Computer Vision
Fall 2016
Problem Set #7

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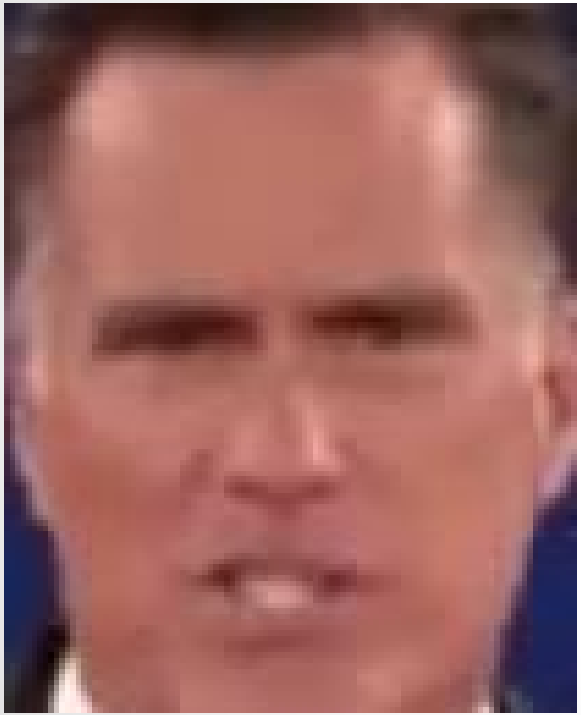
Important Note

Please make sure your latest ps7.py and experiment.py are set to generate the images shown in your report. We will run your algorithms again locally using the same input videos to verify these results. We will not accept modifications to these files after the deadline if running your code fails.

