CompE565, Fall 2021

Homework 3: Motion Estimation for Video Compression

Prepared by

Jacob Bananal (820416396)

E-mail: *jbananal2509@sdsu.edu*

Computer Engineering San Diego State University

Table of Contents

List of figures

Introduction

For this homework assignment, this examines the initial concepts of video compression along with the importance of the transmission of the video data. I learned how to do a motion estimation technique to reduce the temporal redundancy in video sequences. As mentioned in the directions, with the given video, I used frames 6-10 where I determine the P-frames from the I-frame. At the end, I then show the reconstructed image of the frame along with the difference or error of the predicted and the targeted image. In addition, at the very end of the code is a function I wrote called exhaustive search algorithm which is a block matching technique used for motion estimation.

Procedural Section

In order to read a video file I use the VideoReader command which is simply “video_obj = VideoReader('walk_qcif.avi');.” Then I extracted the frames 6-10, where it will convert each extracted frame into ycbcr. From this I was able to set the I-frame to 6 and then the P-frames would simply be 6-10. After setting the I-frames and P-frames, I wrote the code to where it will iterate through a FOR-loop that will start at 6 then loop to 10 which will get the motion estimation, motion vector and difference matrix for the P-frames. Once I was able to figure out the motion estimation, motion vector, and the difference matrix for the P-frames, I set our current frame and reference frame in the code along with setting the macroblock size to 16. With the macroblock size set to 16, I wrote the code to where it would iterate through a FOR-loop to calculate the search window movement which will give me the motion vector display. I also displayed the motion vector for frames 6-10 using the quiver command which has (x1,y1,x2,y2) inside the quiver. In order to get the error image, I would simply subtract the target frame from the reference frame. For the figures which I will display below in this document, I displayed the original image, error image and the reconstructed image for frames 6-10. Last, at the very end of the code, I wrote a function called exhaustive search algorithm which returns the number of additions, number of subtractions, and the total comparisons it takes for the motion estimation algorithm.

Results

Figure 1: This shows the intra frame

Figure 2: This shows the motion vector of the y-component of video image frame 6 & 7

