# Computer Vision
# Spring 2017
# 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

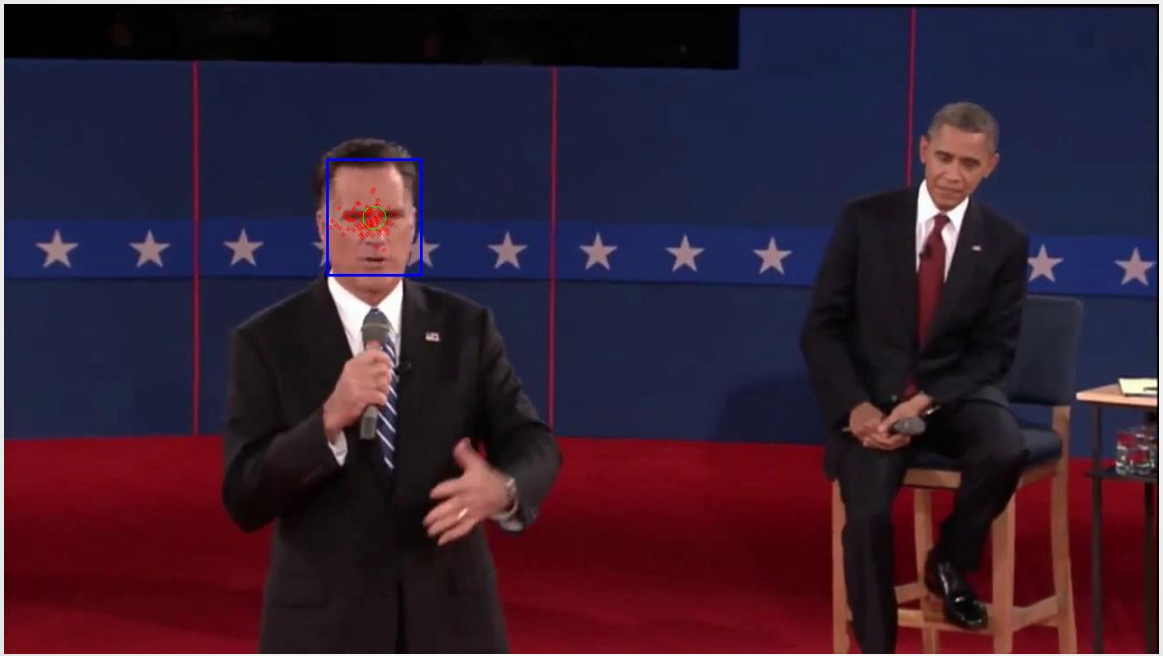


Image frame 28 with overlaid visualizations **- ps7-1-a-2.png**

# 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