1a: Template used for tracking



Template image patch image - **ps7-1-a-1.png**

1a: Image frame 28 with overlaid visualizations

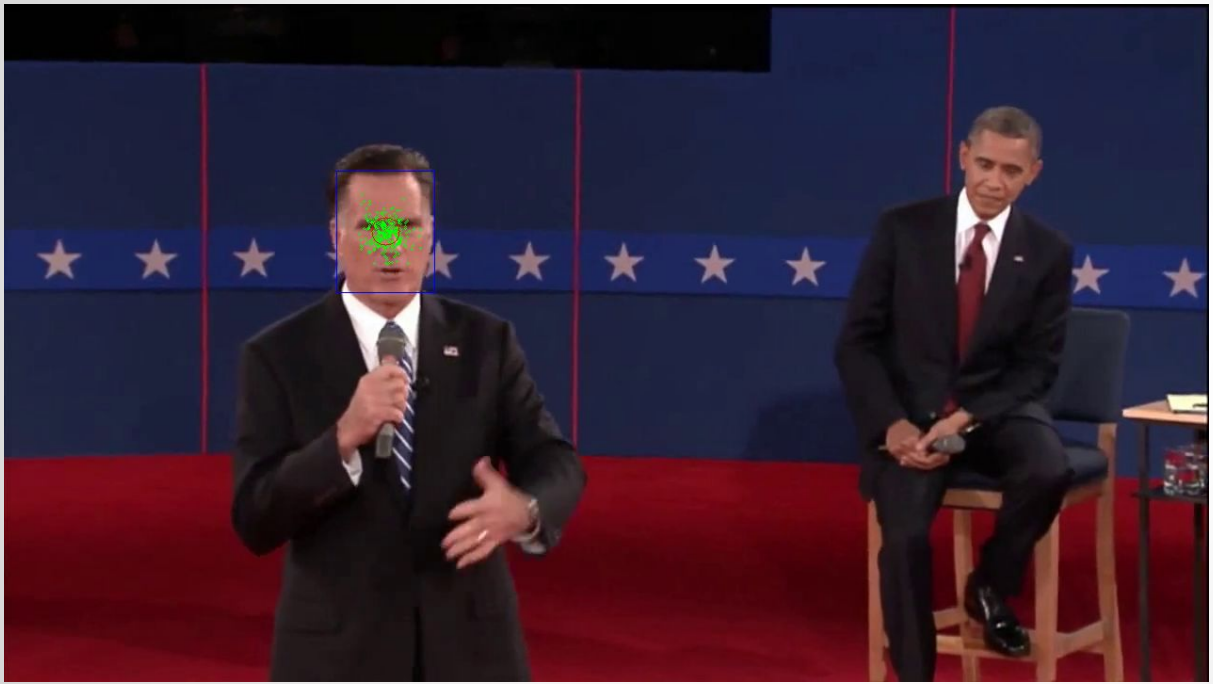


Image frame 28 with overlaid visualizations - **ps7-1-a-2.png**

1a: Image frame 94 with overlaid visualizations

Image frame 94 with overlaid visualizations - **ps7-1-a-3.png**

1a: Image frame 171 with overlaid visualizations

Image frame 171 with overlaid visualizations - **ps7-1-a-4.png**