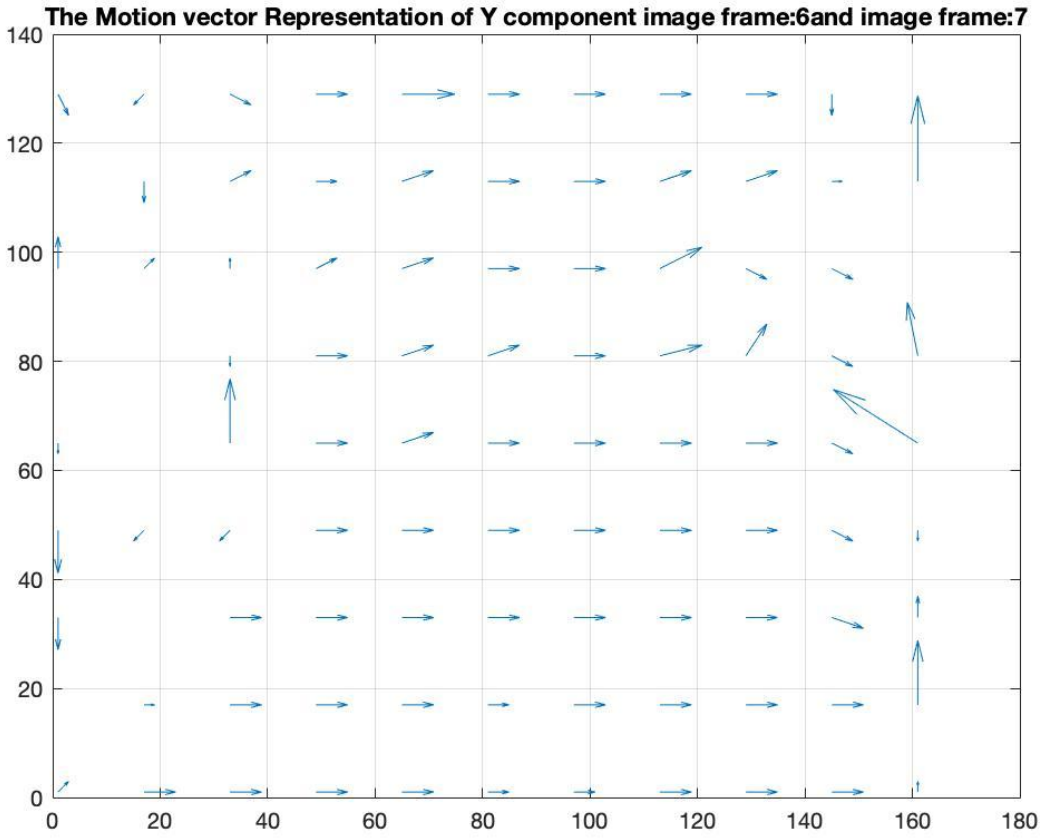


Figure 3:This shows the y-component of the original video frame 6, the predicted targeted y-component of the video frame 7, and the error between the predicted and target frame.

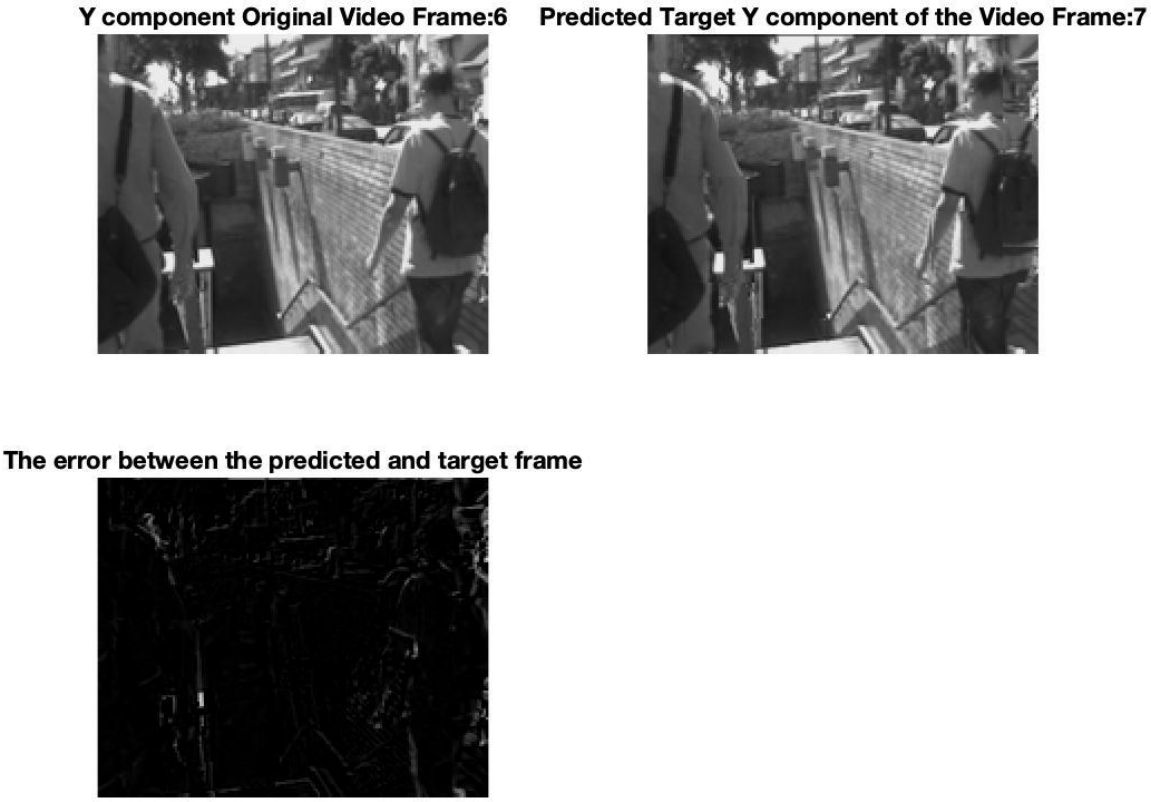


Figure 4: This shows the motion vector of the y-component of video image frame 7 & 8

