EE 417 Computer Vision

Berkant Deniz Aktaş

19515

Post-Laboratory Report

November 30, 2018

Sabancı University

Faculty of Engineering and Natural Sciences

Computer Science and Engineering

Introduction //TODO EXPLAIN ADD CODES

In the lab6, we implemented optic flow for videos in order to track the motion. The idea is computing gradient and check SSD. In this report, I will try to implement different window sizes K and try different smoothing filters on a fixed K.

Different Window Size

For simplicity and suggestions based on lab we can set threshold to 5000 and try to detect optic flow. Results are taken from different videos for K = 10

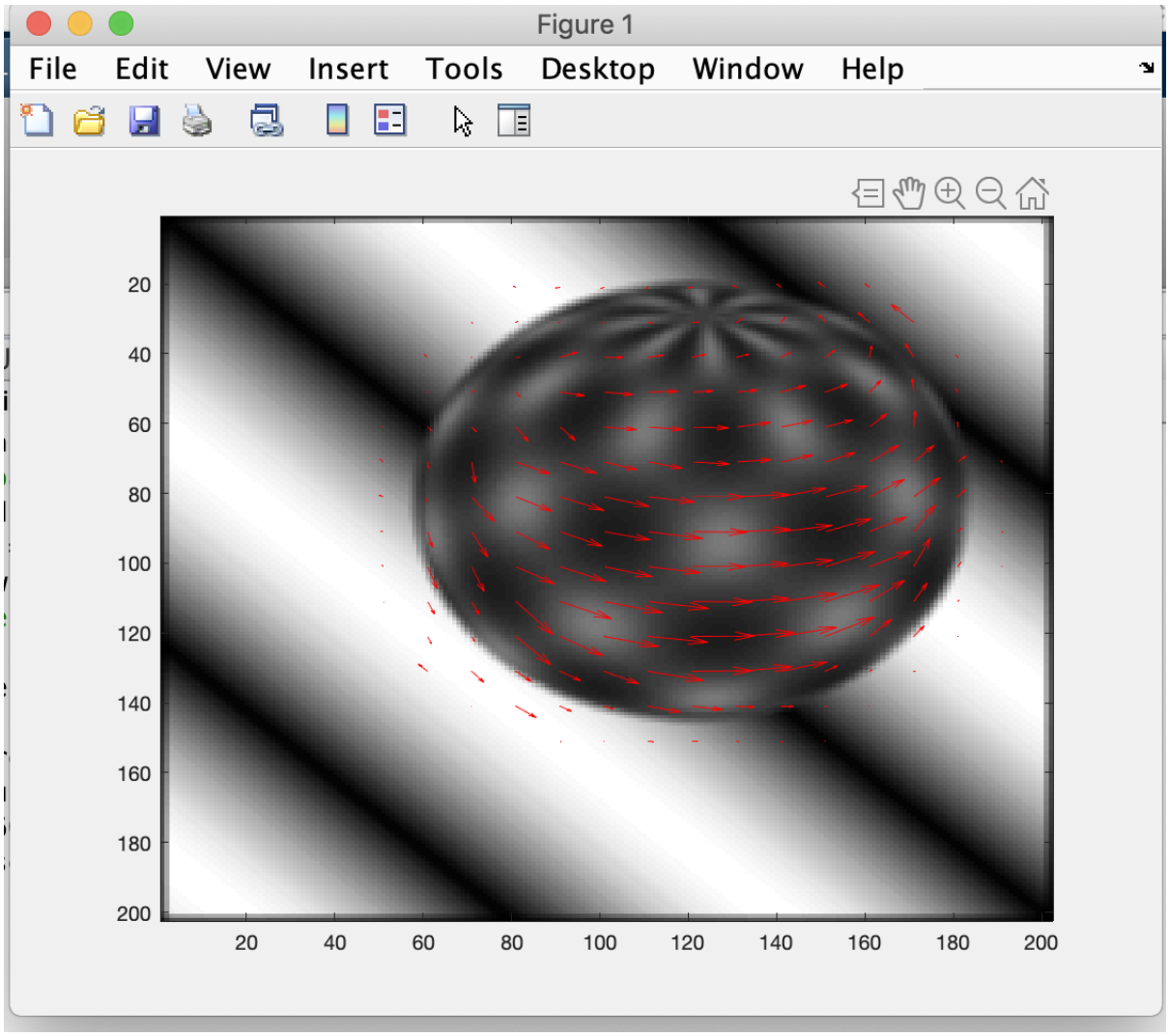

Figure 1. K = 10 on sphere

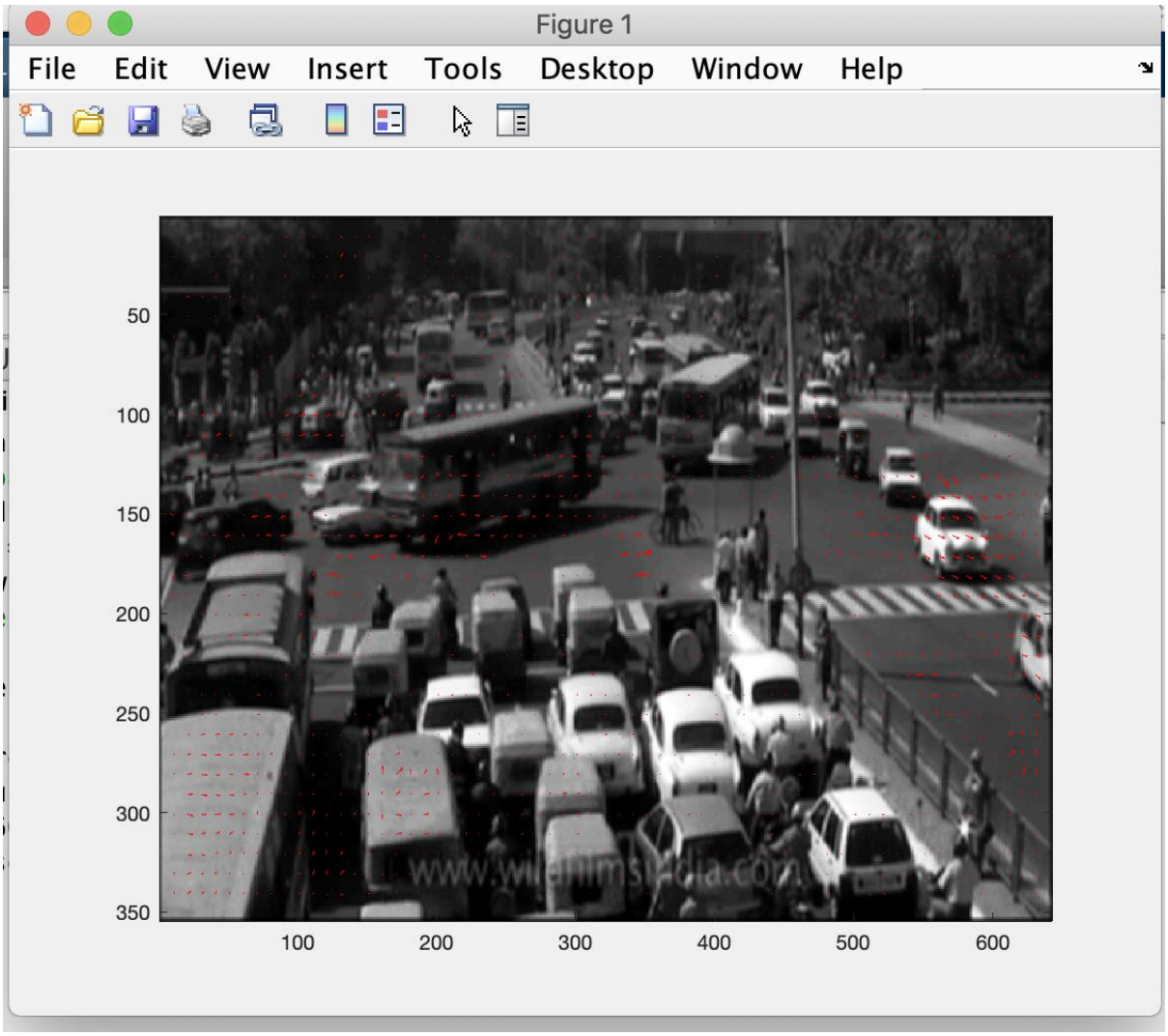

Figure 2. K = 10 on cars1

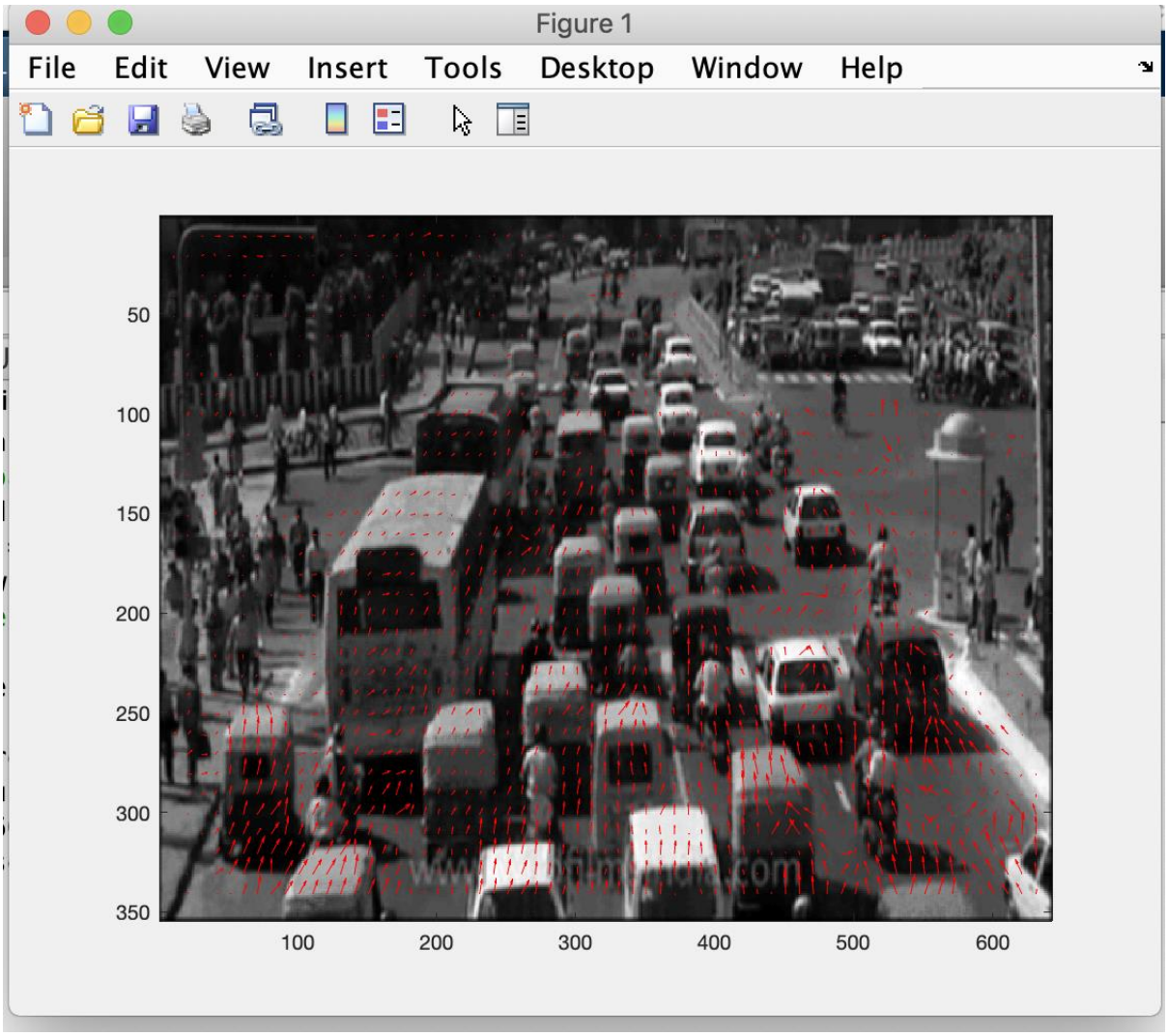

Figure 3. K=10 on cars2

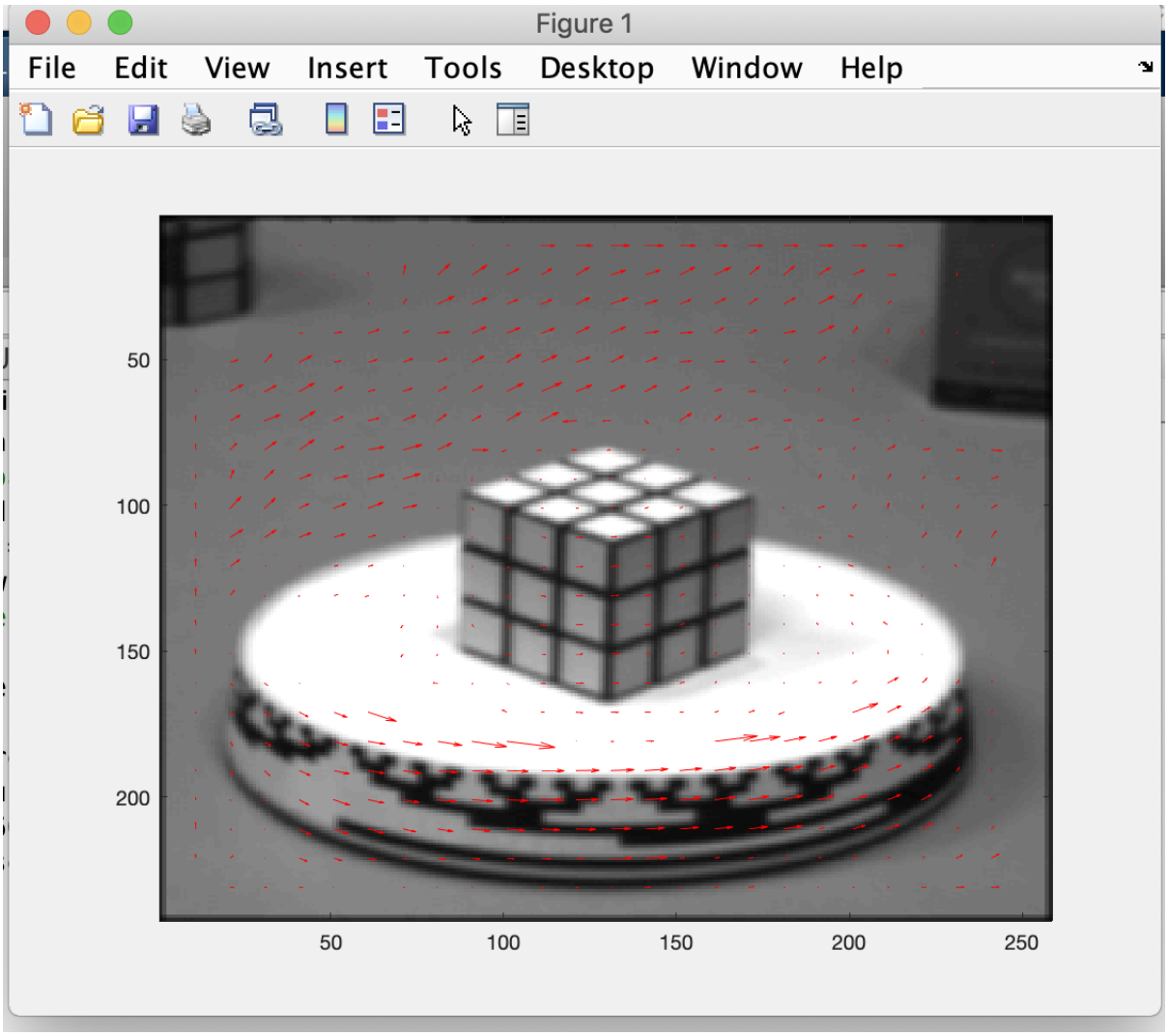

Figure 4. K=10 on rubic

We can see really good detection on sphere. But there are some problems related with others. Figure 4 show rubic is rotating counter clockwise but clockwise flow detected on top of image. Figure 3. Shows cars2 and optic flow is on vertical direction upwards. But Figure2 cars1 flow is not that clear. We can try changing parameter K to lower values and higher values and test on these 4 videos.