1b: Image frame 14 with overlaid visualizations

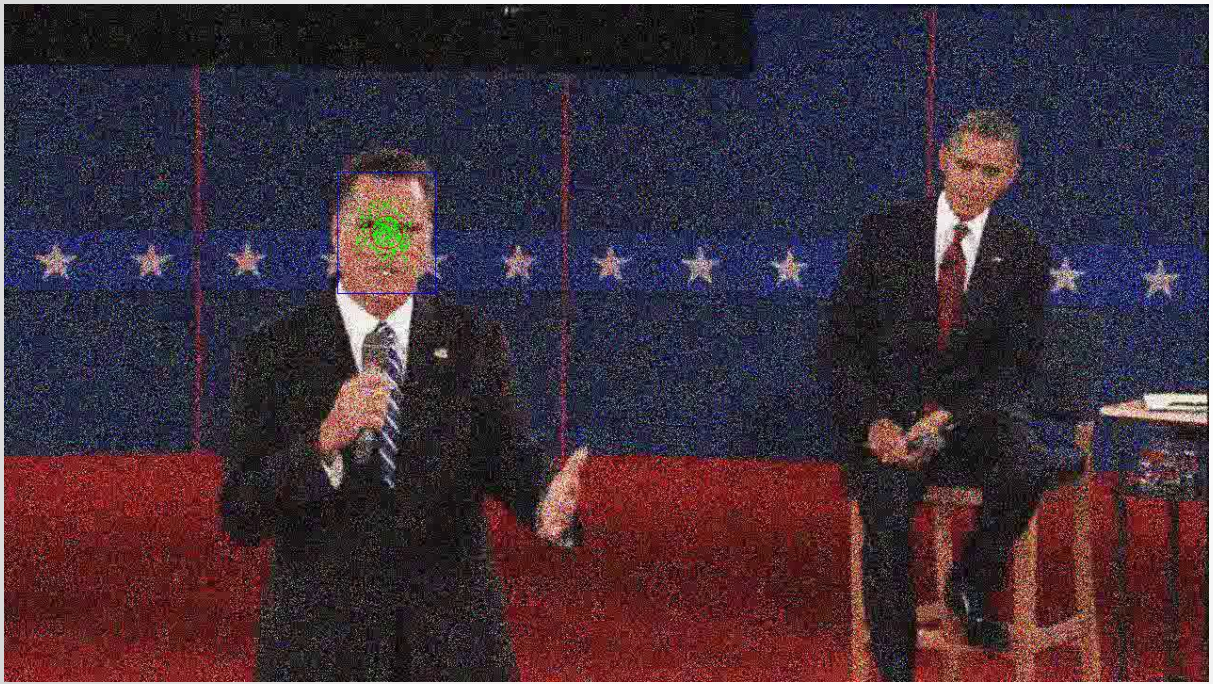


Image frame 14 with overlaid visualizations - **ps7-1-b-1.png**

1b: Image frame 94 with overlaid visualizations

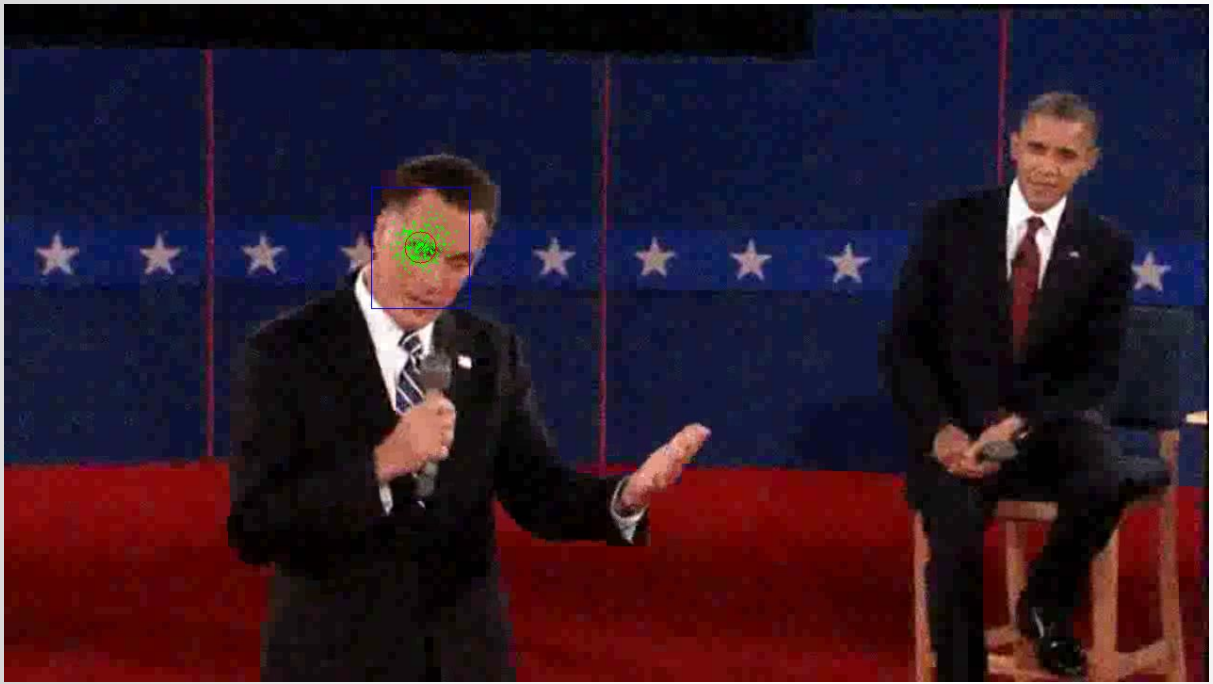


Image frame 94 with overlaid visualizations - **ps7-1-b-2.png**

1b: Image frame 530 with overlaid visualizations

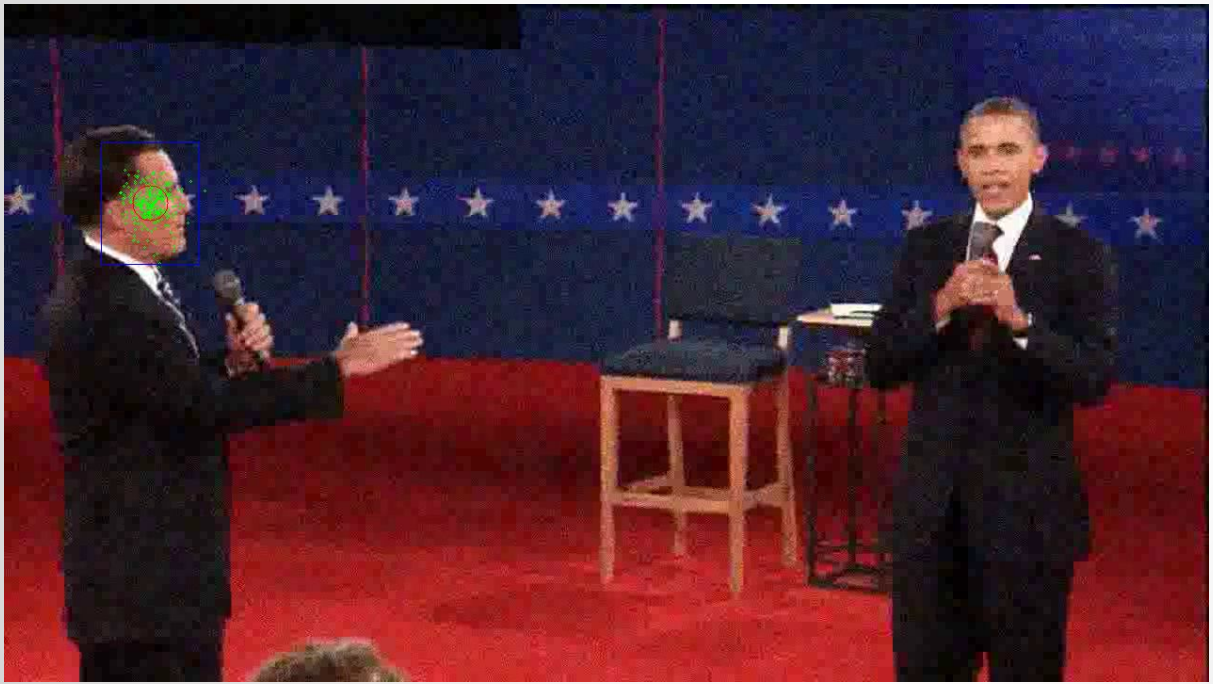
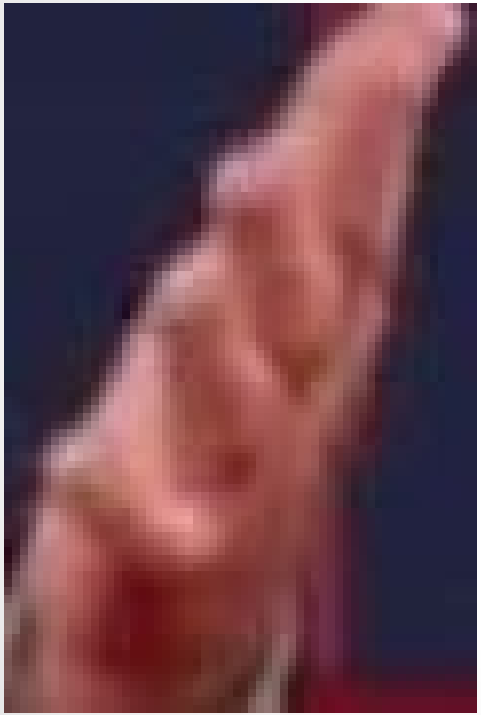