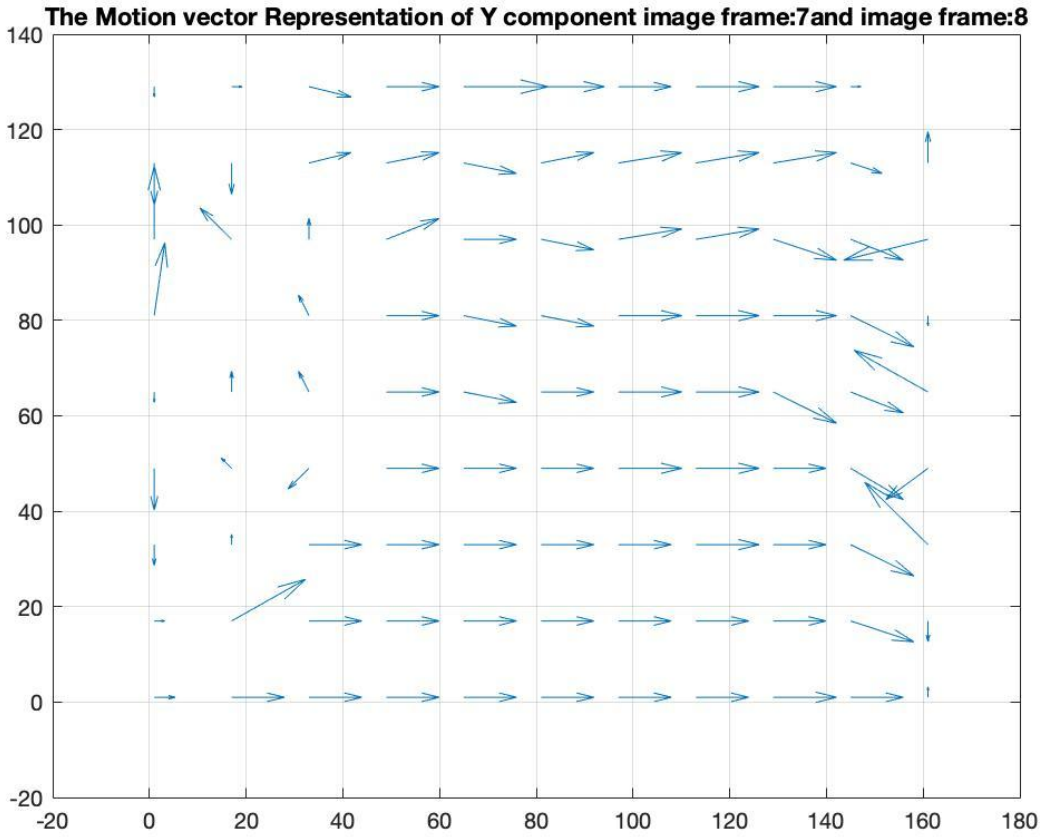


Figure 5: This shows the y-component of the original video frame 7, the predicted targeted y-component of the video frame 8, and the error between the predicted and target frame.