Let's try K = 30 first.

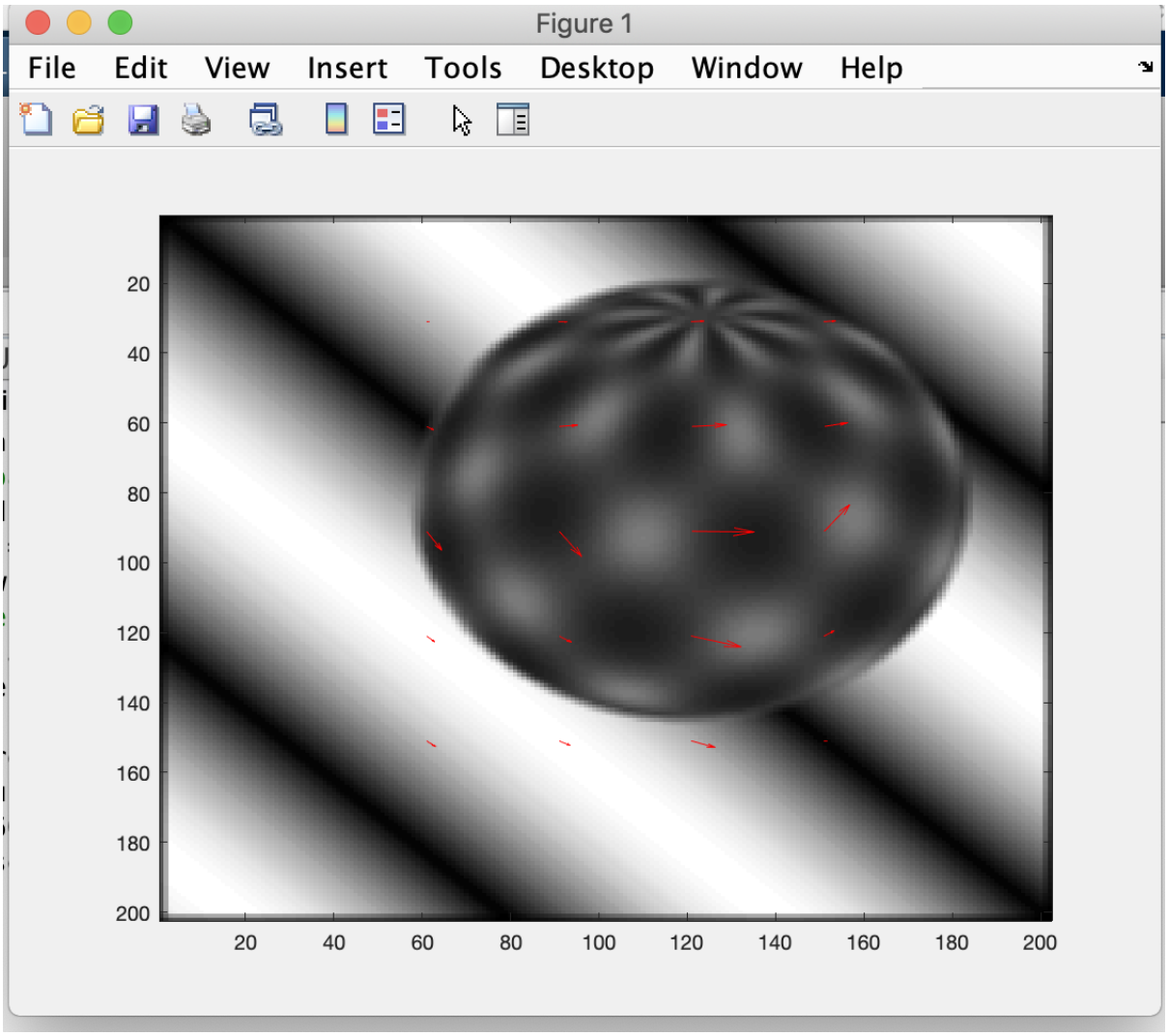

Figure 5. K=30 on sphere

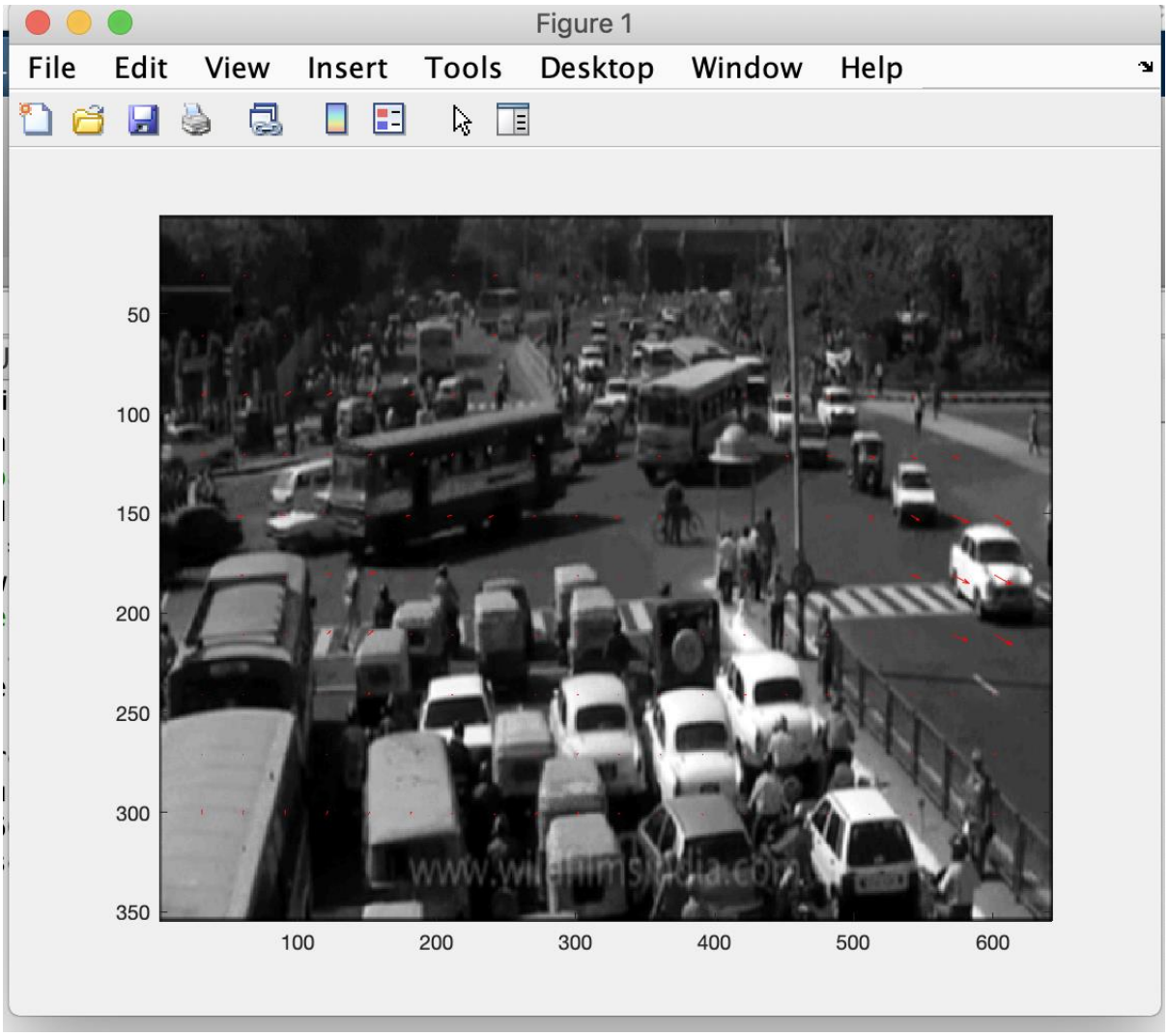

Figure 6. K = 30 on cars1

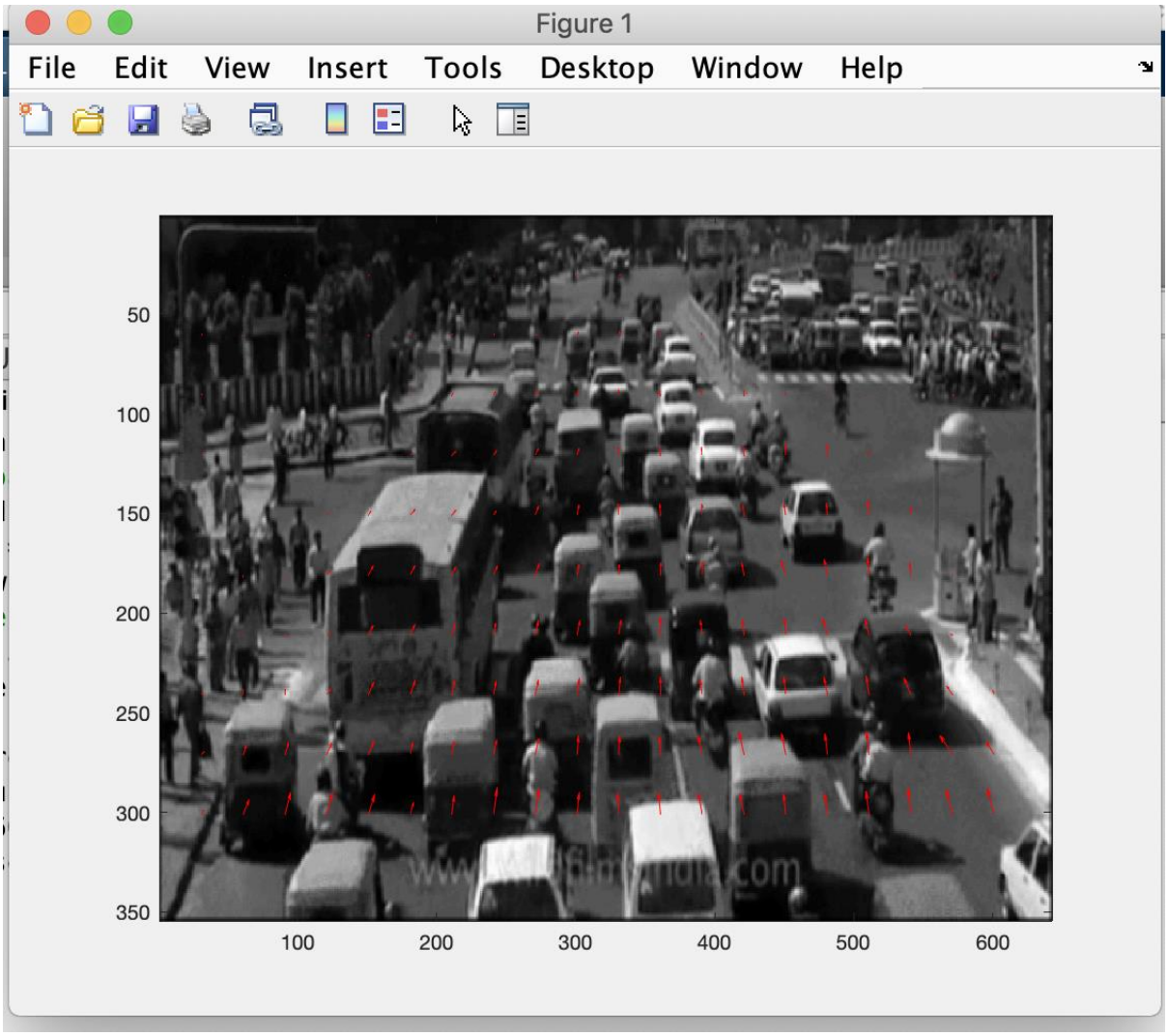

Figure 7. K=30 on cars2

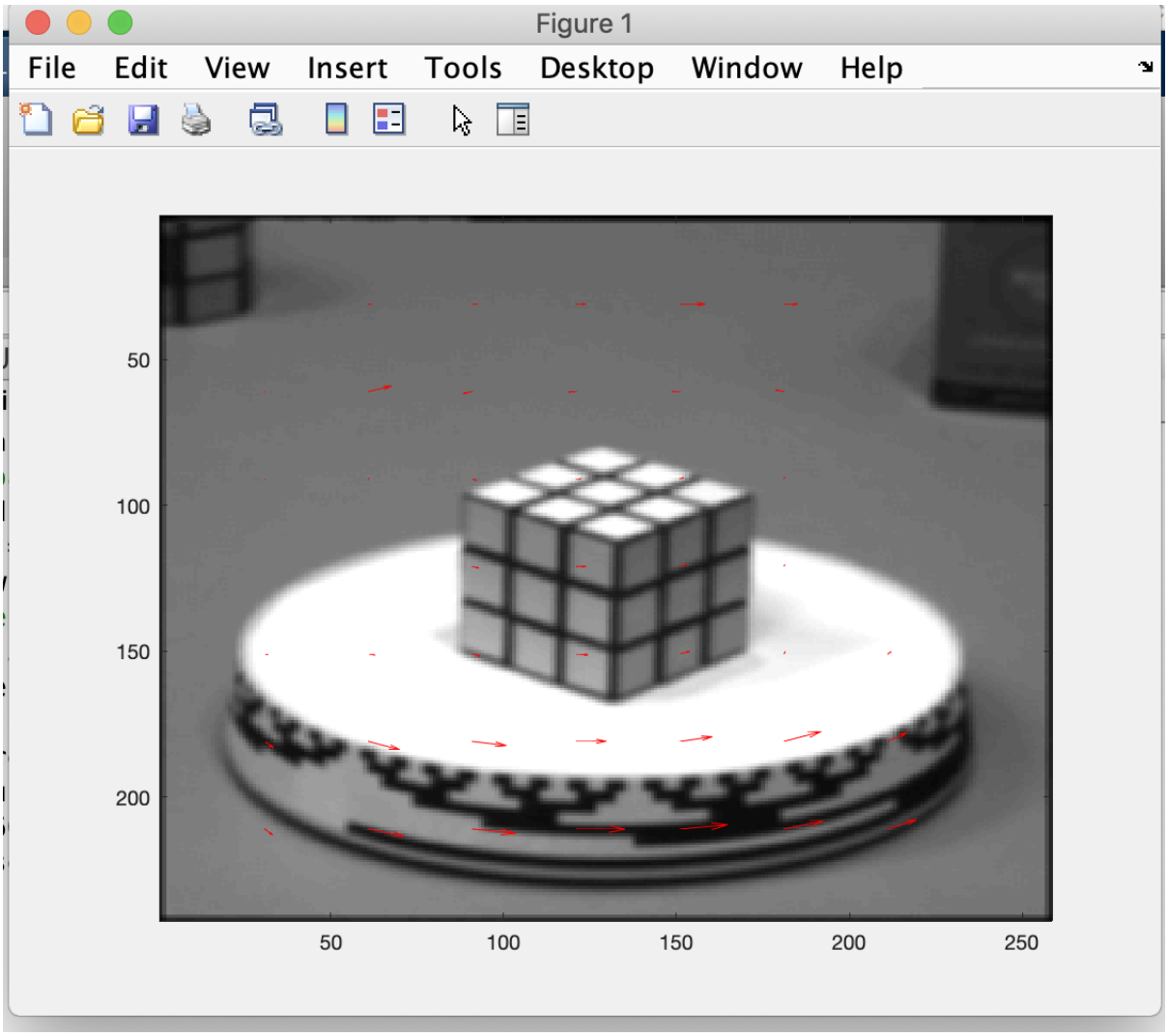

Figure 8. K=30 on rubic

As one can guess easily, increasing K reduced the detected gradients on the video. For sphere using K=10 gave better result for detecting flow. If we look rubic, we can see that bottom of the image has correct gradients also reduced error on the top of the image. Also it is good for cars2 and cars1 because there were lots of similar gradients due to small window size.

Lets decrease K to 5.