Image frame 530 with overlaid visualizations - **ps7-1-b-3.png**

2a: Template used for tracking



Template image patch image **- ps7-2-a-1.png**

2a: Image frame 15 with overlaid visualizations

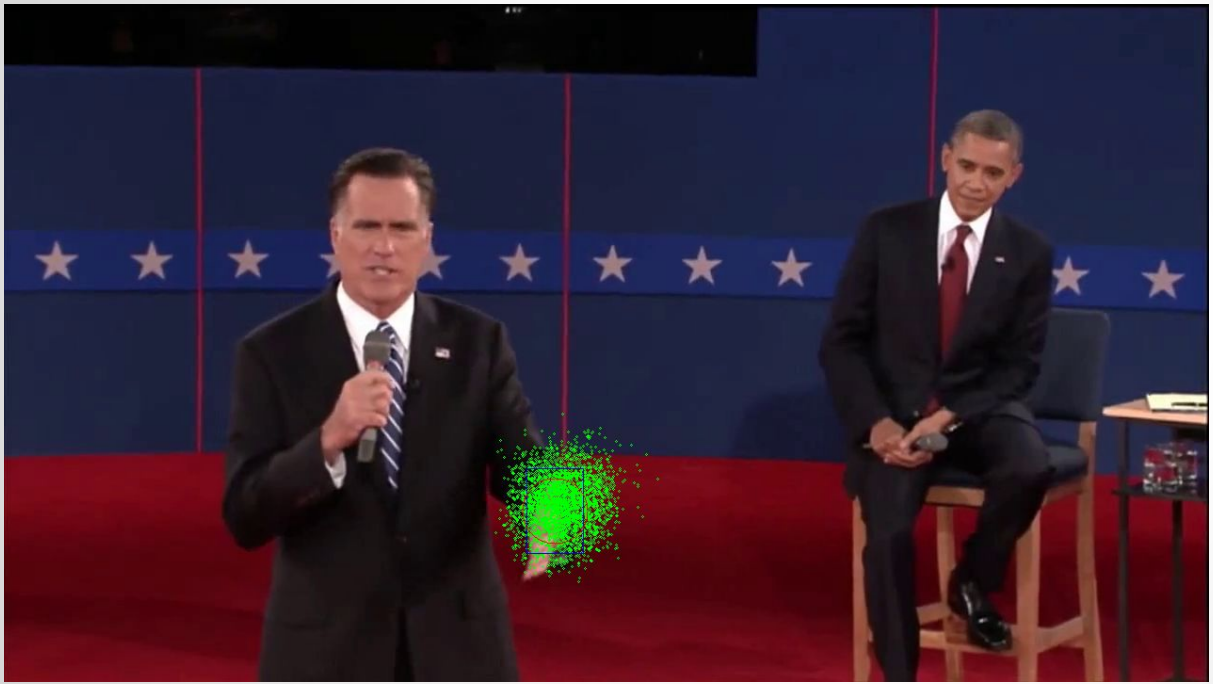


Image frame 15 with overlaid visualizations - **ps7-2-a-2.png**

