

Lab Write-Up

Q3: Use the previous functions to determine attribute trends across all data samples for a given activity. Which attributes best help distinguish the sensor traces of one activity compared to another?

Attributes: controller_right_pos_y, controller_left_pos_y, controller_right_pos_z, controller_left_pos_z, headset_pos_y, headset_pos_z

Originally, I elaborated on my choice of attributes in this question, however I found my elaboration to be more relevant to answering question 5 so please refer there. I assumed that this question is merely asking for my selection of attributes not my explanation. Below, is some of the data I generated from my code in order to evaluate and select the attributes that I deemed most useful in distinguishing the various activities from one another.

▼ Standing

	mean	variance
headset_vel.x	0.000010	0.00003
5		
headset_vel.y	0.000113	0.00000
3		
headset_vel.z	-0.001250	0.00005
4		
headset_angularVel.x	0.001786	0.00032
2		
headset_angularVel.y	-0.001866	0.00061
0		
headset_angularVel.z	0.001452	0.00029
3		
headset_pos.x	-0.107453	0.00001
9		
headset_pos.y	0.040919	0.00000
1		
headset_pos.z	0.148153	0.00003
8		
headset_rot.x	353.825497	0.47738
6		
headset_rot.y	191.303393	8578.37196
5		
headset_rot.z	183.324614	10552.44960
0		
controller_left_vel.x	-0.000649	0.00008
4		
controller_left_vel.y	-0.001762	0.00002
3		
controller_left_vel.z	-0.000581	0.00010
2		
controller_left_angularVel.x	-0.003742	0.00063
8		
controller_left_angularVel.y	-0.000694	0.00133
2		
controller_left_angularVel.z	-0.004698	0.00141
2		
controller_left_pos.x	-0.309674	0.00002
2		
controller_left_pos.y	-0.699233	0.00000
4		
controller_left_pos.z	0.185440	0.00002
3		
controller_left_rot.x	63.685944	0.60956
6		
controller_left_rot.y	306.108441	1.24804
9		

▼ Sitting

	mean	variance
headset_vel.x	-0.000174	2.025692e-0
5		
headset_vel.y	0.000012	4.568997e-0
6		
headset_vel.z	-0.000275	1.118746e-0
5		
headset_angularVel.x	0.001057	5.368059e-0
4		
headset_angularVel.y	0.001160	9.043394e-0
4		
headset_angularVel.z	-0.000552	3.027327e-0
4		
headset_pos.x	0.153456	4.710389e-0
6		
headset_pos.y	-0.152078	1.436504e-0
6		
headset_pos.z	-0.747877	6.377553e-0
6		
headset_rot.x	355.547031	7.383707e-0
1		
headset_rot.y	9.463653	1.875016e+0
3		
headset_rot.z	309.953603	1.103556e+0
4		
controller_left_vel.x	0.000175	3.894532e-0
6		
controller_left_vel.y	-0.000508	2.578329e-0
6		
controller_left_vel.z	0.000089	1.360856e-0
6		
controller_left_angularVel.x	0.000078	3.471478e-0
4		
controller_left_angularVel.y	-0.000398	1.741999e-0
4		
controller_left_angularVel.z	0.001202	2.048058e-0
4		
controller_left_pos.x	0.163837	1.558673e-0
7		
controller_left_pos.y	-0.596047	8.307124e-0
8		
controller_left_pos.z	-0.401815	6.102387e-0
7		
controller_left_rot.x	17.064821	3.356159e-0
2		
controller_left_rot.y	15.369314	2.608496e-0
2		

controller_left_rot.z	284.310194	4.48232
1		
controller_right_vel.x	-0.003997	0.08475
8		
controller_right_vel.y	0.006091	0.03530
3		
controller_right_vel.z	-0.003001	0.00129
5		
controller_right_angularVel.x	-0.019573	0.00294
6		
controller_right_angularVel.y	0.013544	0.00452
5		
controller_right_angularVel.z	-0.000755	0.00245
0		
controller_right_pos.x	-0.889876	0.23330
2		
controller_right_pos.y	-0.038102	0.11255
2		
controller_right_pos.z	0.338406	0.00366
2		
controller_right_rot.x	69.590942	0.88809
5		
controller_right_rot.y	55.338685	9.34642
0		
controller_right_rot.z	77.751201	5072.35299
4		