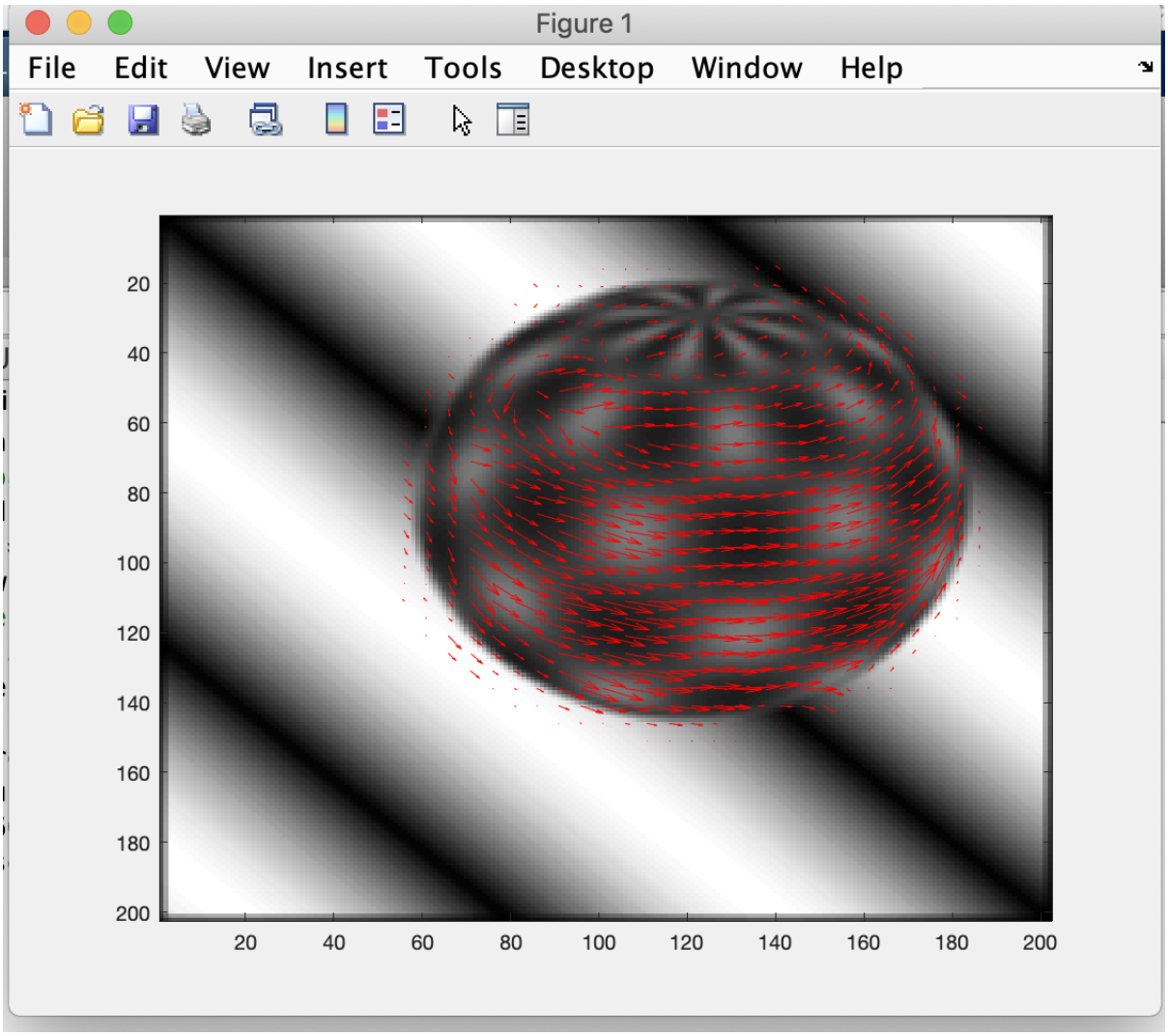

Figure 9. K=5 on sphere

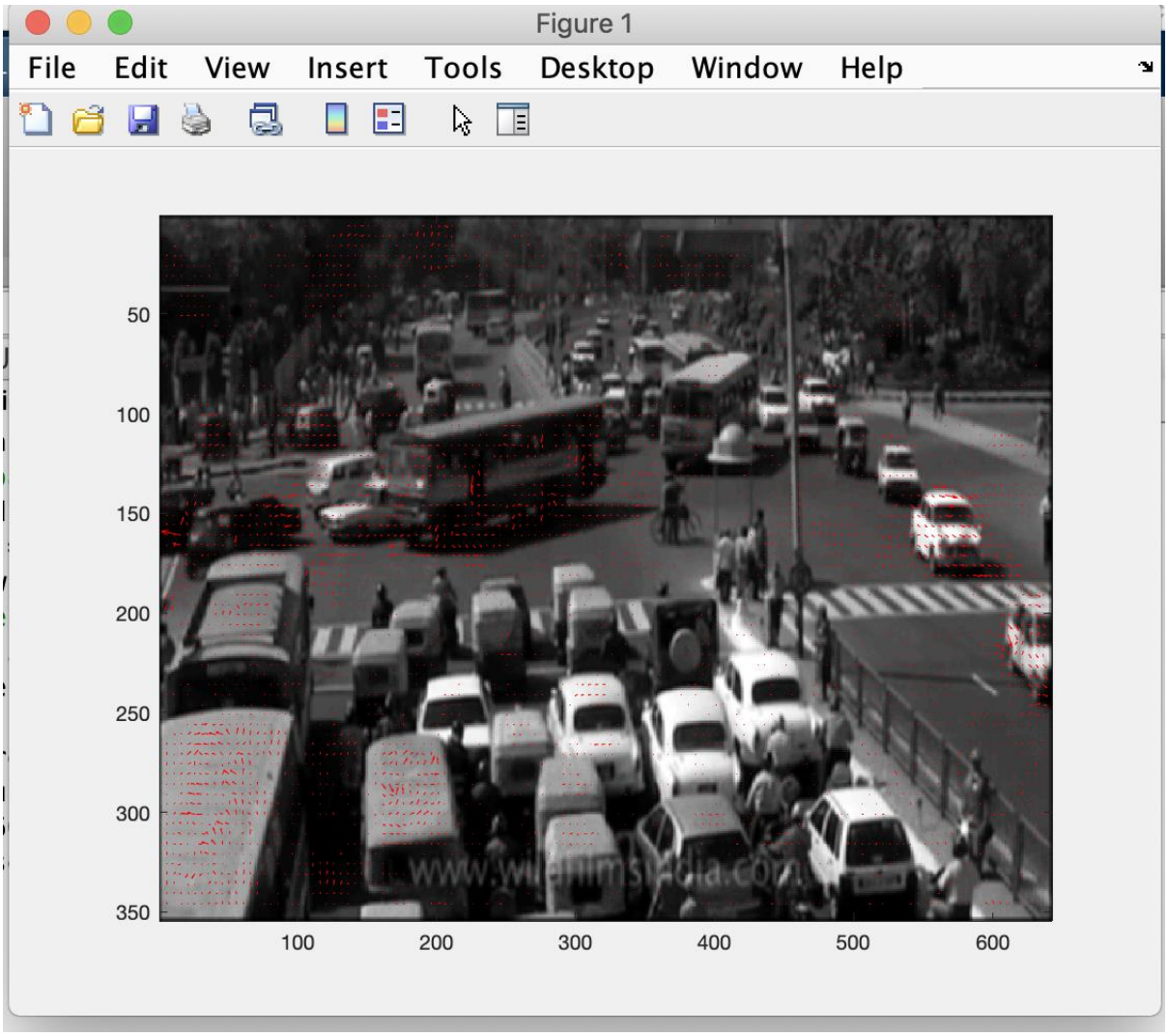

Figure 10. K=5 on cars1

Figure 11. K = 5 on cars2

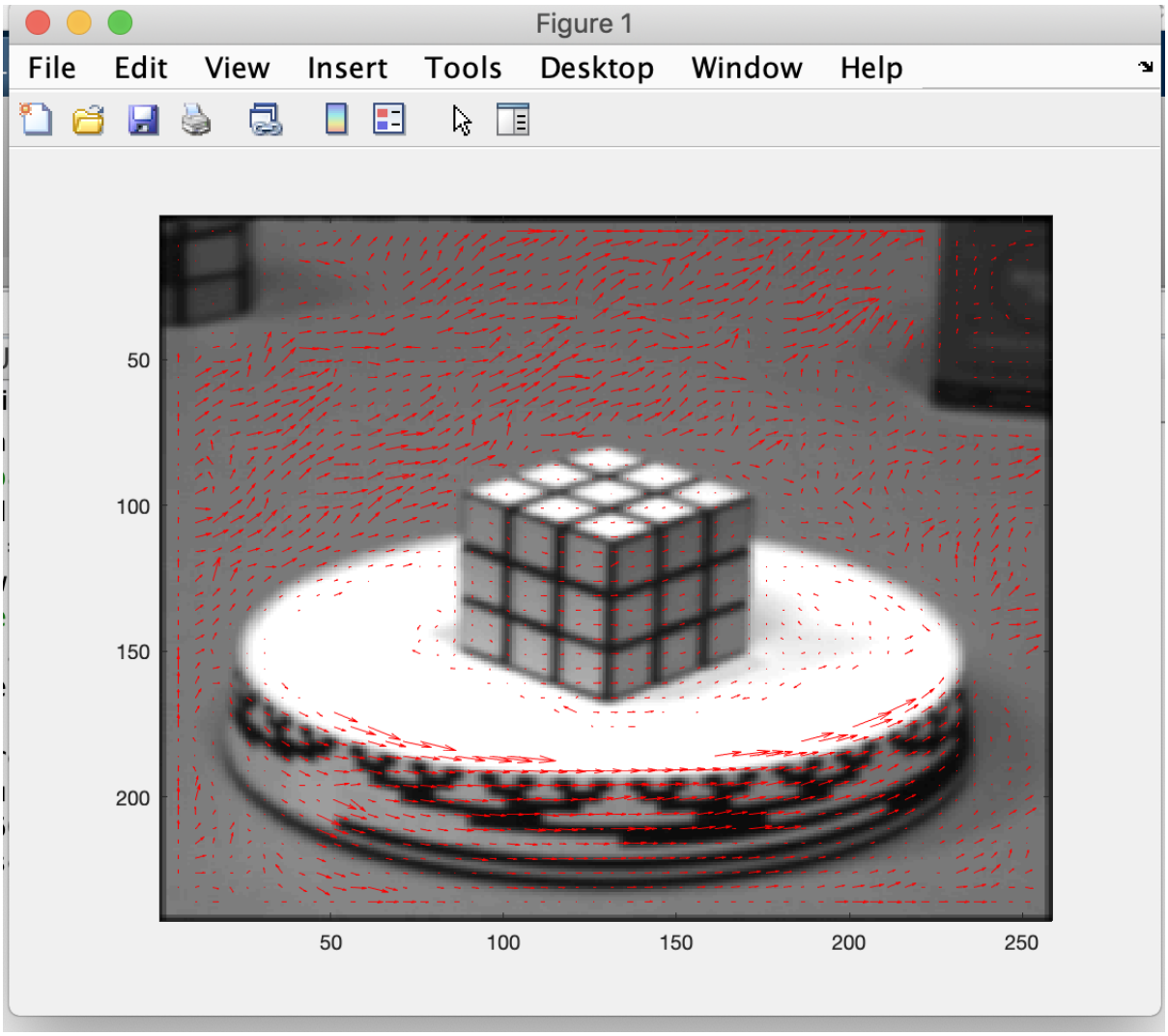

Figure 12. K=5 on rubic

Having smaller k resulted detecting lots of gradients because we decreased window size.

We can see more areas but some of them are not correct and not needed. In my opinion, one should try different k values for different videos and choose one which is suitable for corresponding video. If video contains different objects with different movements, choosing a smaller K would be beneficial because having a big windows size could miss some of the flows. Imagine we are having 2 objects moving different directions and window size is bigger than the size of both objects. There may be problems in these case such as not finding

directions properly but If we use small window in this case we can detect both objects movement direction. On the other hand, having a single object moving or rotating like a sphere example. Increasing K will not hurt because there is one object and we can see main directions and conclude a result.

Different Smoothing Filters

Now lets try to change smoothing filter and see results. I will try to use K = 5 and try different filters.

Box filter

Figure 9 shows 3x3 box filter smoothed object and detected flow. The problem about box filter is taking the average. Imagine, a window has an pixel which has really high intensity value compared the other pixels in the window. Applying box filter will increase the intensity values of other 8 pixels. Thus, there will be square ringing artifacts in the image. Lets try to use box filter and test different window sizes to effects on sphere.