2a: Image frame 50 with overlaid visualizations

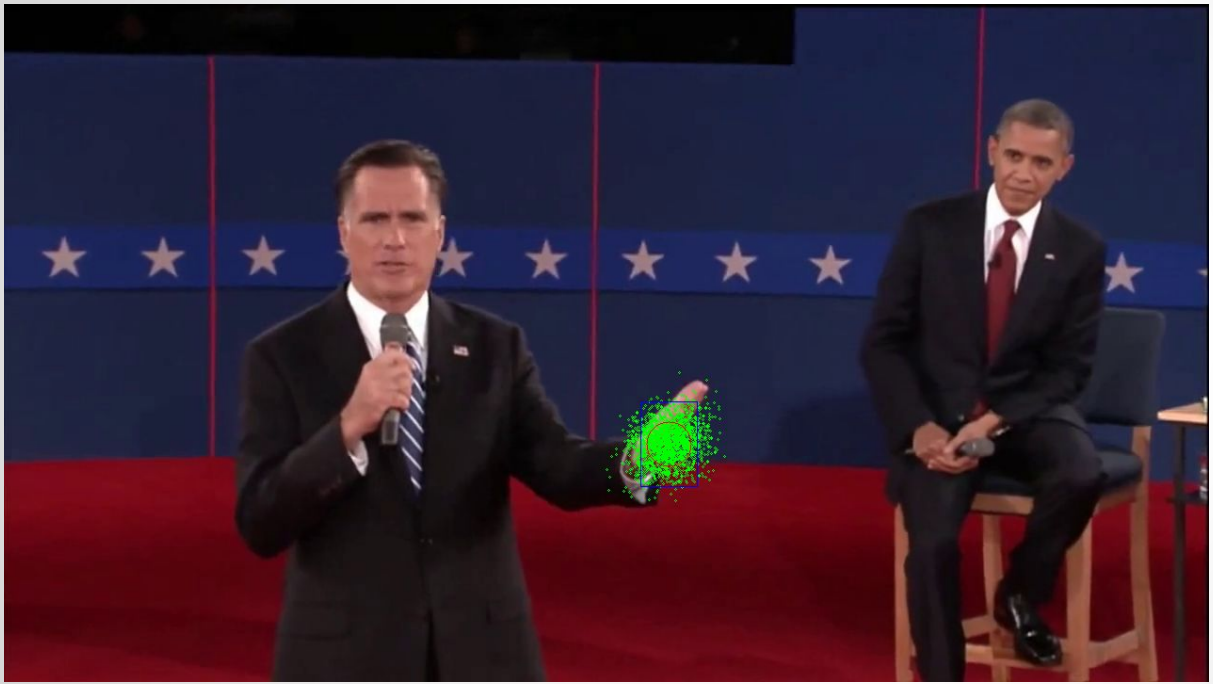


Image frame 50 with overlaid visualizations - **ps7-2-a-3.png**

2a: Image frame 140 with overlaid visualizations

Image frame 140 with overlaid visualizations - **ps7-2-a-4.png**

2b: Template used for tracking

