sizes up to double the original size, the algorithm still performed well. The reason why the window stayed on the face (even with occlusion) was because it was very unlikely for the algorithm to find a bigger/better matching set of points in the neighborhood. In other words, a bigger window prevented the algorithm from making big jumps.
- However, windows sizes that would be bigger than double and had mostly background did poorly. Basically, the template started looking for the background rather than the face.

Smaller vs. Bigger

- It is probably better to have a window size that is slightly bigger than the object we wish to track (1.1-1.2size).
- Also, it is needed for the template to be mostly the object and not background, so that the algorithm doesn't start tracking the incorrect object.

Part 1.3 - Different Sigmas

- A large sigma value makes the tracker wander off the face when occluded. A small sigma value, on the other hand, makes the tracker stick very tightly to the face. This is probably due to the relationship between sigma and weights. Basically, since sigma is the denominator for the size of the range of weights, the lower sigma, the bigger the size of the range of weights. A bigger range of weights provides the tracker with better differentiation between good and bad weights, while a smaller range can make the tracker get confused between good and bad.

Part 1.4 - Different Particle Number

- The number of particles cannot be particularly low (below 20) because the tracker needs to be able to generate a good variety of possibilities (particles) when it loses the face due to occlusion. Basically, the tracker needs enough possibilities to make sure

that it is not looking around too narrowly.

- A high number of particles were better for the tracker to perform good, but once it got past around 60, the tracking didn't really improve, but the computation time increased. A high number of particles basically gave the tracker a better precision to know where the face was, but it traded the precision for computation time.
- In conclusion, we want a moderate amount of particles that give the tracker a pretty good precision and ability to come back from occlusion times, but not too big to make it take an enormous amount of time to compute.

Part 1.5 - noisy_debate.avi (FACE)

- When the noised increased, the tracker tended to drift away from the center of the face. However, as soon as the noise decreased, the tracker would come back to the center (more precise).
- Smaller sigma values helped the tracker stay on the face better during noise increments and decrements.



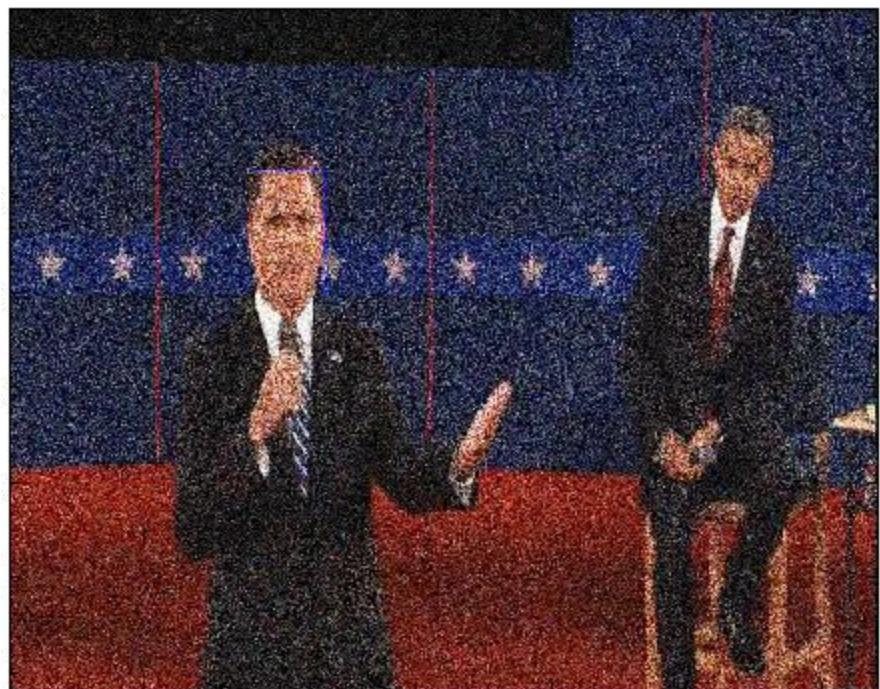
Face template



Frame 14



Frame 32



Frame 46

Part 2: Appearance Model Update

Part 2.1 - press_debate.avi (HAND)



