

# Color Quest: Tracking Color Using CAMShift

## Objective

- Track multiple colors in a video using CAMShift
- Record videos of color tracking
- Import pre-recorded videos in order to track colors
- Personally choose tracking window
- Creating an objective that will reset program when reached
- Creating a menu that takes mouse inputs and displays options

## CAMShift

CAMShift is a function that is used to identify where a color is located in an image. In order to do so, the following steps are taken:

1. Turns the image into Hue Saturation Value (HSV) format (See Fig. 4)
2. Creates a histogram of image to identify color patterns (See Fig. 6)
3. Creates BackProject to calculate probability of a color being in a certain location (See Fig. 9)

After these three steps, CAMShift determines the balance point of a certain color (the center location of the desired color). Then, a tracking window is created around the balance point. If the location of the color moves, the window will move and resize as necessary.

## Additional Features

Restart Box	<ul style="list-style-type: none"><li>• Uses masks to change appearance of boxed area</li><li>• When track window enters boxed area, program resets</li></ul>
Mouse Selection	<ul style="list-style-type: none"><li>• Allows use of mouse to customize tracking selection</li><li>• Freezes frame to make selection</li></ul>
Save Video	<ul style="list-style-type: none"><li>• Allows user to save video of tracking session</li></ul>
Import Video	<ul style="list-style-type: none"><li>• Allows user to import pre-recorded video instead of webcam to track colors</li></ul>
Menu	<ul style="list-style-type: none"><li>• Custom GUI to choose features and navigate program</li></ul>
Show Frames Per Second (FPS)	<ul style="list-style-type: none"><li>• Display the amount of FPS for video on image</li></ul>