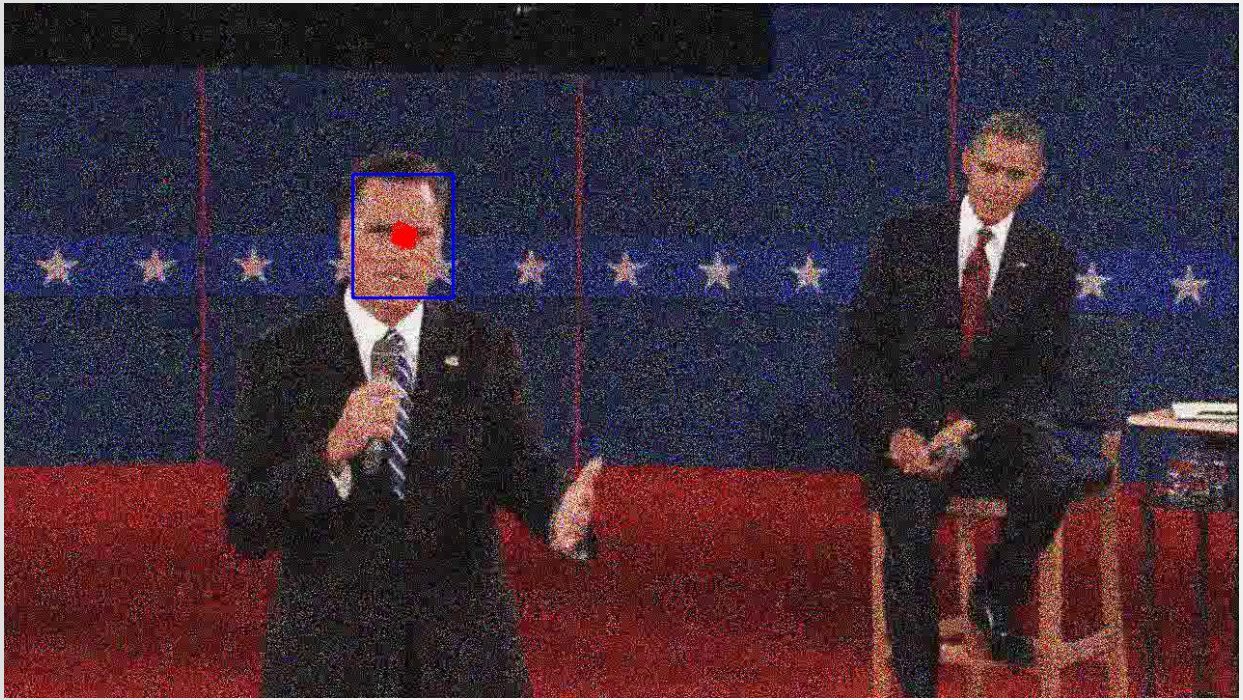


Image frame 14 with overlaid visualizations **- ps7-1-b-1.png**

# 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

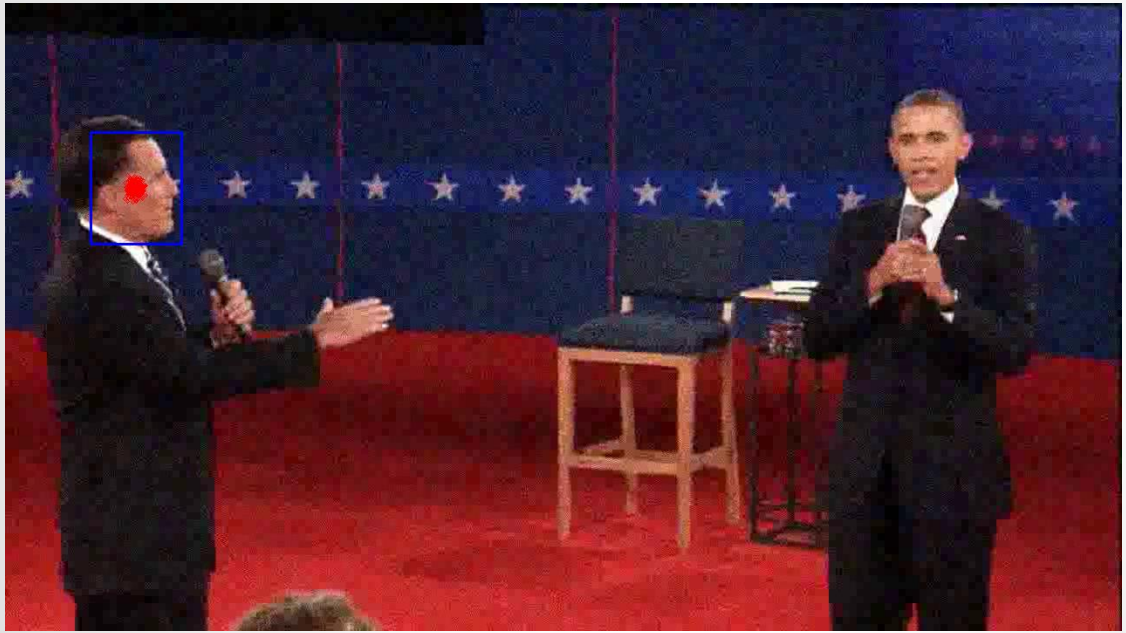
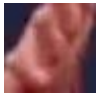