Template image patch image - **ps7-2-b-1.png**

2b: Image frame 15 with overlaid visualizations

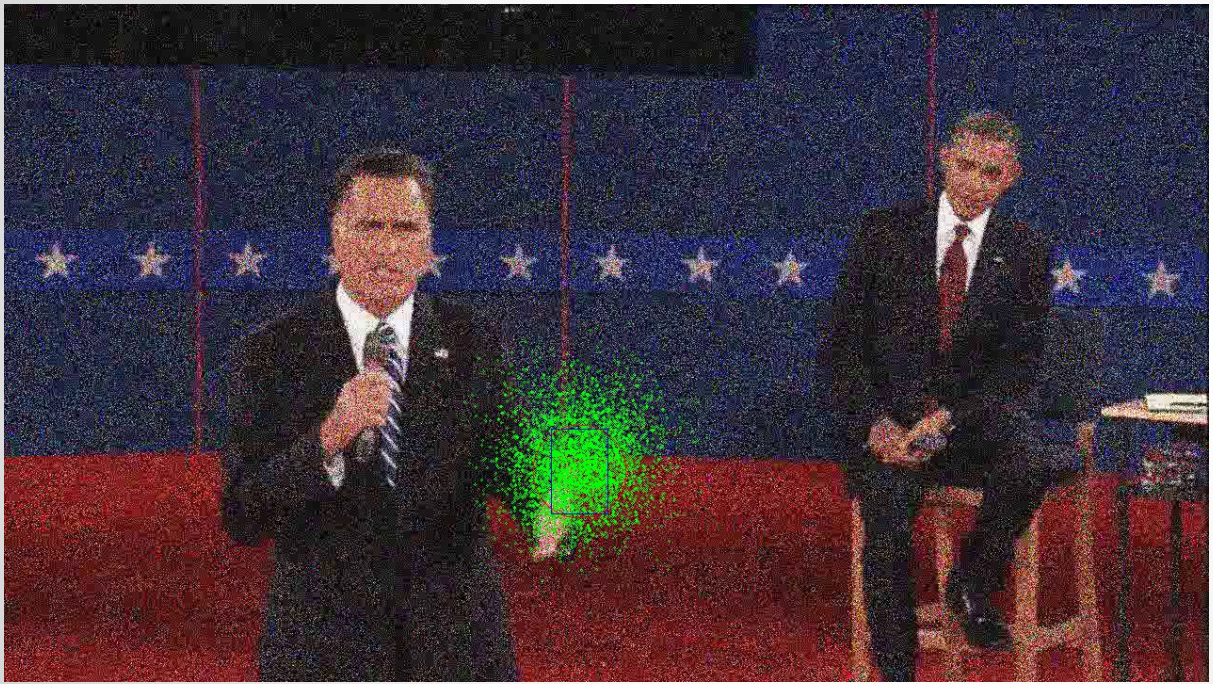


Image frame 15 with overlaid visualizations - **ps7-2-b-2.png**

2b: Image frame 50 with overlaid visualizations

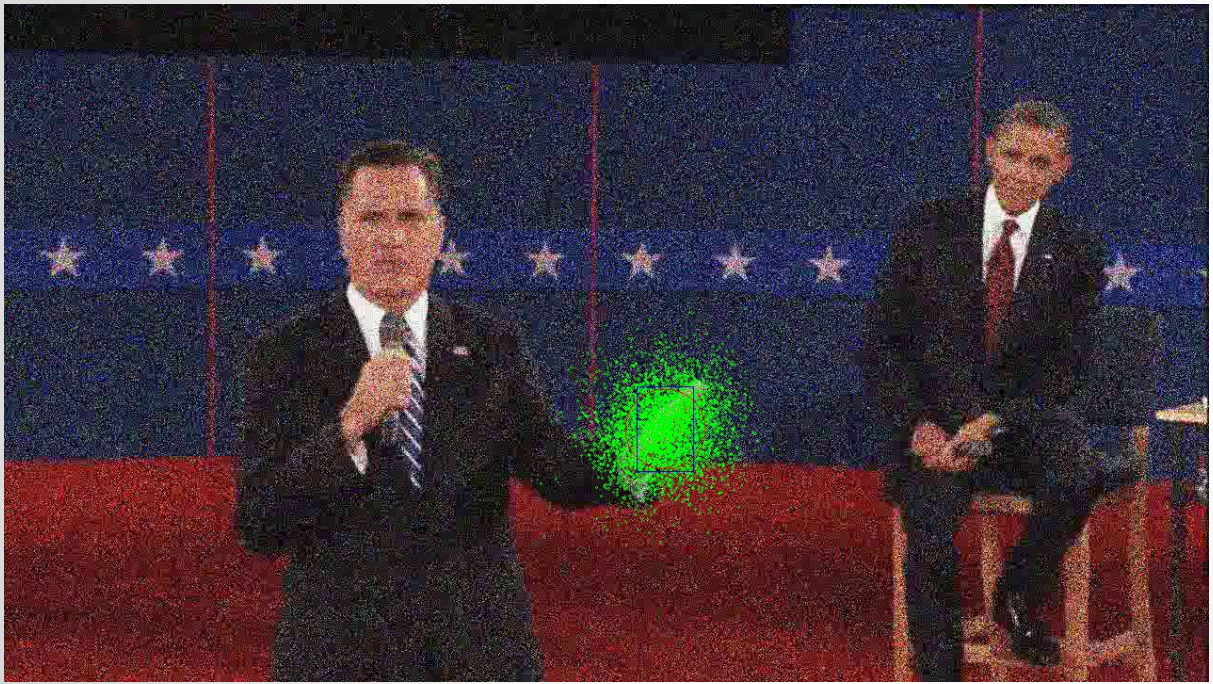
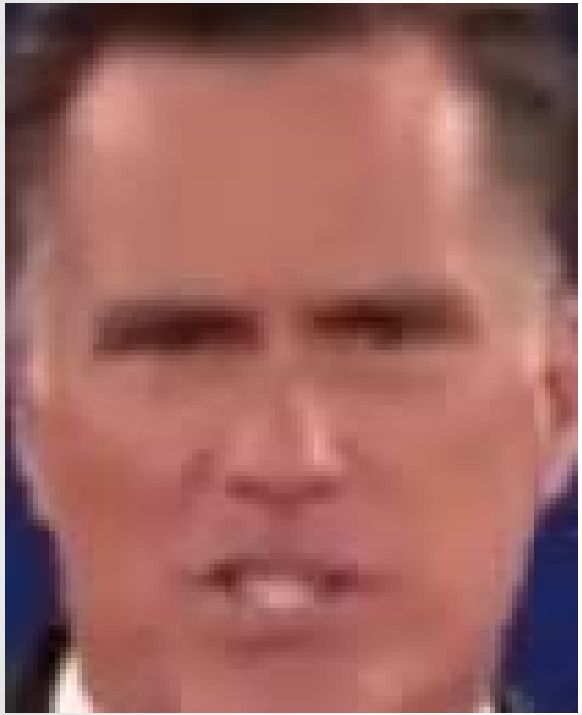


