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ASSIGNMENT 8

MOTION HISTORY IMAGES

JACOB KILVER
JKILVER3

1. Frame Differenced MHI

a. Binary images

At first I was doing my image differencing incorrectly due to using the wrong data type, so I had to use the morphological open operator to get good looking images. Once I started using floating point values for the image differencing, I did not have these issues, so I removed the morphological open operator.

The first image seems to only have motion in the hands.

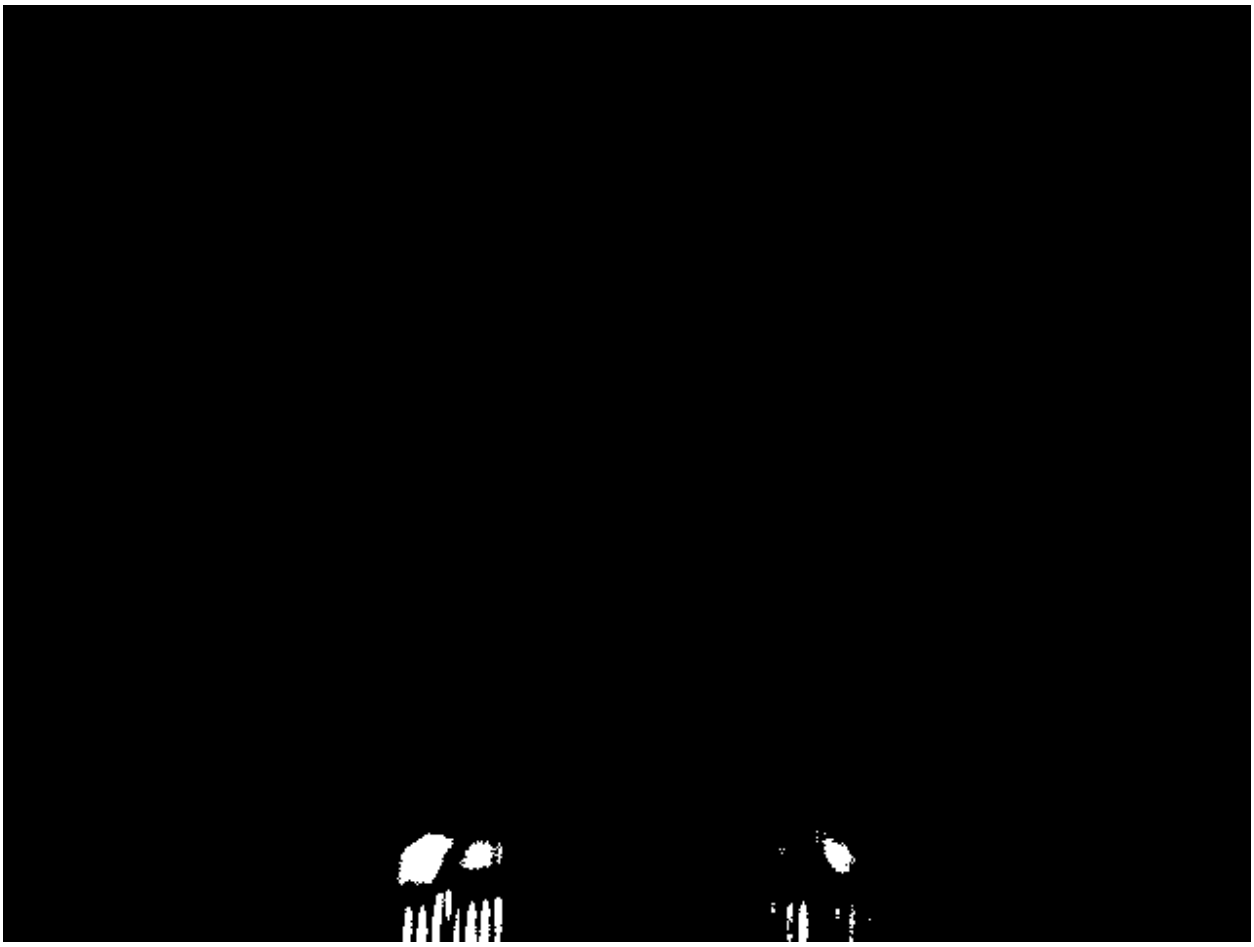

Figure 1: ps8-1-a-1.png

The second image clearly shows motion in the arms.