Image frame 530 with overlaid visualizations **- ps7-1-b-3.png**

# 2a: Template used for tracking



**NOTE: to run 2a comment lines 552 & 553 in PS07.py as I needed to add a uniform kernel to smooth the frame in an attempt to reduce the noise in 2b**

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

# 2a: Image frame 22 with overlaid visualizations

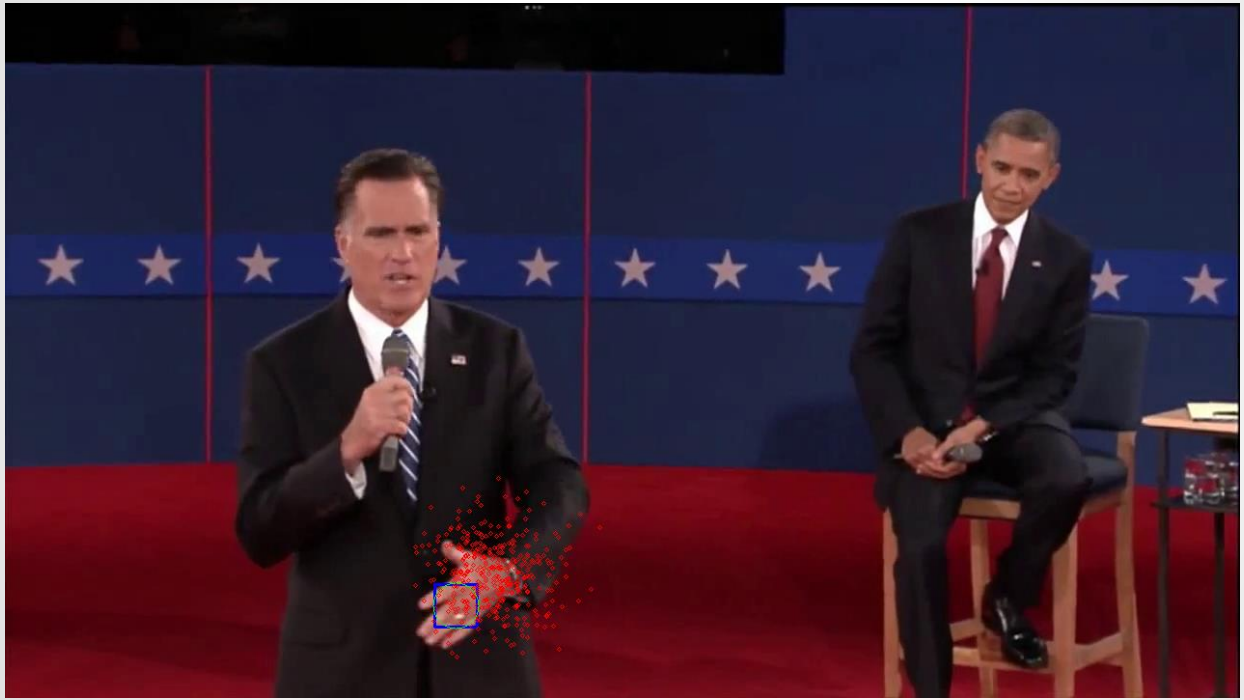


Image frame 22 with overlaid visualizations **- ps7-2-a-2.png**