controller_left_rot.z	17.511005	1.308851e-0
1		
controller_right_vel.x	-0.000392	1.488126e-0
5		
controller_right_vel.y	-0.000458	2.273976e-0
5		
controller_right_vel.z	0.000177	1.665667e-0
6		
controller_right_angularVel.x	-0.001299	1.810061e-0
3		
controller_right_angularVel.y	0.001271	8.666638e-0
4		
controller_right_angularVel.z	-0.001396	1.649438e-0
3		
controller_right_pos.x	0.288711	2.149819e-0
7		
controller_right_pos.y	-0.602589	5.048157e-0
7		
controller_right_pos.z	-0.423812	3.825666e-0
7		
controller_right_rot.x	27.753853	1.051391e-0
1		
controller_right_rot.y	8.520042	3.006982e-0
1		
controller_right_rot.z	150.991406	2.158443e+0
4		

▼ Jogging

	mean	variance
e		
headset_vel.x	0.019335	0.00762
9		
headset_vel.y	0.002240	0.58914
0		
headset_vel.z	0.024670	0.02101
2		
headset-angularVel.x	0.001240	0.60124
5		
headset-angularVel.y	0.004788	0.11158
4		
headset-angularVel.z	-0.001696	0.07013
2		
headset_pos.x	0.239152	0.00671
1		
headset_pos.y	0.108004	0.00280
5		
headset_pos.z	0.475942	0.02369
1		
headset_rot.x	343.932706	2263.49016
7		
headset_rot.y	297.479213	16106.39612
8		
headset_rot.z	221.167224	27774.89987
1		
controller_left_vel.x	0.031927	0.04934
4		
controller_left_vel.y	-0.022816	1.60166
0		
controller_left_vel.z	-0.002930	0.23678
7		
controller_left_angularVel.x	0.138655	6.44157
2		
controller_left_angularVel.y	0.110446	3.08951
5		
controller_left_angularVel.z	-0.260377	10.86879
9		
controller_left_pos.x	0.027703	0.00719
0		

▼ Arms Chopping

	mean	variance
headset_vel.x	0.000139	0.00017
2		
headset_vel.y	0.000578	0.00038
4		
headset_vel.z	-0.000731	0.00058
5		
headset-angularVel.x	0.006487	0.03315
7		
headset-angularVel.y	0.001607	0.00451
0		
headset-angularVel.z	0.001256	0.01324
3		
headset_pos.x	0.349317	0.00004
5		
headset_pos.y	0.028466	0.00001
4		
headset_pos.z	-0.125028	0.00007
3		
headset_rot.x	322.691313	8031.26896
6		
headset_rot.y	345.585710	1.90043
7		
headset_rot.z	9.822901	3064.80763
2		
controller_left_vel.x	0.010696	0.04086
8		
controller_left_vel.y	-0.011755	1.32922
2		
controller_left_vel.z	-0.028739	0.35493
9		
controller_left_angularVel.x	-0.130231	6.17473
5		
controller_left_angularVel.y	0.396873	2.92264
9		
controller_left_angularVel.z	0.095684	8.39171
6		
controller_left_pos.x	0.140299	0.00083
1		
controller_left_pos.y	-0.260953	0.03035