Image frame 50 with overlaid visualizations - **ps7-2-b-3.png**

2b: Image frame 140 with overlaid visualizations

Image frame 140 with overlaid visualizations - **ps7-2-b-4.png**

3a: Template used for tracking



Template image patch image **- ps7-3-a-1.png**

3a: Image frame 28 with overlaid visualizations

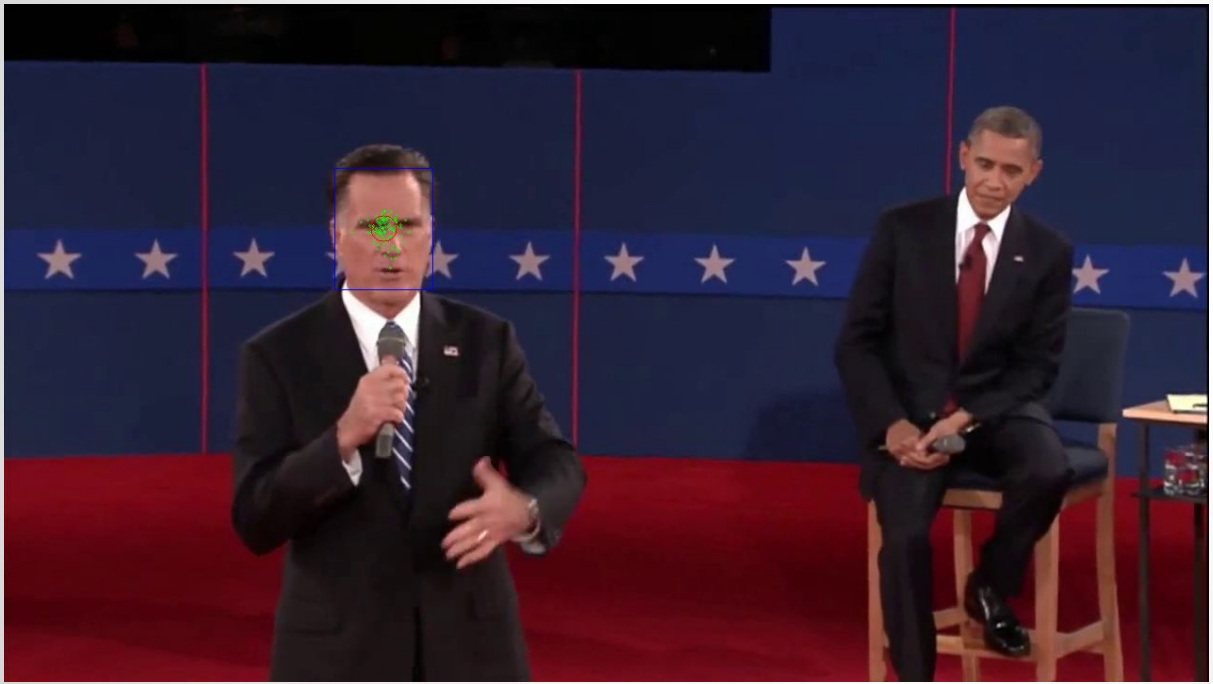


Image frame 28 with overlaid visualizations - **ps7-3-a-2.png**

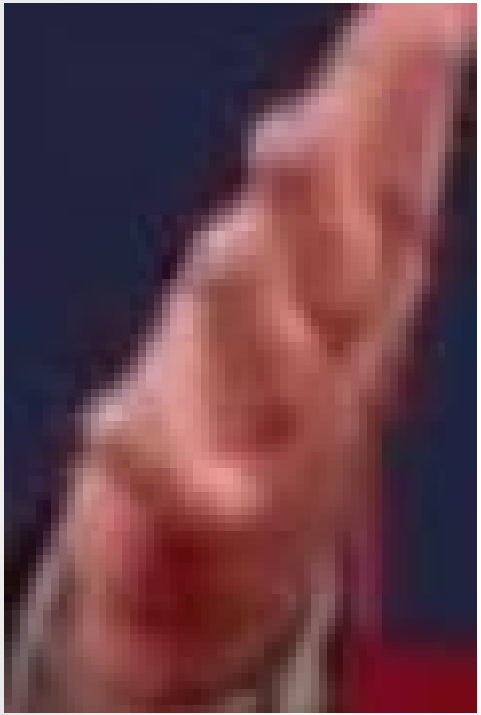
3a: Image frame 94 with overlaid visualizations