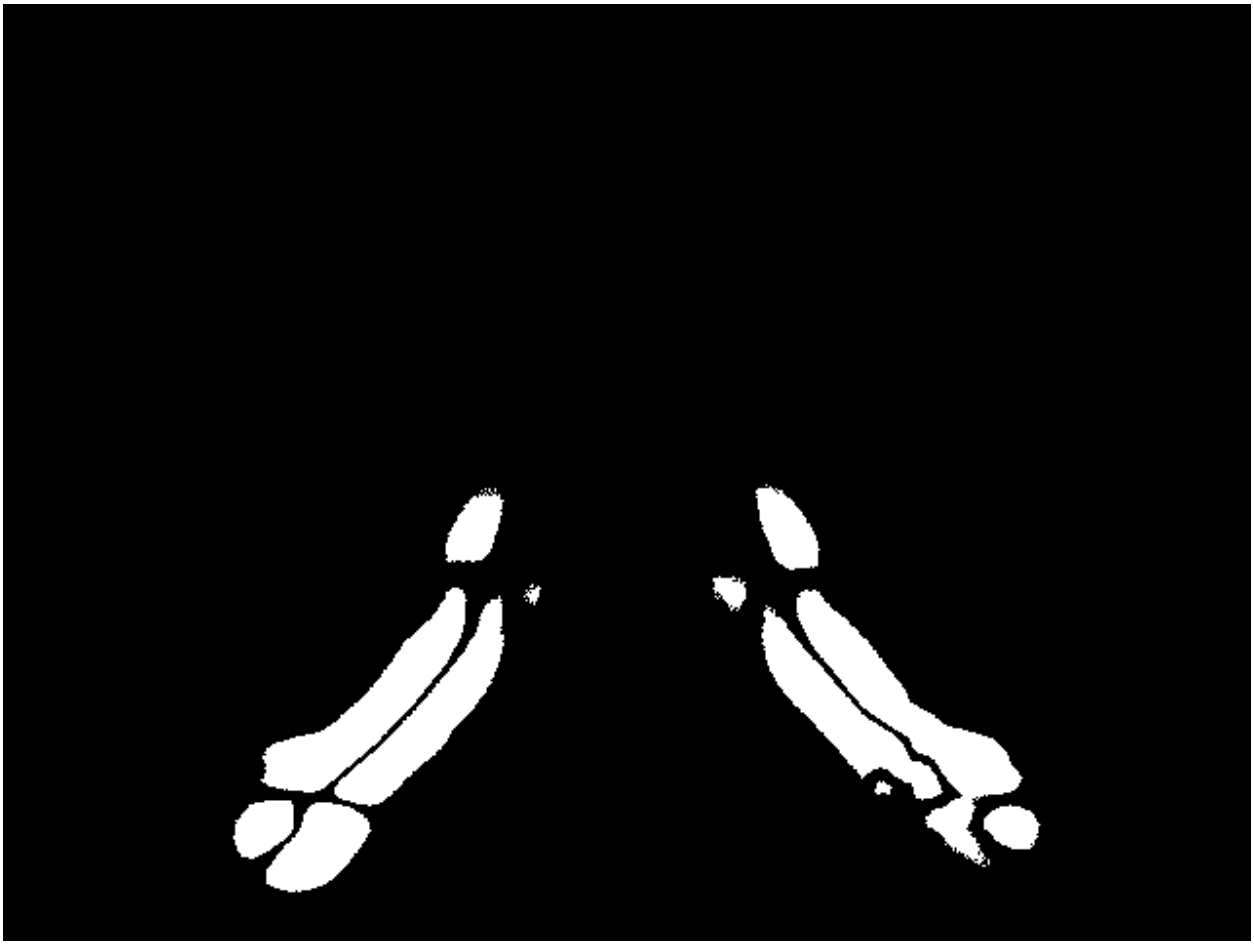

Figure 2: ps8-1-a-2.png

Again, clear motion in the arms.