Hand template



Frame 15



Frame 50



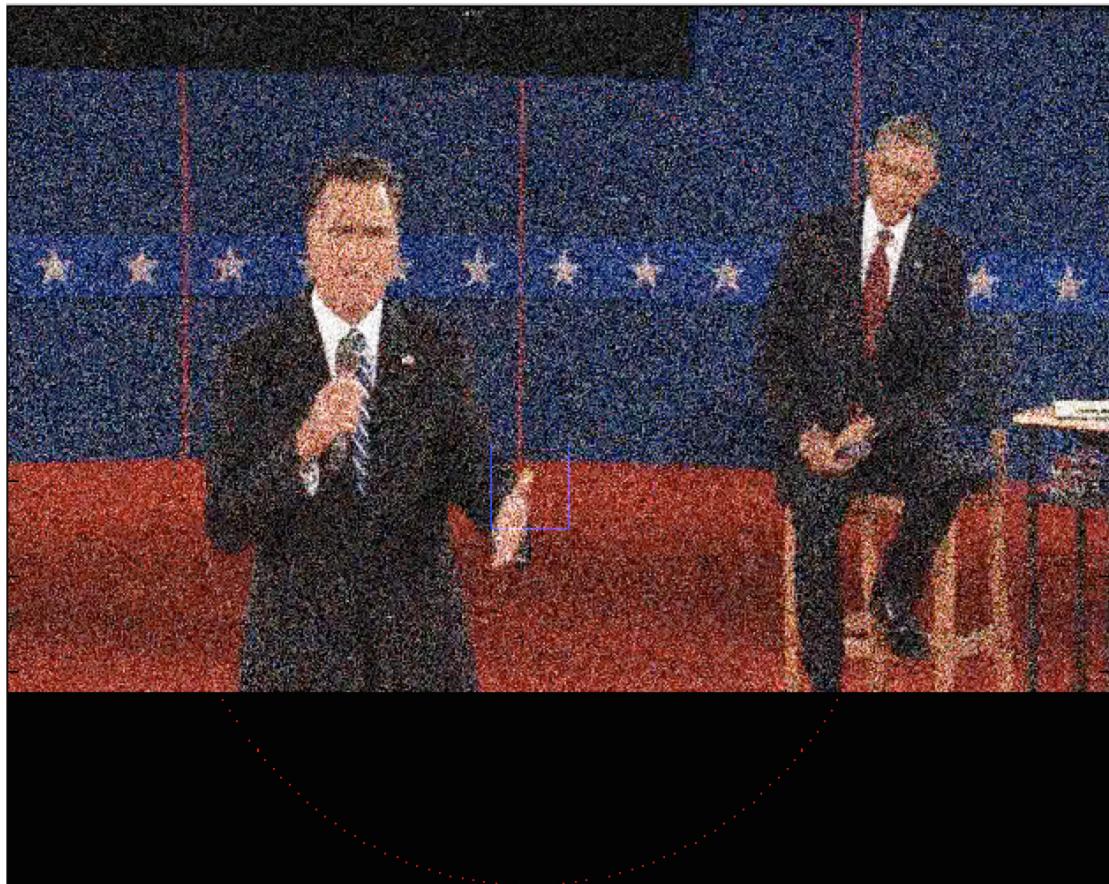
Frame 140

Part 2.2 - noisy_debate.avi (HAND)

- The standard deviation was increased because the hand moved a lot faster and farther, so the tracker needed to be able to jump a little more to be able to find the hand.
- The number of particles were also increased to improve the precision of the tracker (more particles, more specific).



Hand template



Frame 15



Frame 50



Frame 140