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## Method

Figure 2:  
Original Image with Selection

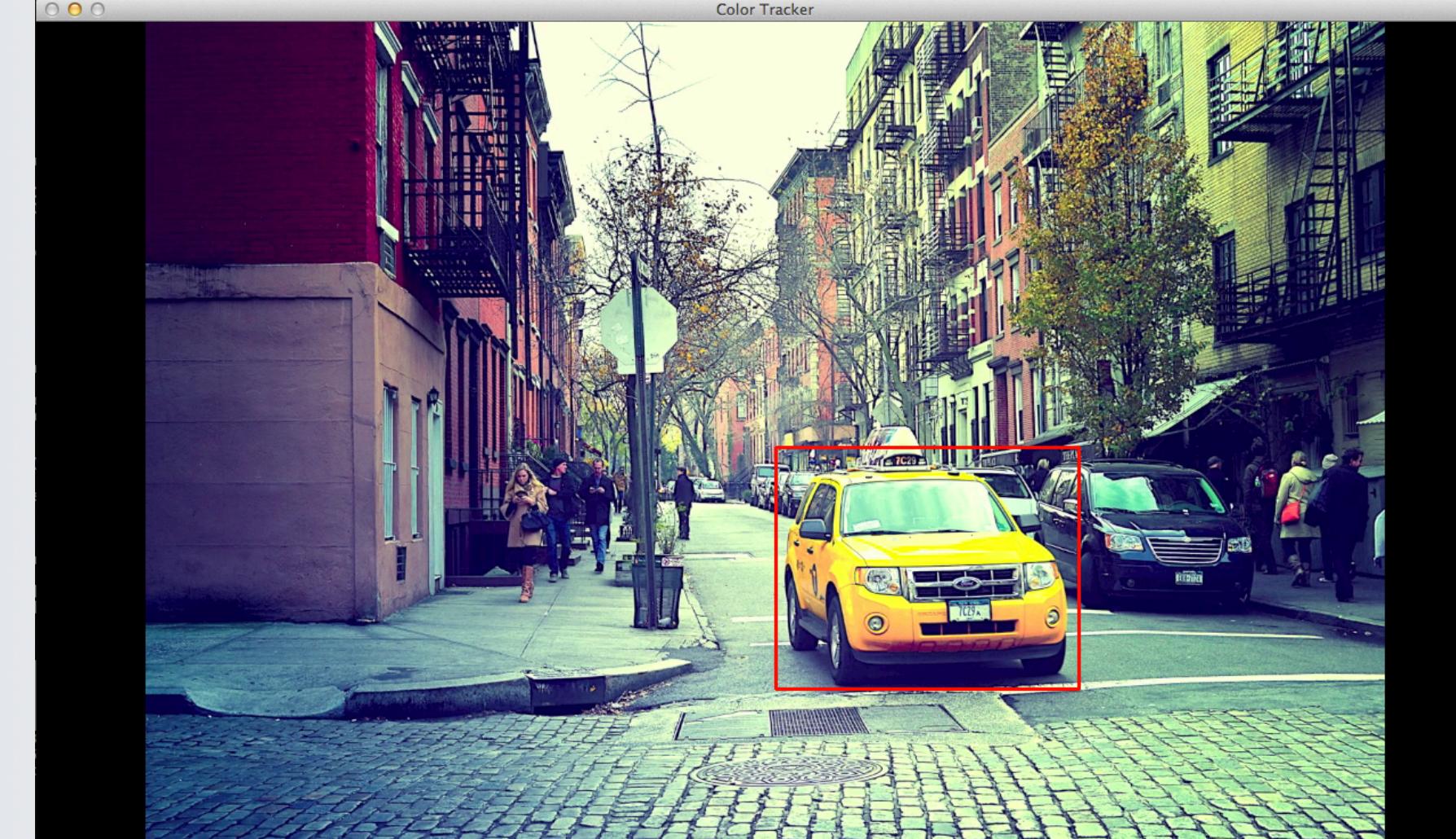


Figure 3:  