controller_left_pos.y	-0.271082	0.01664		6	controller_left_pos.z	0.074859	0.00626
5	0.591192	0.02393		3	controller_left_rot.x	230.019853	17412.24412
controller_left_pos.z				2	controller_left_rot.y	303.473926	346.52777
3	212.889735	22520.68172		0	controller_left_rot.z	143.073830	22312.60134
controller_left_rot.x				9	controller_right_vel.x	0.006636	0.03429
2	313.497497	352.65795		5	controller_right_vel.y	-0.005709	1.42096
controller_left_rot.y				4	controller_right_vel.z	-0.030765	0.33275
0	136.893656	22286.79122		0	controller_right_angularVel.x	-0.034324	14.00905
4	0.011889	0.05272		0	controller_right_angularVel.y	0.203068	0.78817
controller_right_vel.x				4	controller_right_angularVel.z	0.004688	1.72027
2	0.017166	1.84898		0	controller_right_pos.x	0.428859	0.00027
4	controller_right_vel.y			2	controller_right_pos.y	-0.258049	0.03231
controller_right_vel.z	-0.003996	0.29848		6	controller_right_pos.z	0.152669	0.00623
4				8	controller_right_rot.x	217.888693	18784.02049
controller_right-angularVel.x	0.029972	14.61388		9	controller_right_rot.y	226.245338	26437.84060
2				1	controller_right_rot.z	234.797099	24604.44441
controller_right-angularVel.y	-0.083873	2.10156		9			
7							
controller_right-angularVel.z	0.363239	1.94300					
4							
controller_right_pos.x	0.425797	0.00648					
4							
controller_right_pos.y	-0.306082	0.02256					
1							
controller_right_pos.z	0.650021	0.02660					
3							
controller_right_rot.x	158.984508	23153.60716					
5							
controller_right_rot.y	81.886728	18839.81313					
4							
controller_right_rot.z	316.742385	7981.54436					
4							

▼ Arms Stretching

	mean	variance
7	-0.000230	0.00036
headset_vel.x		
0	0.000353	0.00023
headset_vel.y		
8	0.000834	0.00730
headset_vel.z		
0	0.002930	0.01424
headset-angularVel.x		
0	0.003668	0.01042
headset-angularVel.y		
3	-0.001809	0.00477
headset-angularVel.z		
4	0.150706	0.00006
headset_pos.x		
0	0.020770	0.00002
headset_pos.y		
7	0.036345	0.00074
headset_pos.z		
8	250.207313	14526.60039
headset_rot.x		
2	342.666962	4665.95949
headset_rot.y		
0	146.097573	28751.53846
headset_rot.z		
8	-0.007403	0.34261
controller_left_vel.x		
6	0.017213	0.37646
controller_left_vel.y		
3	-0.011105	0.44015
controller_left_vel.z		
6	0.190701	1.23020
controller_left-angularVel.x		
9	-0.080368	2.34289
controller_left-angularVel.y		

▼ Twisting

	mean	variance
2	0.006702	0.02972
headset_vel.x		
0	-0.000664	0.00136
headset_vel.y		
1	-0.005093	0.04177
headset_vel.z		
8	-0.017478	0.09578
headset-angularVel.x		
3	-0.085826	4.86378
headset-angularVel.y		
5	0.036296	0.14320
headset-angularVel.z		
6	0.289026	0.00659
headset_pos.x		
6	0.013672	0.00013
headset_pos.y		
3	-0.196507	0.00500
headset_pos.z		
8	266.039289	20590.91913
headset_rot.x		
7	198.698567	12871.45251
headset_rot.y		
9	172.224729	30428.05212
headset_rot.z		
8	0.035616	0.02799
controller_left_vel.x		
0	-0.019011	0.00342
controller_left_vel.y		
0	0.031240	0.05650
controller_left_vel.z		
8	-0.089585	0.67866
controller_left-angularVel.x		
6	-0.088285	2.23552
controller_left-angularVel.y		