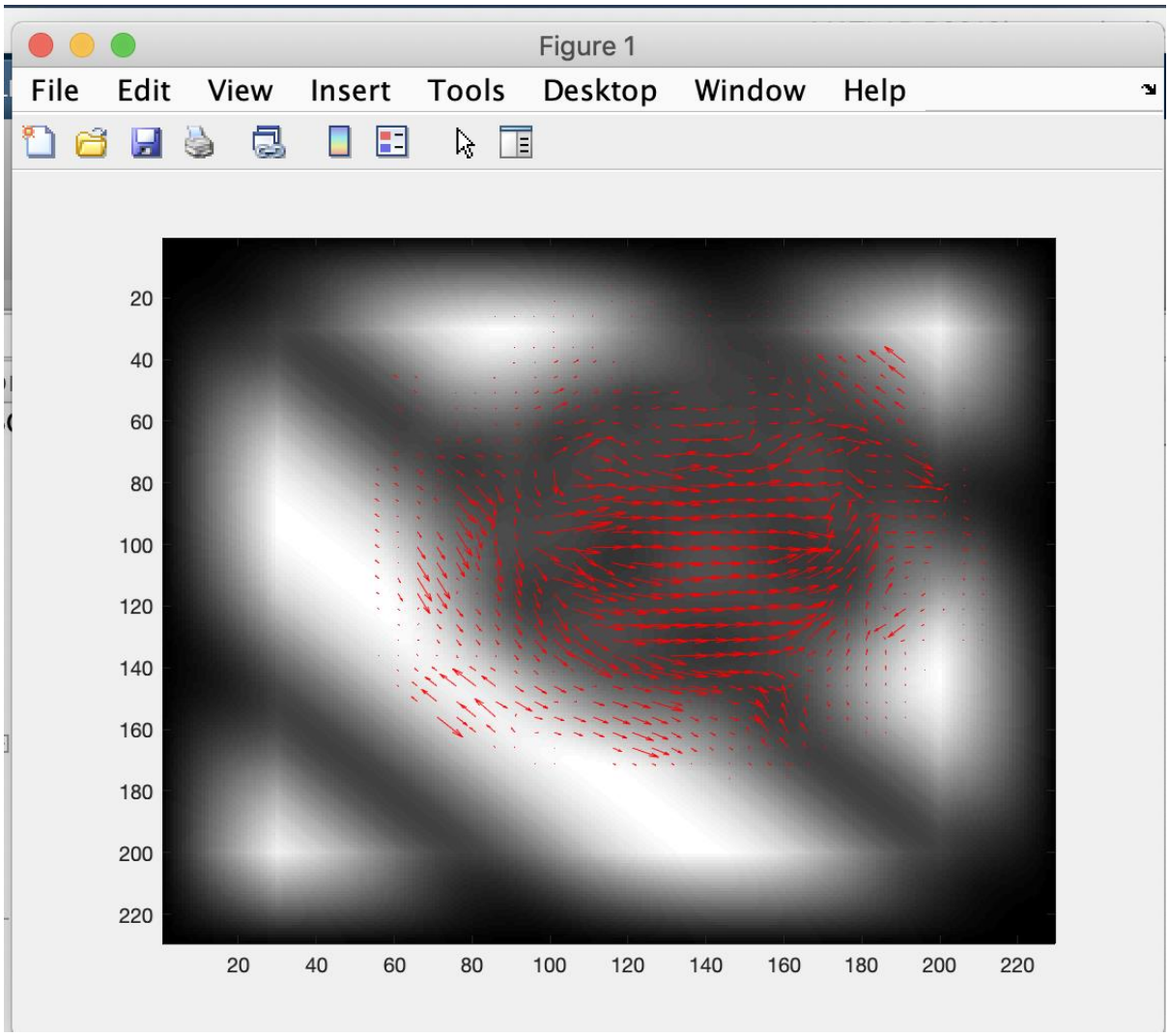

Figure 13. Box filter 20x20

Comparing the Figure 9 and 13 we can see that there are some flows on wrong directions.

Also, the object size is increased a little bit because it includes the near pixels of the sphere.

If we continue and increase size to 100 :

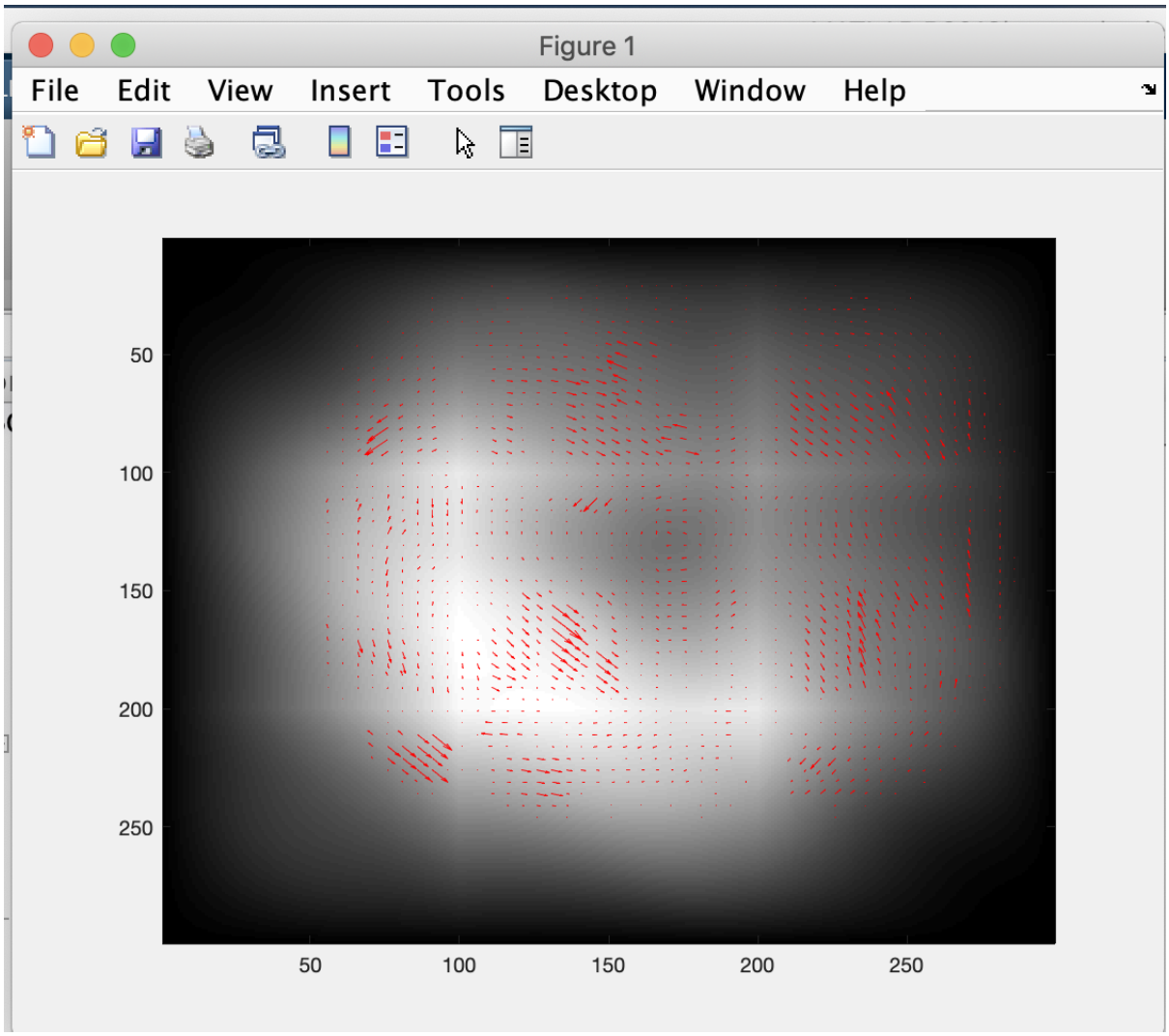

Figure 14. Box filter 100x100

Now we lost our sphere object and detected wrong flow. Also like previous example, sphere is no related with the original one.

Gaussian Filter

Now lets try gaussian filter on same sphere with k=5. I manually computed gaussian kernel and applied it. So, the window size of the smoothing kernel is 5x5 in this case.