Cropped to Selection



Figure 4:  
Selection in HSV

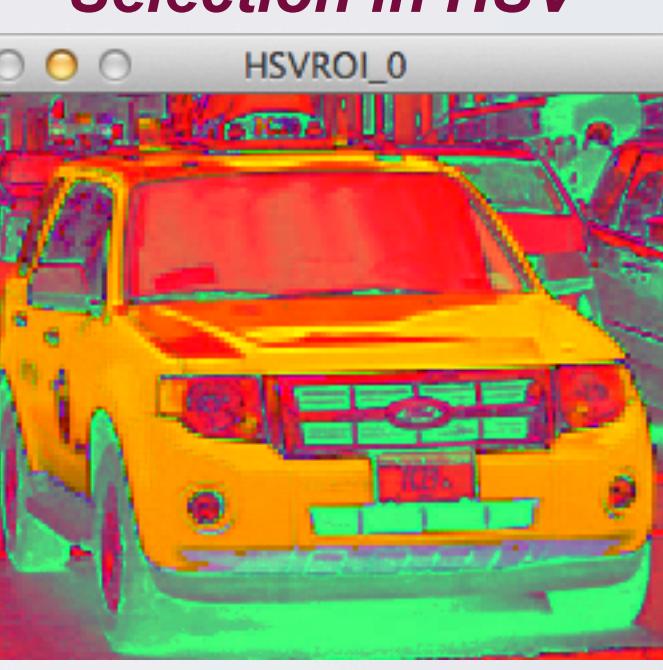


Figure 5:  
Mask of HSV Image



Figure 6:  
Histogram of HSV