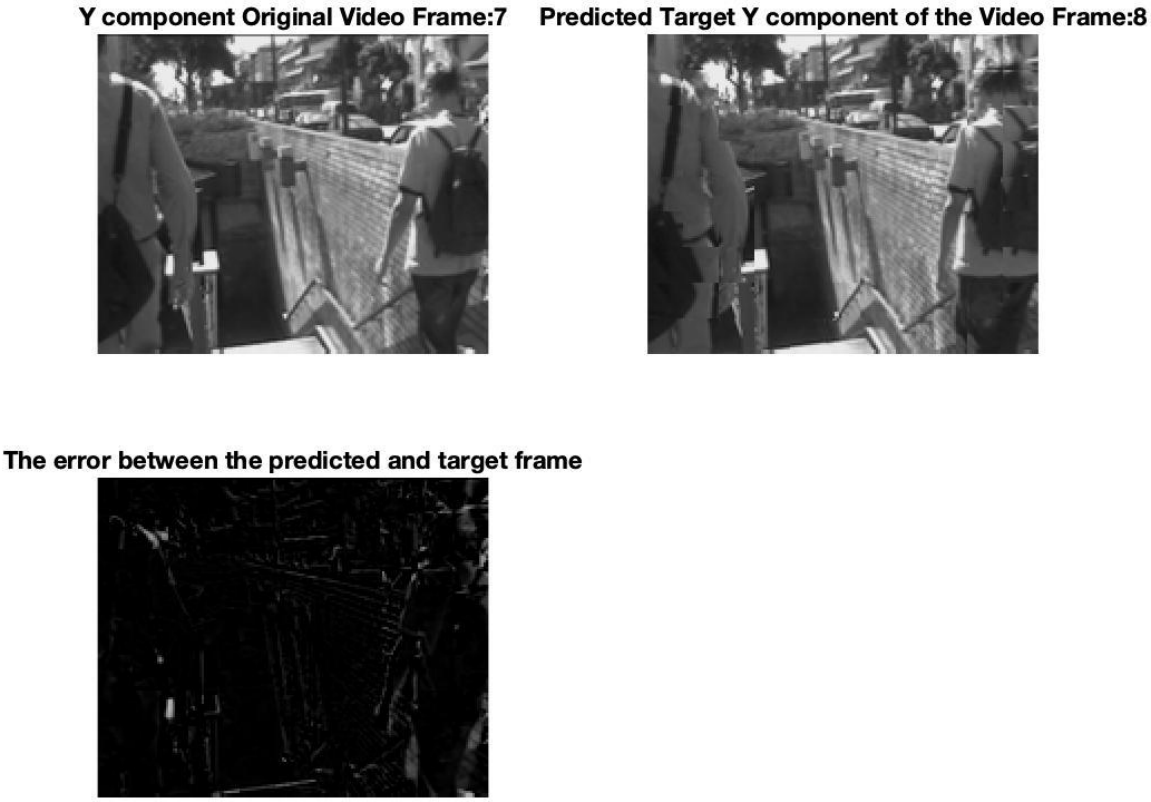


Figure 6: This shows the motion vector of the y-component of video image frame 8 & 9