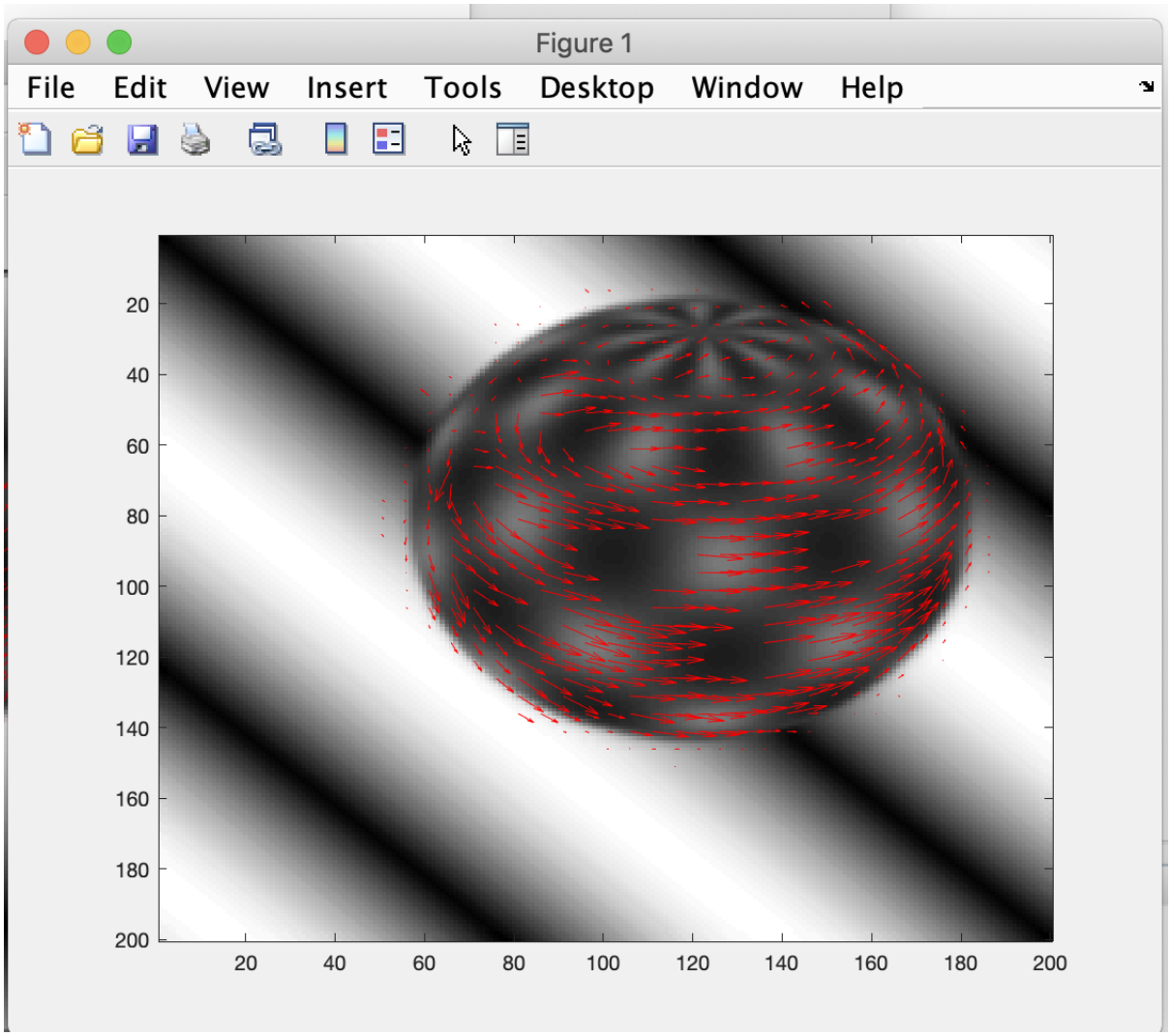

Figure 15. gaussian filtered sphere

As its shown on the figure 15, flow detection is pretty good. If you look closely you can see some areas are not detected. I think it is because of the nature of gaussian filter. Gaussian filter gives weighted average of the near pixels. Also we know that it works as a low-pass filter. Thus, we eleminated high frequency pixels and can not detect flow around them e.g black areas.

Comparison

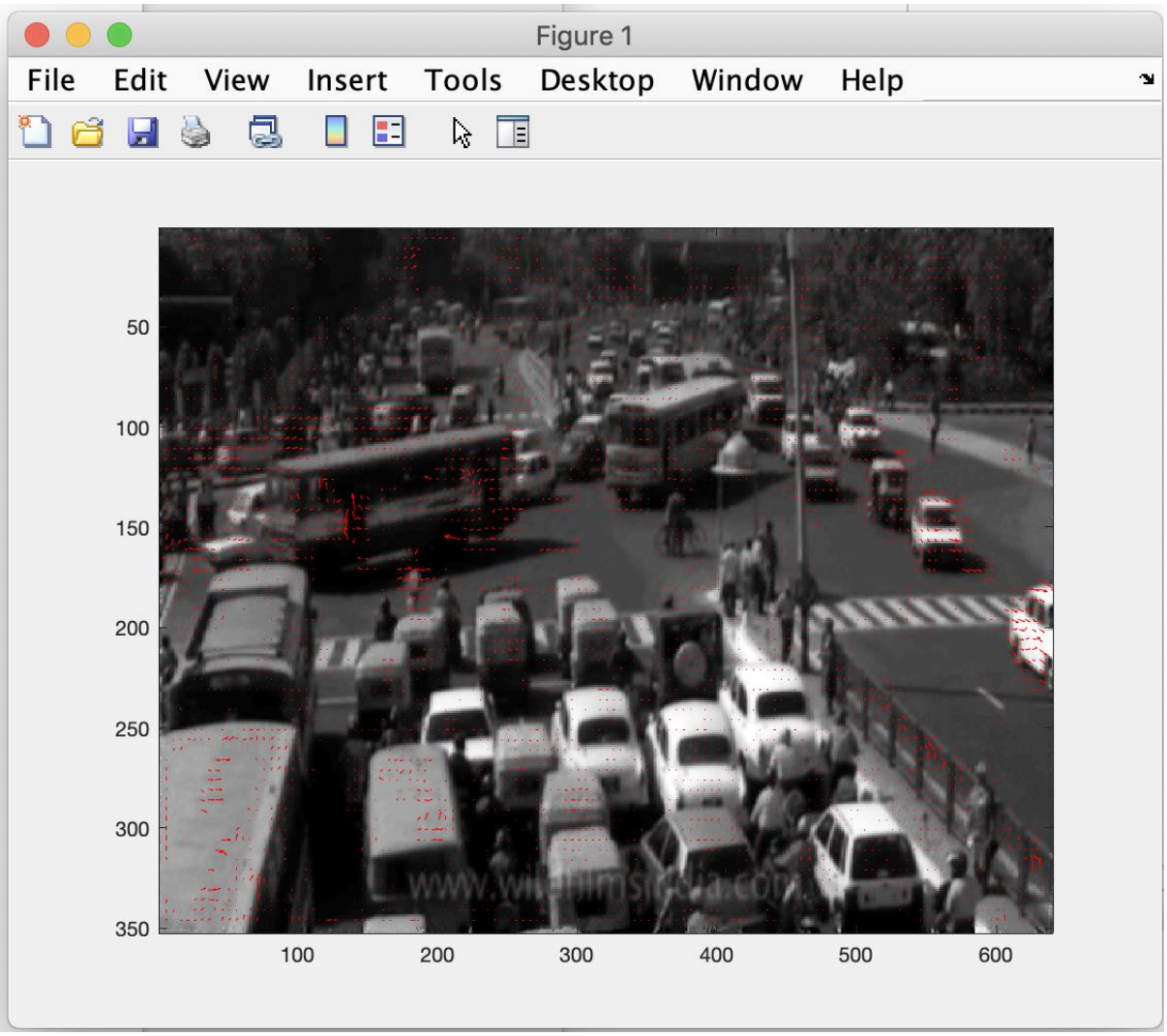

Figure 16. gaussian filtered cars1

We can compare Figure 10 and Figure 16. We can obtain better results with gaussian filter and the detected flow is not shape of squares. With box filter we are kind of down sampling image but because of the its nature it will work like we are merging pixels to achieve one big pixel in given window size. Gaussian filter behaves same but takes weighted average. Not considering the weighted average may lead detection of flow in wrong direction or not

detecting at all. I suggest using Gaussian Filter for better pre-processing while using Lucas Kanade Optical Flow detector.