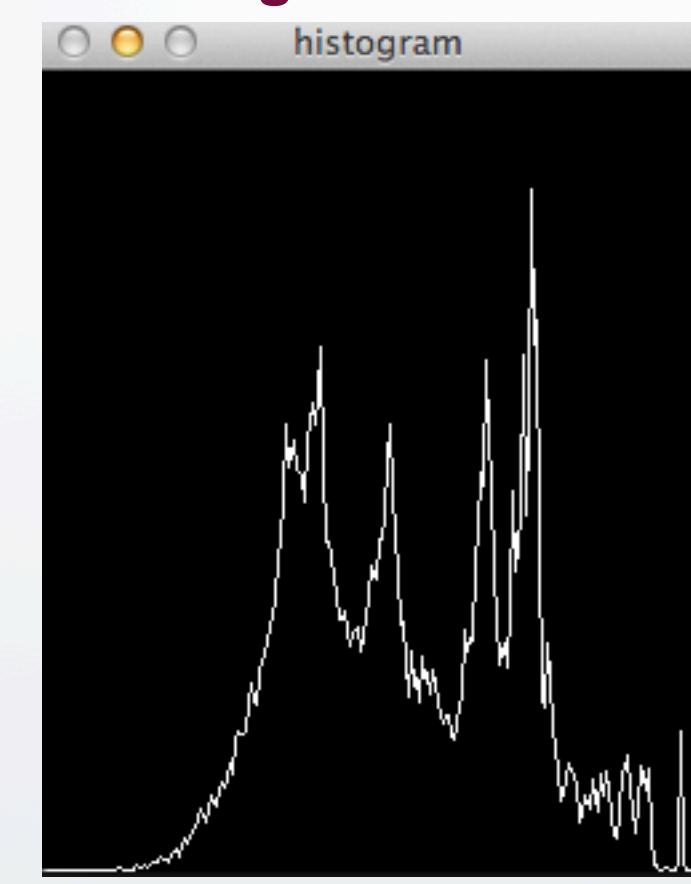


Figure 7:  
Normalized Histogram

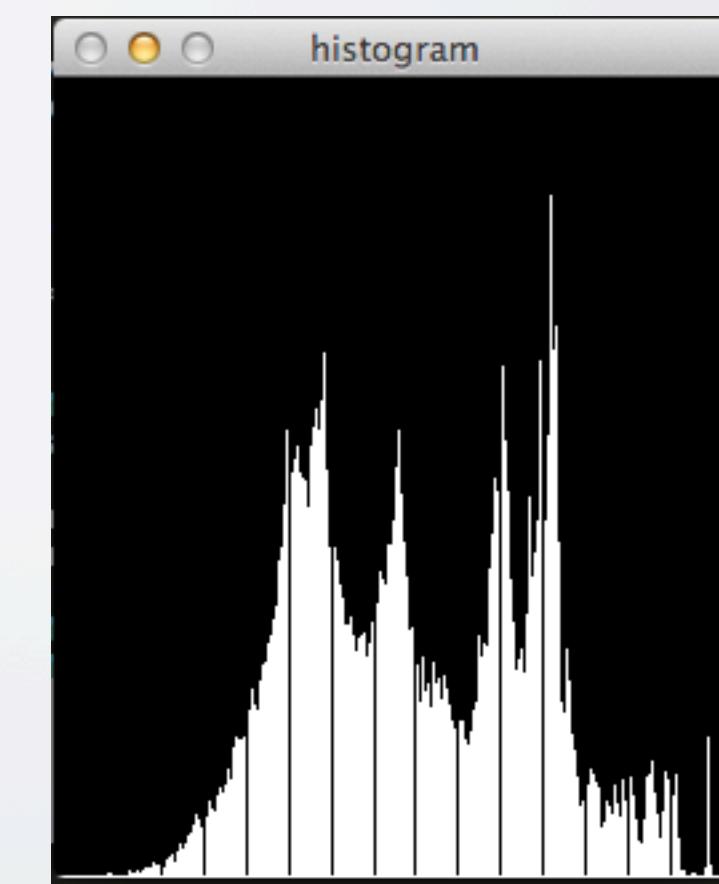


Figure 8:  
Full Image in HSV

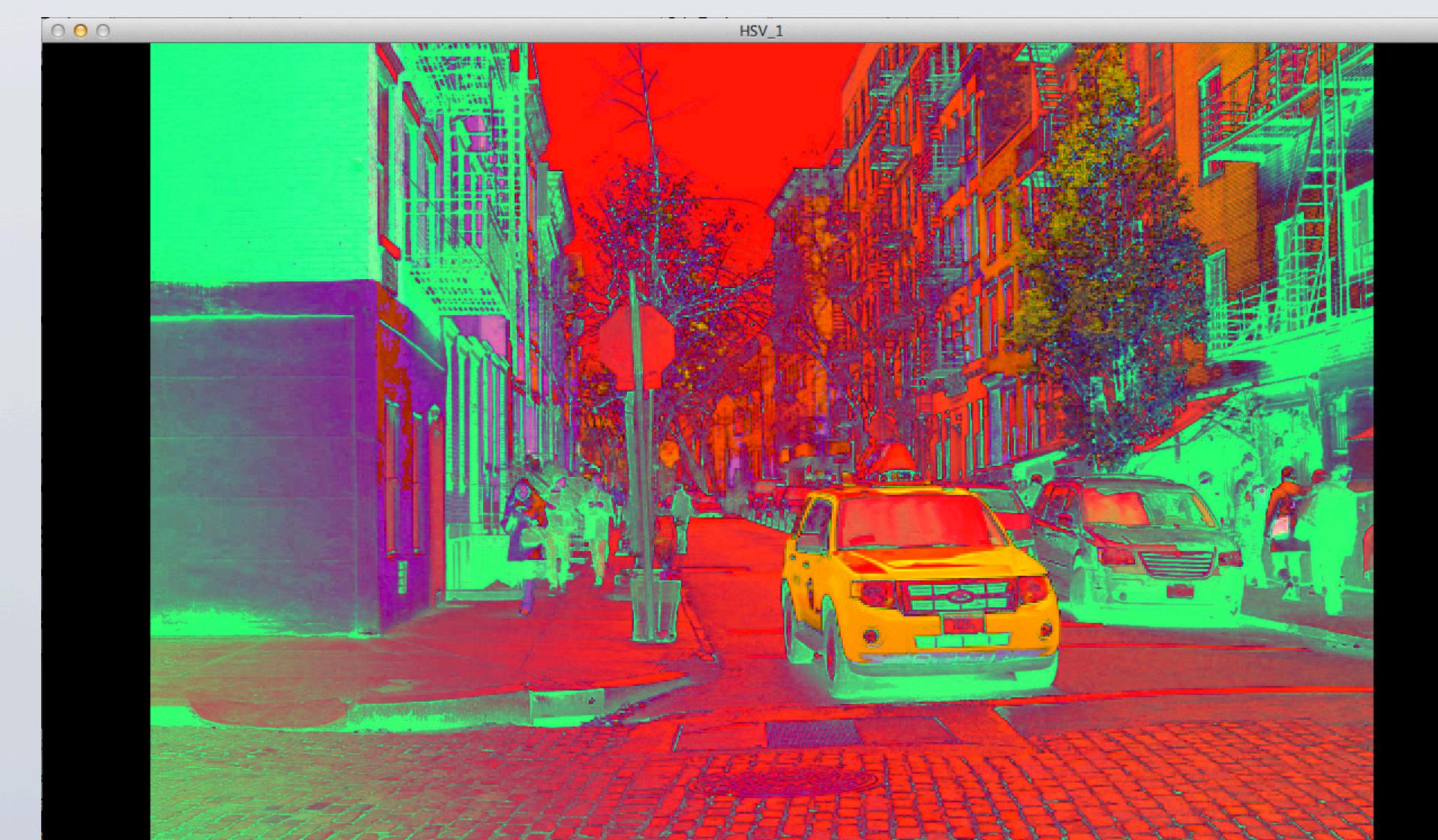