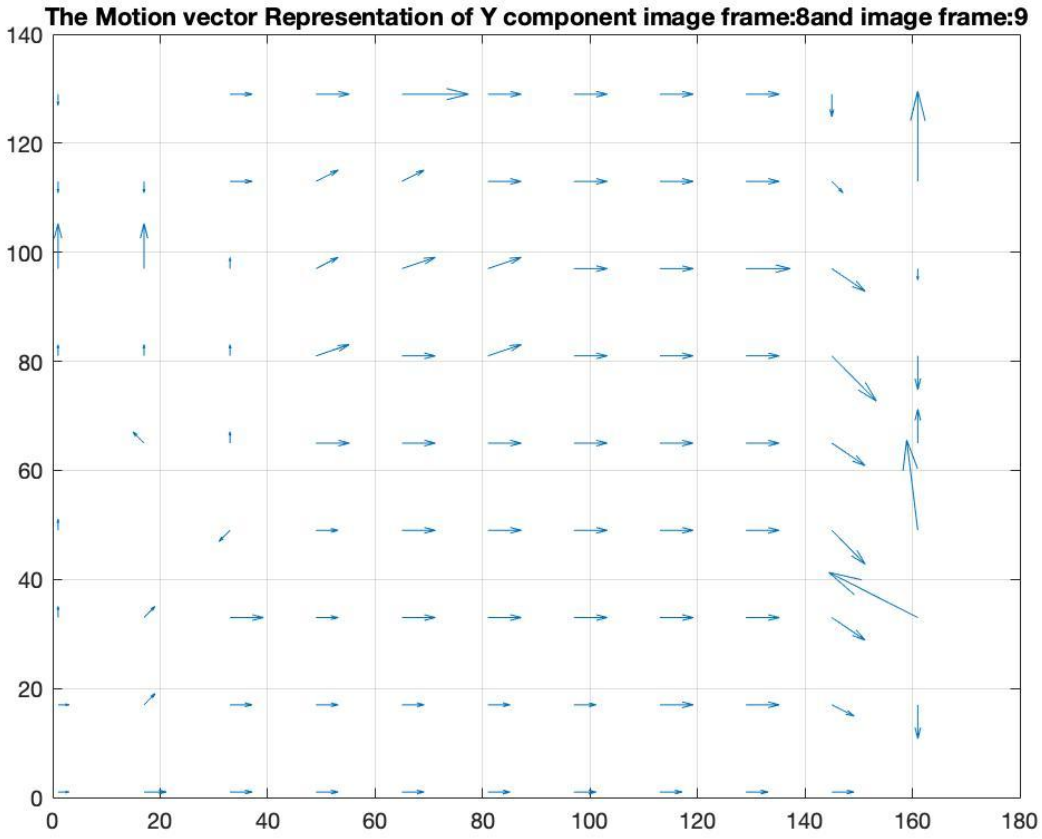


Figure 7: This shows the y-component of the original video frame 8, the predicted targeted y-component of the video frame 9, and the error between the predicted and target frame.

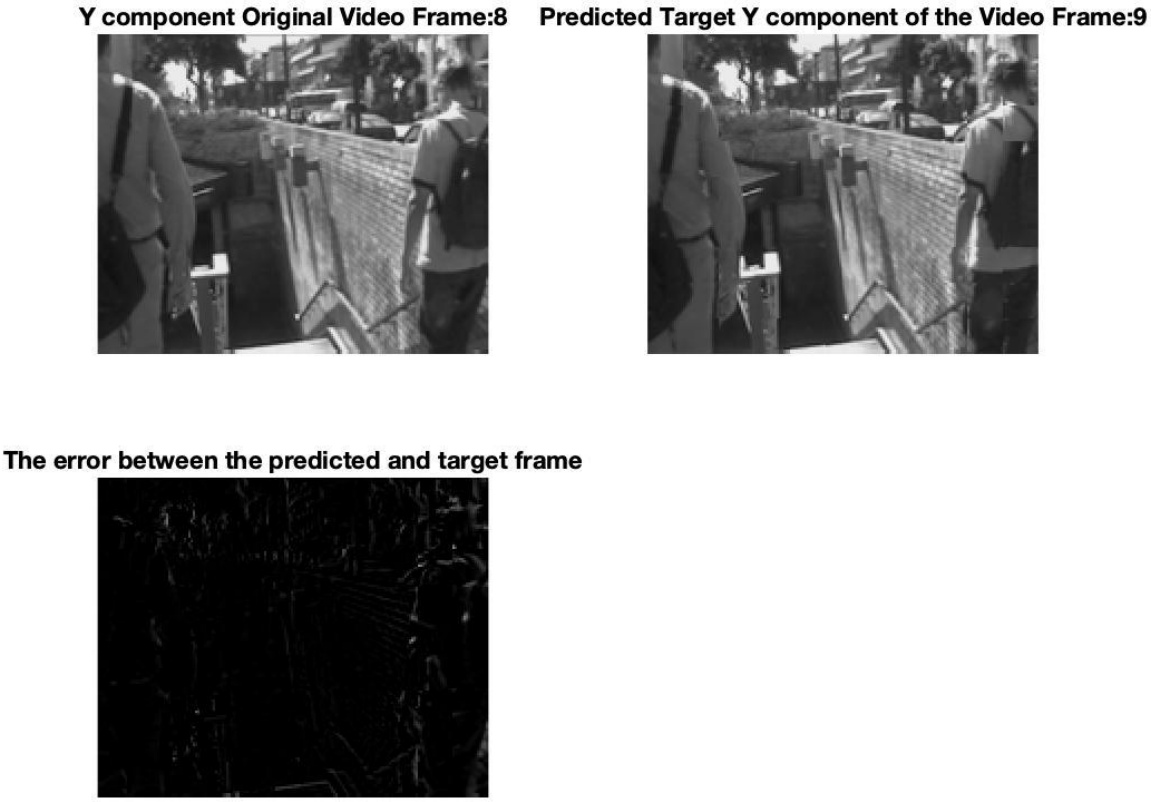


Figure 8: This shows the motion vector of the y-component of video image frame 9 & 10