Image frame 94 with overlaid visualizations - **ps7-3-a-3.png**

3a: Image frame 171 with overlaid visualizations

Image frame 171 with overlaid visualizations - **ps7-3-a-4.png**

3b: Template used for tracking



Template image patch image - **ps7-3-b-1.png**

3b: Image frame 15 with overlaid visualizations

Image frame 15 with overlaid visualizations - **ps7-3-b-2.png**

3b: Image frame 50 with overlaid visualizations

Image frame 50 with overlaid visualizations - **ps7-3-b-3.png**

3b: Image frame 140 with overlaid visualizations

Image frame 140 with overlaid visualizations - **ps7-3-b-4.png**

4: Discussion Problems

- Using problem 1, experiment with different dimensions for the window image patch you are trying to track. Decrease the window size until the performance of the tracker degrades significantly. Try significantly larger windows than what worked in 1-a. What are the trade-offs of window size and what makes some image patches work better than others for tracking? **Describe 2-3 advantages of larger window size and 2-3 advantages of smaller window size**
  - Larger window size
    - We can use less number of particles since the window size is bigger
    - More easy to track because there are more details
  - Smaller window size
    - Overall time elapse is faster than larger window size
    - Can contain less background noise

4: Discussion Problems

- Using problem 1, Adjust the σ_{MSE} parameter to higher and lower values and run the tracker. **Discuss how changing σ_{MSE} parameter alters the results and attempt to explain why.**
  - If the sigma_mse is too low, it will be hard to converge because everything becomes similar. But, we may still be able to converge. However, if the sigma_mse is too large, it will be harder to converge because everything becomes dissimilar.

4: Discussion Problems

- From problem 1 again, what happens when you try and optimize the number of particles needed to track the target. **Discuss your Optimized Particle Number and Discuss the trade-offs of using a larger number of particles to represent the distribution.**
    - When using a larger number of particles, we may converge faster. That is, the number of frames required to find the model will be less. However, the execution time will be slower since we have to check similarity on all of those particles.

CHALLENGE PROBLEM:
5: Template used for tracking

Template image patch image - **ps7-5-a-1.png**

5a: Image frame 40 with overlaid visualizations

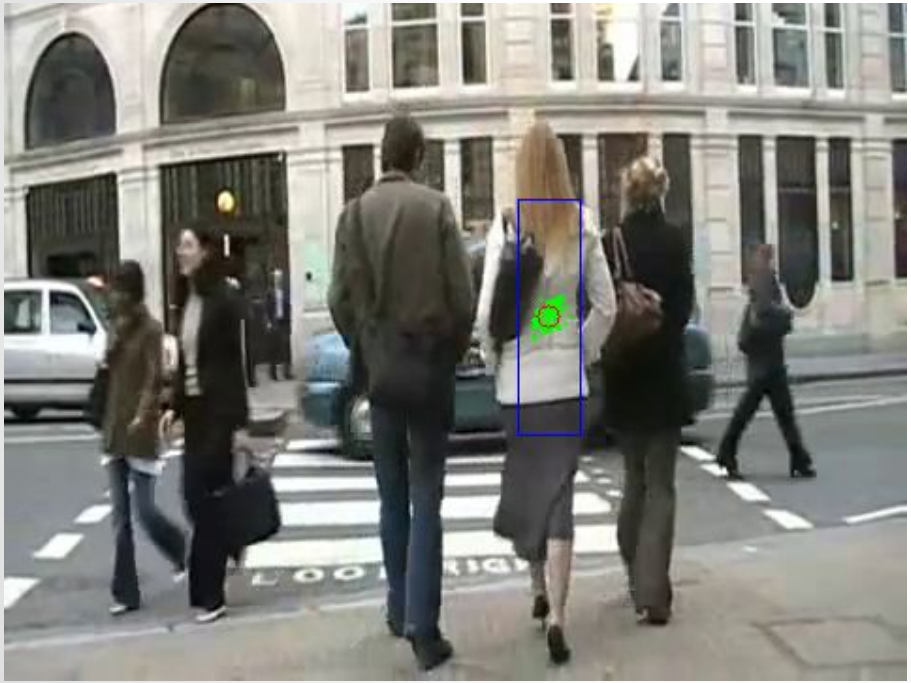


Image frame 40 with overlaid visualizations - **ps7-5-a-2.png**

5a: Image frame 100 with overlaid visualizations

Image frame 100 with overlaid visualizations - **ps7-5-a-3.png**

5a: Image frame 240 with overlaid visualizations

Image frame 240 with overlaid visualizations - **ps7-5-a-4.png**