# 2a: Image frame 50 with overlaid visualizations

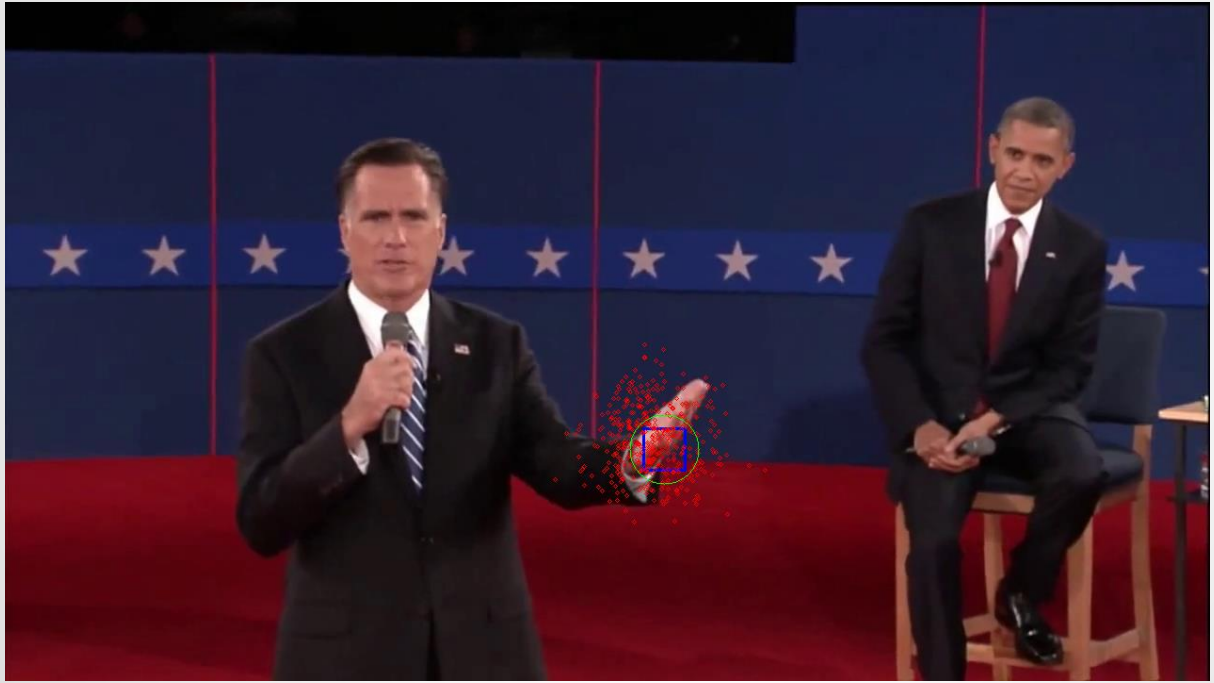


Image frame 50 with overlaid visualizations **- ps7-2-a-3.png**

# 2a: Image frame 160 with overlaid visualizations

Image frame 160 with overlaid visualizations **- ps7-2-a-4.png**

# 2b: Template used for tracking

**NOTE: to run 2b uncomment lines 552 & 553 in PS07.py as I needed to add a uniform kernel to smooth the frame in an attempt to reduce the noise**