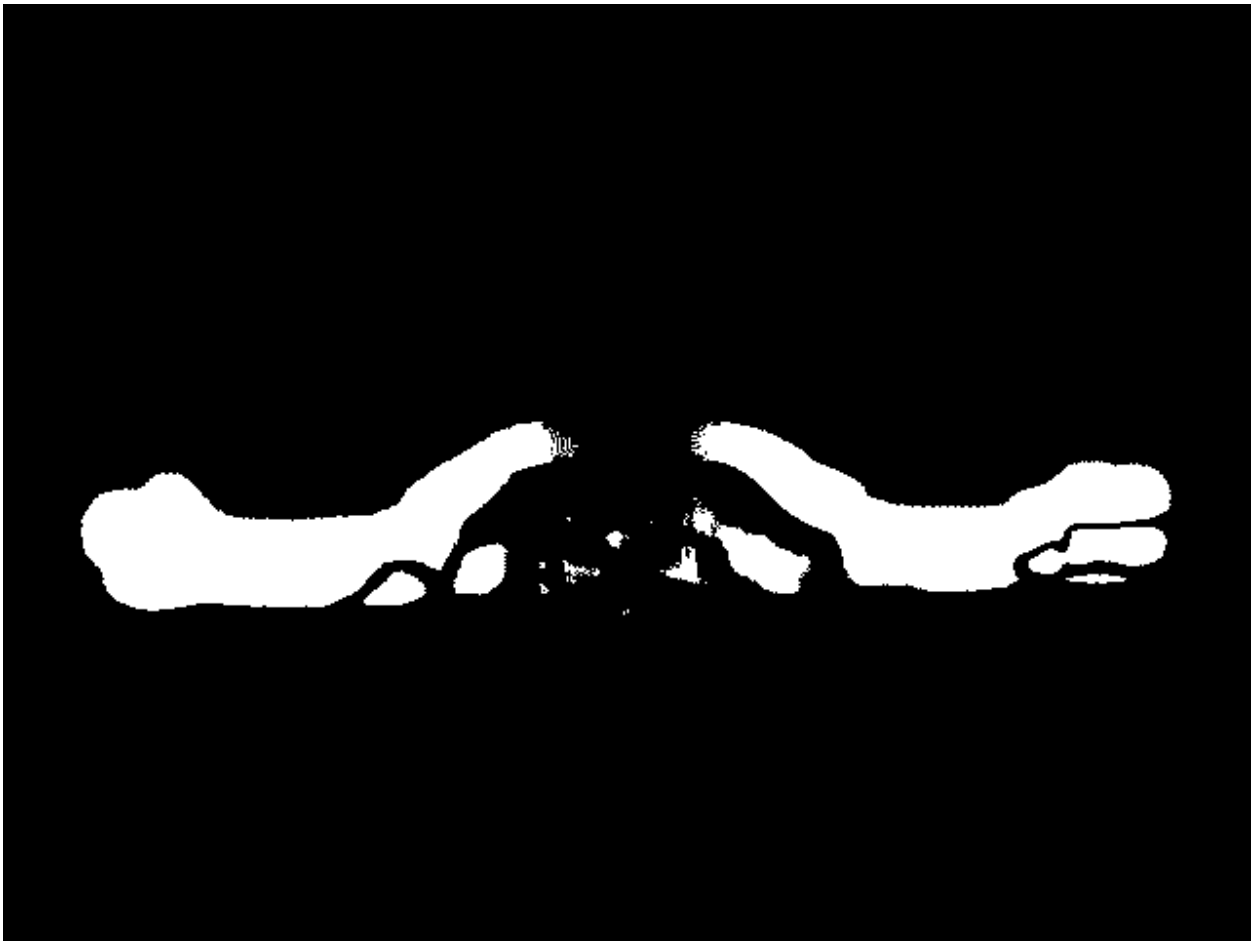

Figure 3: ps8-1-a-3.png

b. Motion history images

MHI frame = 100

Tau = 90

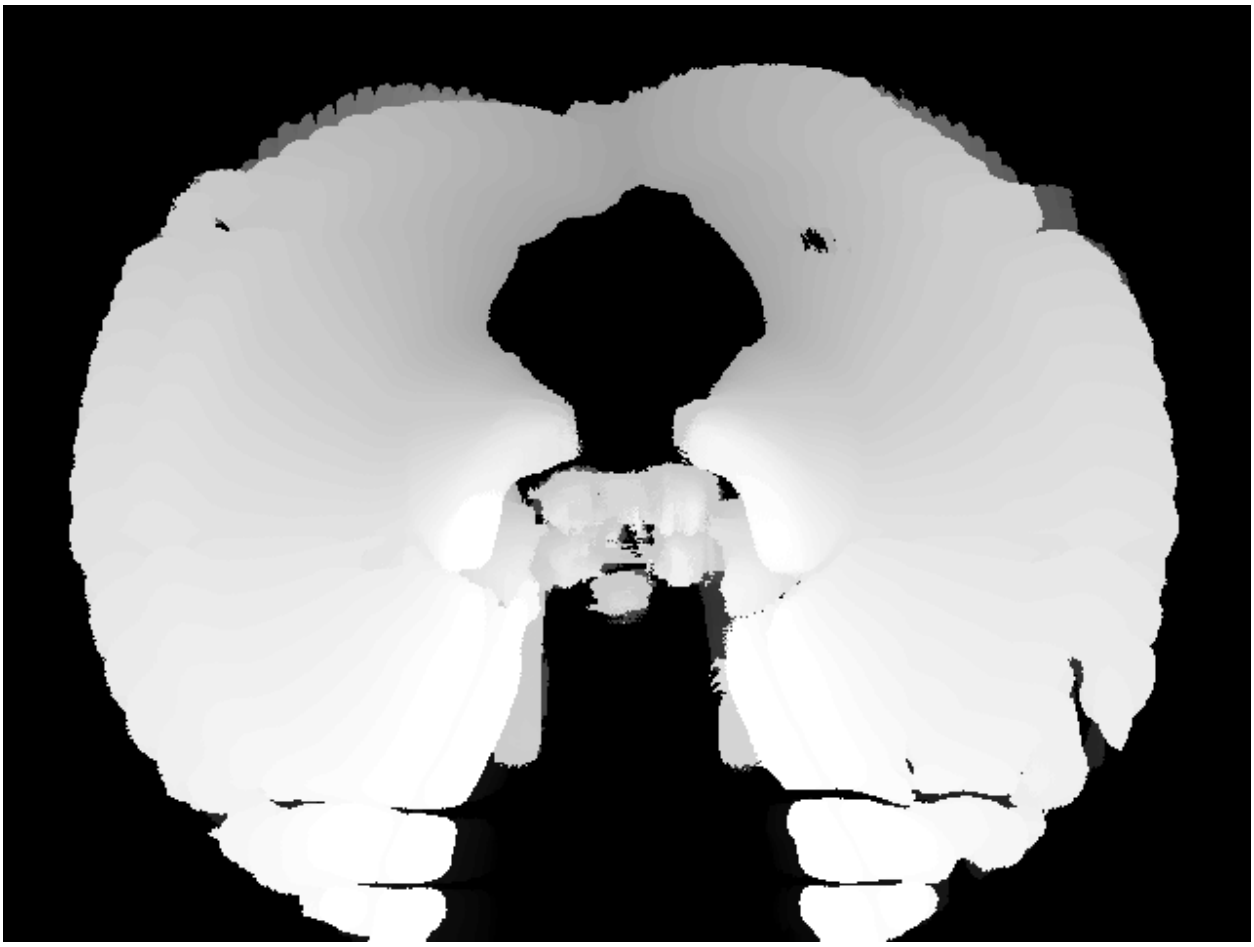

Figure 4: ps8-1-b-1.png

MHI frame = 71

Tau = 70

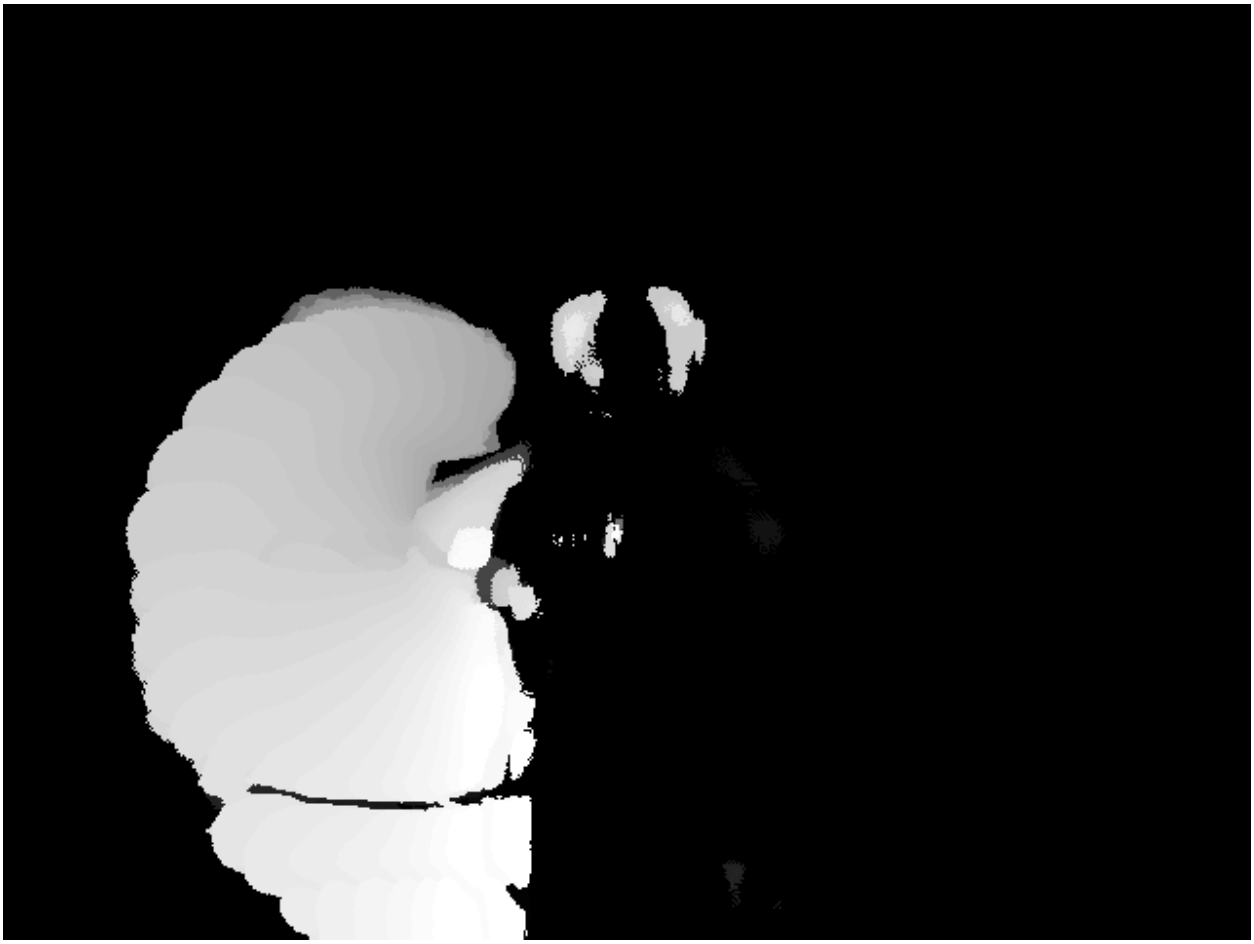

Figure 5: ps8-1-b-2.png

MHI frame = 105

Tau = 100

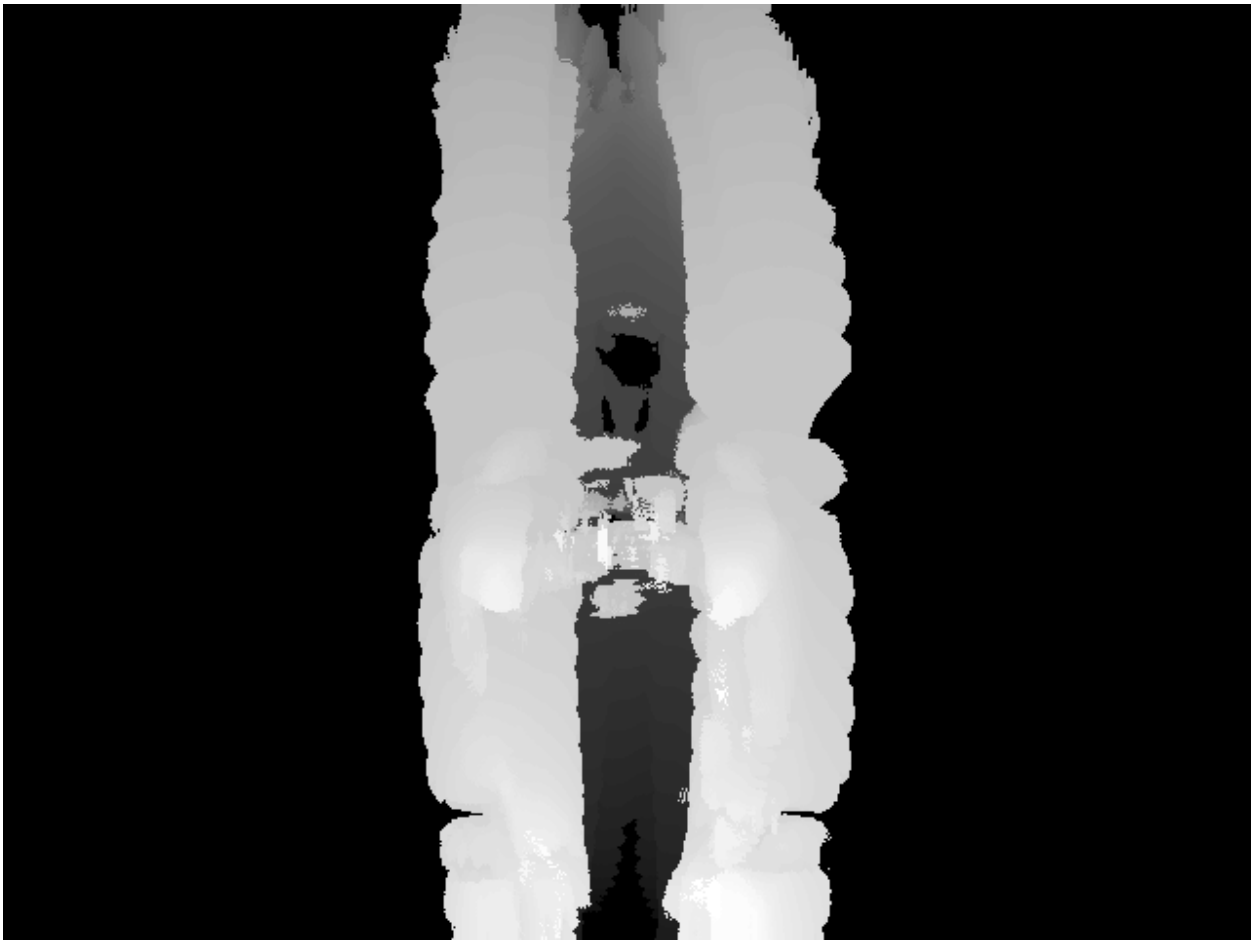

Figure 6: ps8-1-b-3.png

2. Recognition using MHIs

a. "Cheating" version

I normalized the MHIs to have a consistent maximum value. To have a good confusion matrix I had to modify the custom parameters to include custom values for where to take the history frame and τ values. I also had to significantly blur the images to get decent results. I was able to get good results using a simple Euclidean distance. This is the confusion matrix that resulted with this distance metric and unscaled central moments:

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.889 & 0.11 \\ 0 & 0 & 1 \end{bmatrix}$$

This is the confusion matrix using scaled central moments and Euclidean distance:

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.889 & 0.11 \\ 0 & 0 & 1 \end{bmatrix}$$

Using the instructor provided debugging statements, I was able to see that the only mismatches involved action 2 (waving hello) with the second participant. This participant did not wave quite like the other participants, leading to difficulty in correctly identifying it.

b. Non cheating version

Again I used a Euclidean distance similarity function. These are the best results I was able to obtain.

For participant 1:

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0.333 & 0.667 \end{bmatrix}$$

For participant 2:

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.667 & 0.333 \\ 0 & 0 & 1 \end{bmatrix}$$

For participant 3:

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Once again, the algorithm had difficulty with the second participant's second action (waving hello). I attempted to better the results by trying to make this action match that of the other participants more closely, but I was unable to do so. From the discussions on the forum, I decided not to change the distance metric because others were able to get perfect results without doing so. Instead, I decided to focus on getting the best motion history images possible in order to improve matching.