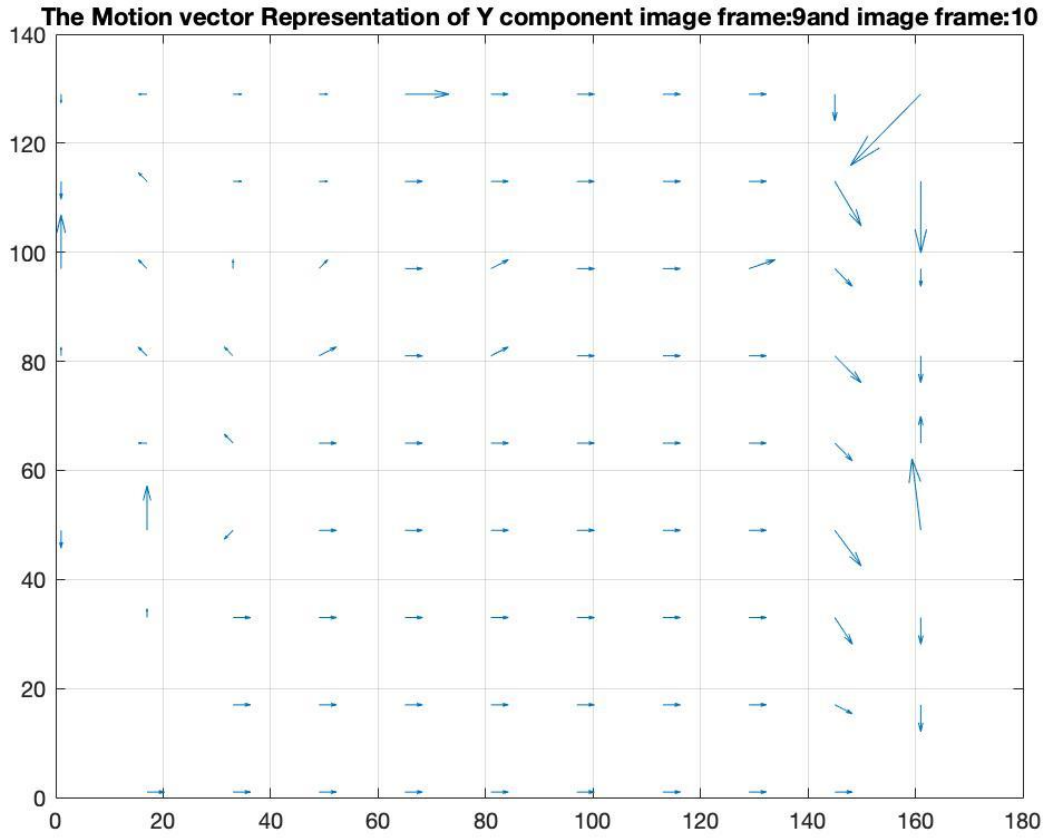
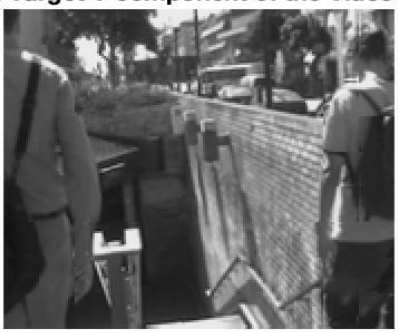


Figure 9: This shows the y-component of the original video frame 9, the predicted targeted y-component of the video frame 10, and the error between the predicted and target frame.

Y component Original Video Frame:9

Predicted Target Y component of the Video Frame:10



The error between the predicted and target frame

At the very end of the code is where I wrote the exhaustive search algorithm which gave me the results:

The total additions for while computing:147968

Total substractions for while computing:73984

Total comparisons for while computing:7102

Conclusion

In conclusion, I learned a lot about the initial concepts of motion estimate for the video image that I was given. Also, I felt like I got a better understanding on how to break down the given video into frames. Towards the end, I learned to reduce the temporal redundancies for the given video along with matching the best motion vector for each frame that was required. As a result, with the new skill sets I just learned from this homework assignment, I think it will not only help with the future homework assignments but I feel like this would be something that most students should post on their resume to show that they can use their knowledge of motion estimates for any video they are given.

References

[1] MathWorks. (2021). “quiver” (R2021b).

https://www.mathworks.com/help/matlab/ref/quiver.html?searchHighlight=quiver&s_tid=srchtitle