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

# 2b: Image frame 22 with overlaid visualizations

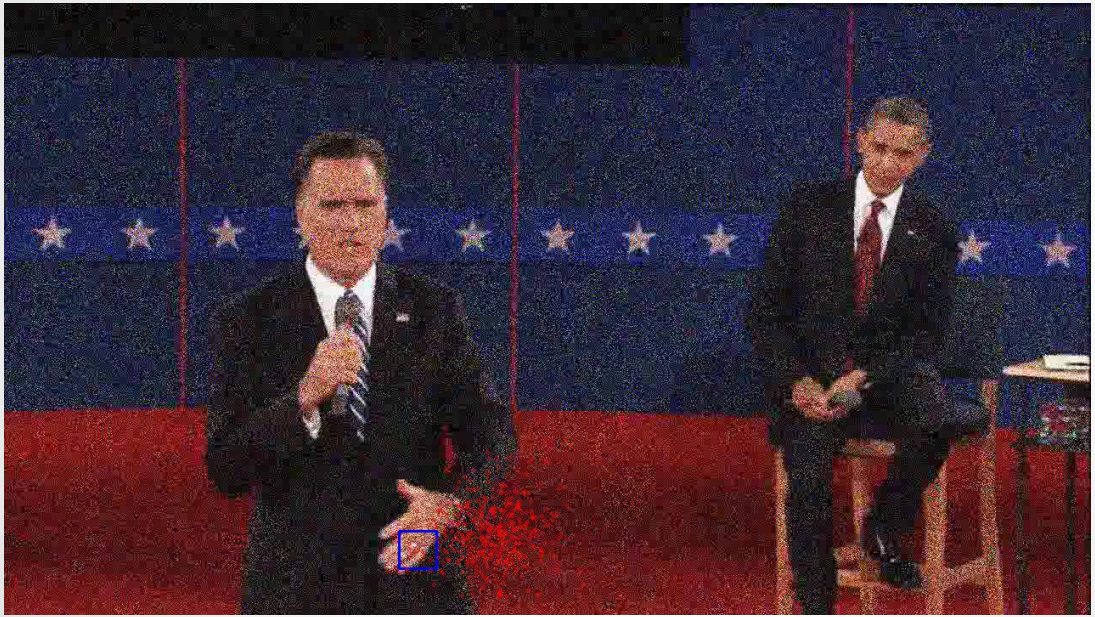


Image frame 22 with overlaid visualizations **- ps7-2-b-2.png**

# 2b: Image frame 50 with overlaid visualizations

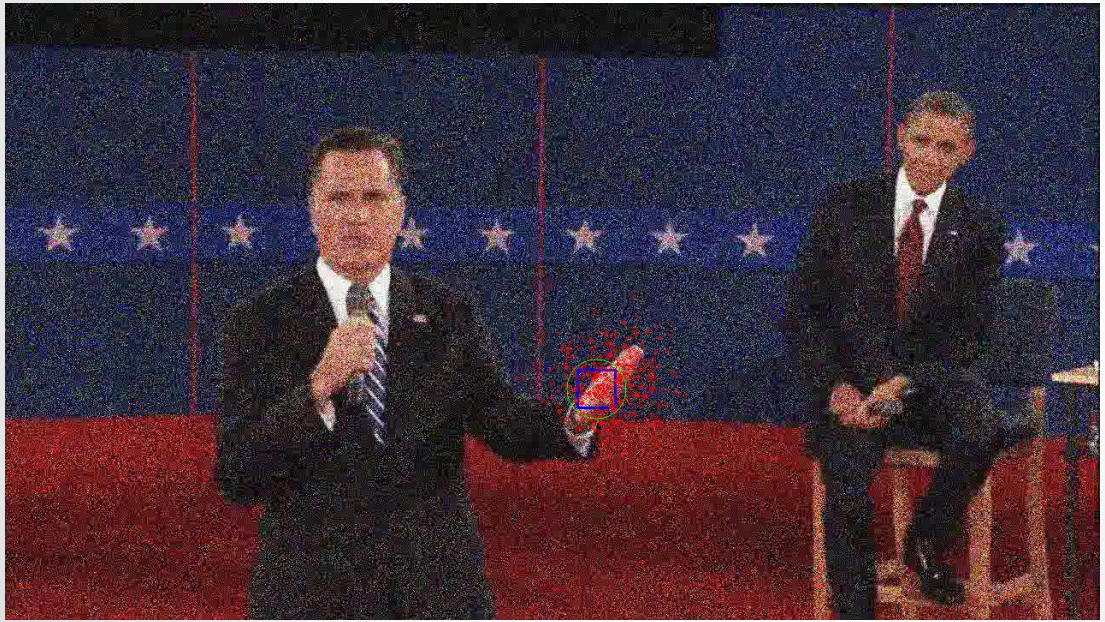


Image frame 50 with overlaid visualizations **- ps7-2-b-3.png**