Figure 9:  
Figure 7 and Figure 8 used to create BackProject

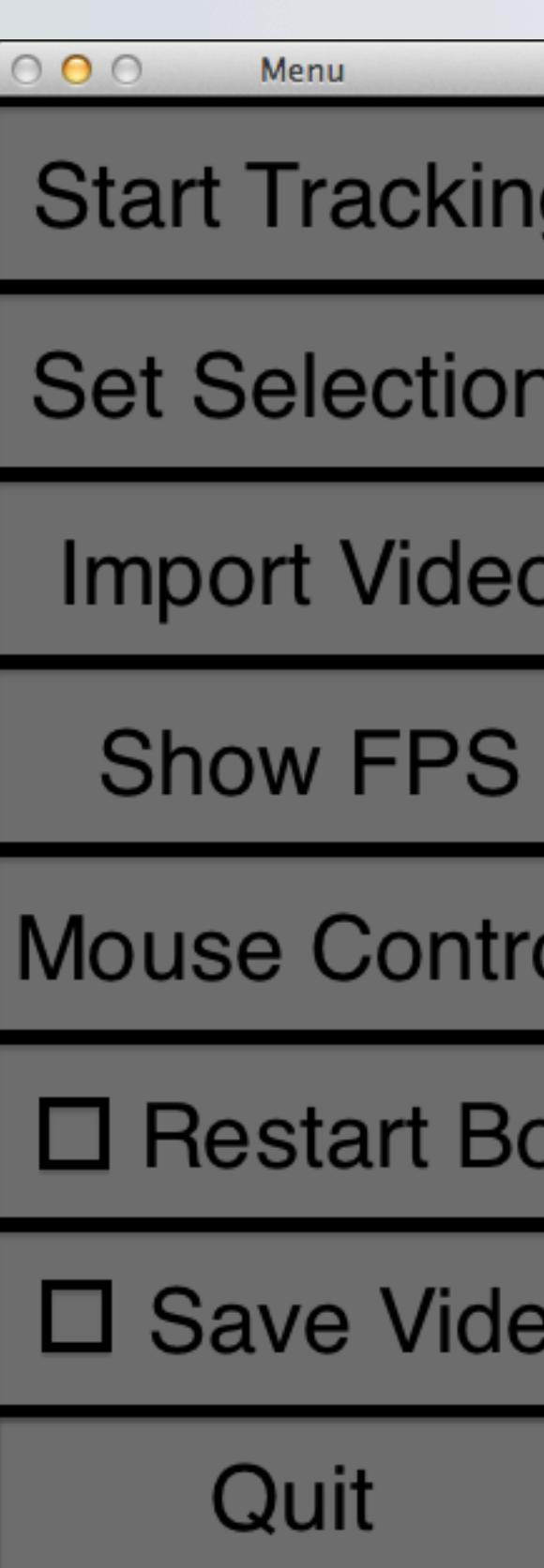
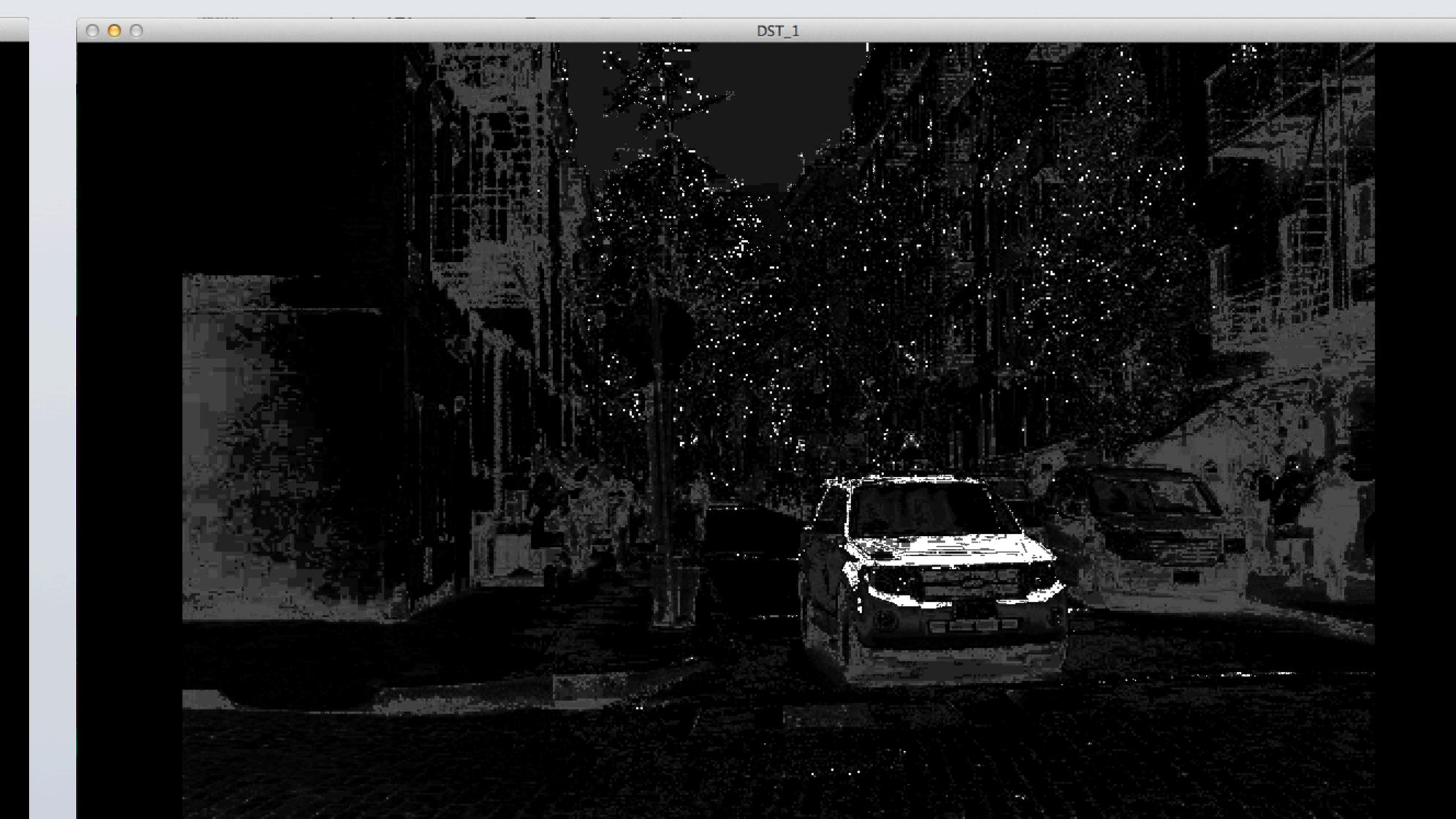