# 2b: Image frame 160 with overlaid visualizations

Image frame 160 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

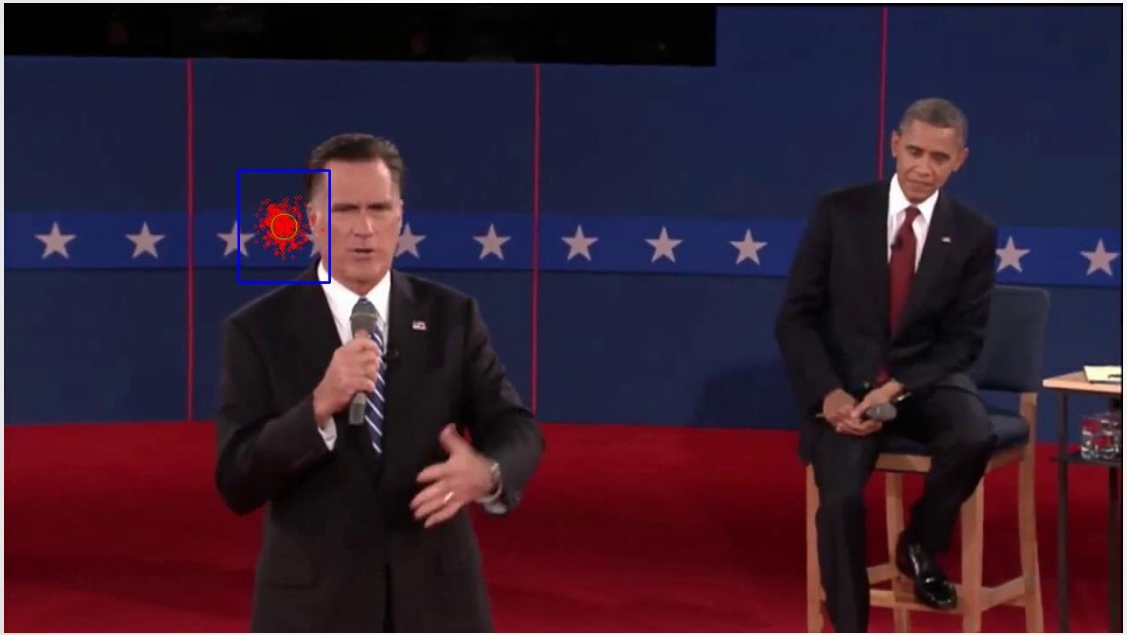


Image frame 28 with overlaid visualizations **- ps7-3-a-2.png**

# 3a: Image frame 94 with overlaid visualizations

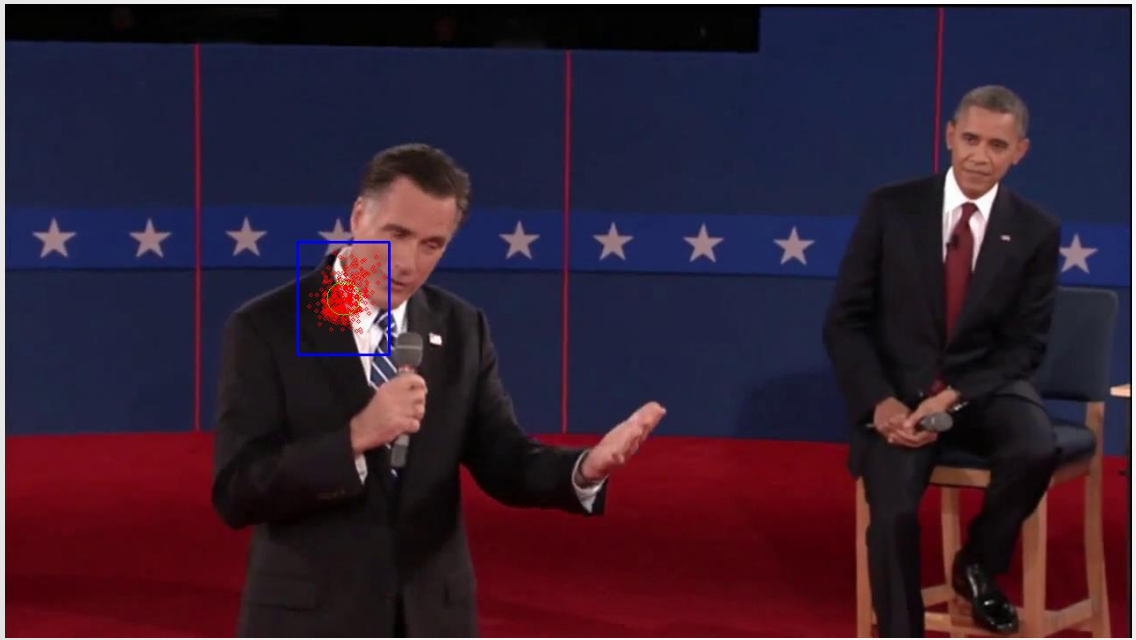
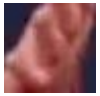


Image frame 94 with overlaid visualizations **- ps7-3-a-3.png**

# 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 22 with overlaid visualizations

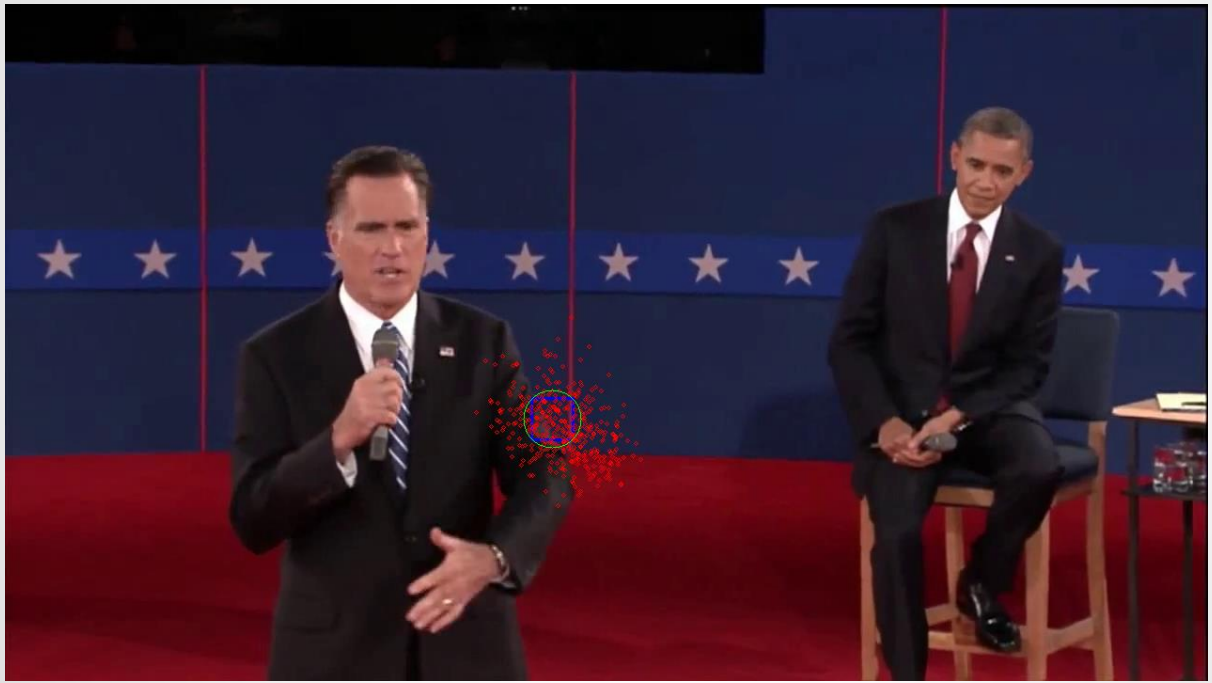


Image frame 22 with overlaid visualizations **- ps7-3-b-2.png**

# 3b: Image frame 50 with overlaid visualizations

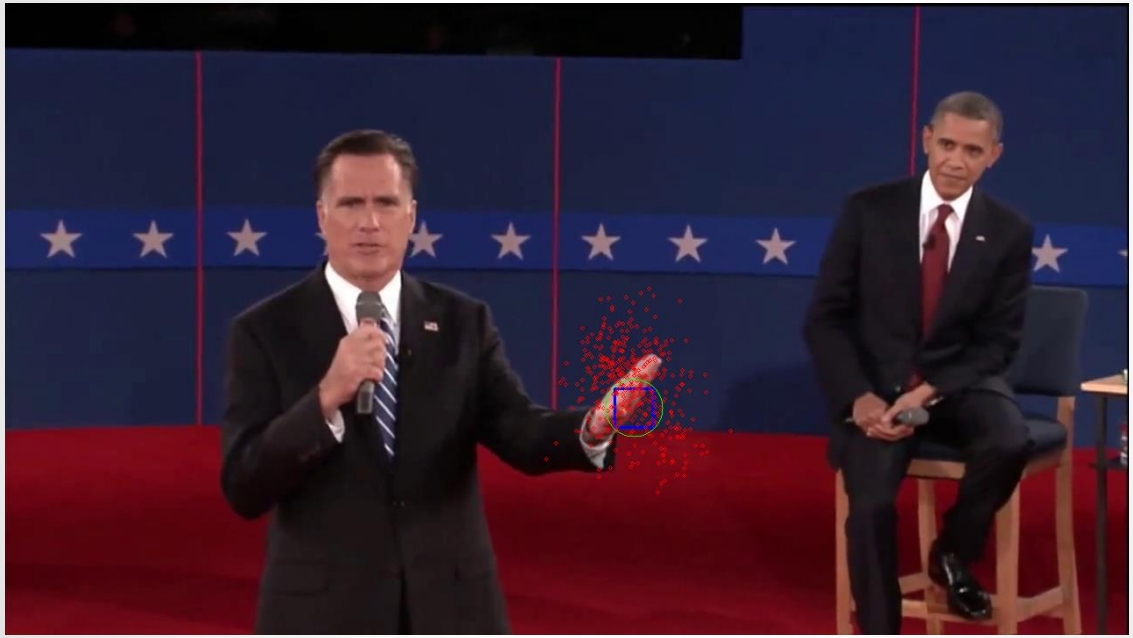


Image frame 50 with overlaid visualizations **- ps7-3-b-3.png**

# 3b: Image frame 160 with overlaid visualizations

Image frame 160 with overlaid visualizations **- ps7-3-b-4.png**

# 4: Discussion Problems

**Describe 2-3 advantages of larger window size and 2-3 advantages of smaller window size**

Using a larger window, the features become less sensitive to changes in orientation and position. Also, as the the window gets larger, there beocomes more features to track so the tracking becomes easier. This however, makes the computation time more and it requires more particles to ensure better presense within the patch.

Using a smaller window decreases the computation time and removes unnecessary parts from the patch like background colors (which was needed when I tracked the hand in p2).

# 4: Discussion Problems

**Discuss how changing $\sigma_{MSE}$ parameter alters the results and attempt to explain why.**

A range of values have been tried from 3 to 60. It was noted that the value of sigma_mse is important in finding a good match affecting the comparison sensitivity of the patch and template. A smaller value resulted in higher sensitivity and gives weight to a few particles. While a larger one resulted in a less sensitive measurement with a distributed weight over a larger range of particles.

# 4: Discussion Problems

. **Discuss your Optimized Particle Number and Discuss the trade-offs of using a larger number of particles to represent the distribution.**

A range of values have been tried from 20 up to 800. With a few number of particles, there is a chance that they do not fall on the template which results in them being stuck in a local minima and a larger sigma_dyn might need to be used to ensure movement and increase likelihood of landing on the template. An advantage however is small computation time. Larger number of particles increases the likelihood of falling on the template and increases chances of success while requiring a smaller sigma_dyn but a disadvantage is the high computation time.

# 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**