Figure 1: Menu

## Evolution of Our Program

### Set Selection and Single Tracker

Our program started out as a humble and simple single color tracker. It had one stationary selection box and one little blue tracking window.

### Restart Box and Dots

On a side project, we worked with masks and changing color channels on an image. This work was applied to the color tracker and evolved into the restart box.

Flashy/flashing dots were created to trail the center of the tracking window. Each dot was its own color and disappeared after a certain amount of time. It would not survive the implementation of multi-tracking.

### Mouse Selection

An alternative way to select a color to track was added in the form of the mouse selection tool. This would later be the root of many bugs.

### Multi-Tracking

The death of everything we had previously created. But like a phoenix, our program rose from the ashes to become the magnificent beast before you. It allows for a variable amount of tracking windows to be displayed at the same time.

### Menu

With all the added features, it became necessary to create a GUI. It is a modular design that allows new buttons to be added easily.

### Import and Save Videos

As the program progressed, it was decided that the ability to read and write video from files would be advantageous for the users.

## Conclusion

This program was both challenging and exciting to write. It was great to see how our project evolved from start to finish. We were able to use the new skills we acquired in class to improve and expand our projects in ways we would not have expected at the start of the project. If we had the chance to rewrite this code, we would have started the project with multiple color tracking in mind. We had difficulties altering our single tracker into a multi-tracker, and had to redo much of the code that was already written. That said, the current program not only runs well, but also demonstrates the skills we have gained throughout this course.