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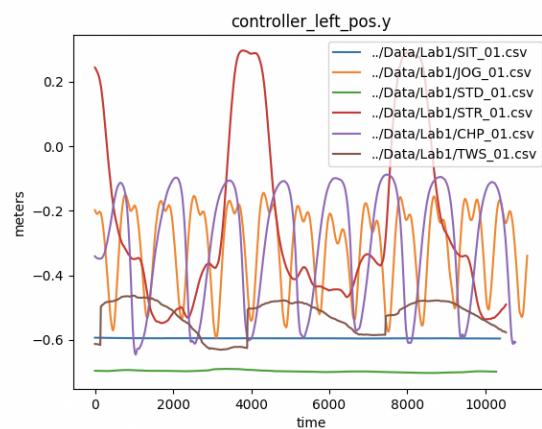
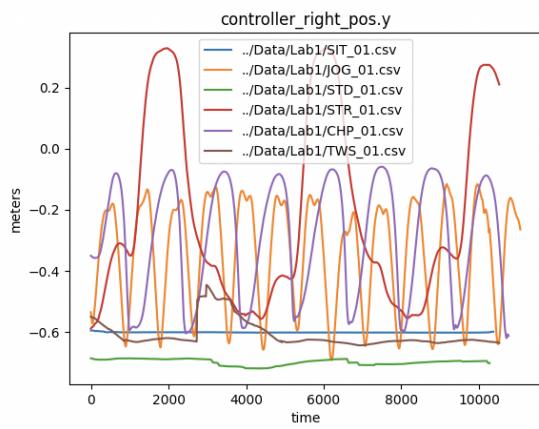
7 controller_left_angularVel.z    0.094566   0.84414
0 controller_left_pos.x          -0.195451   0.02799
9 controller_left_pos.y          -0.232776   0.07130
5 controller_left_pos.z          0.275097   0.02839
9 controller_left_rot.x          201.085270  24508.23378
7 controller_left_rot.y          312.988242  1044.35214
3 controller_left_rot.z          194.415901  26643.64987
7 controller_right_vel.x         0.005152   0.49172
7 controller_right_vel.y         -0.005774   0.38474
1 controller_right_vel.z         -0.024343   0.59187
9 controller_right_angularVel.x  -0.019572   1.74338
9 controller_right_angularVel.y  -0.052742   2.54889
7 controller_right_angularVel.z  -0.021458   1.02899
5 controller_right_pos.x         0.481817   0.03494
7 controller_right_pos.y         -0.248151   0.07547
4 controller_right_pos.z         0.267002   0.03943
3 controller_right_rot.x         132.028280  21262.46852
7 controller_right_rot.y         121.356991  17184.72207
8 controller_right_rot.z         166.144442  27213.00234
8

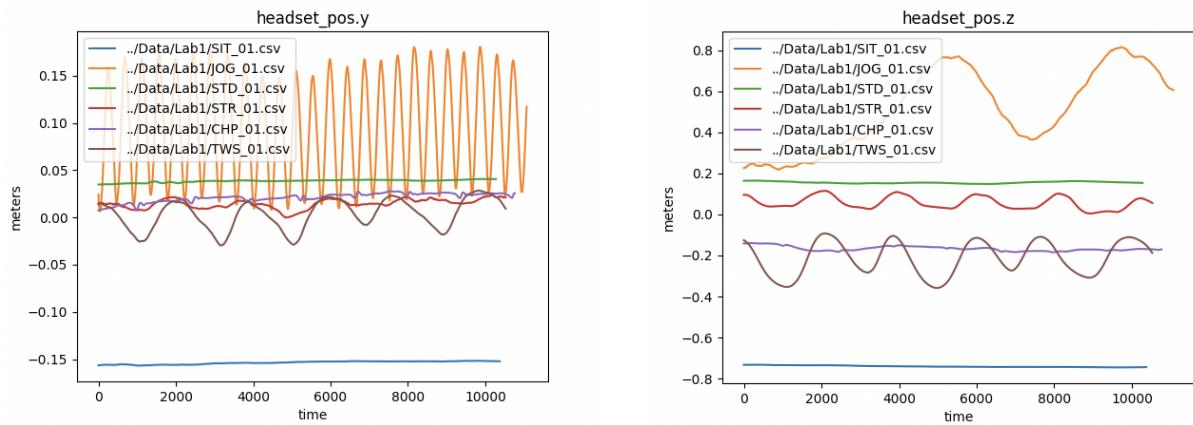
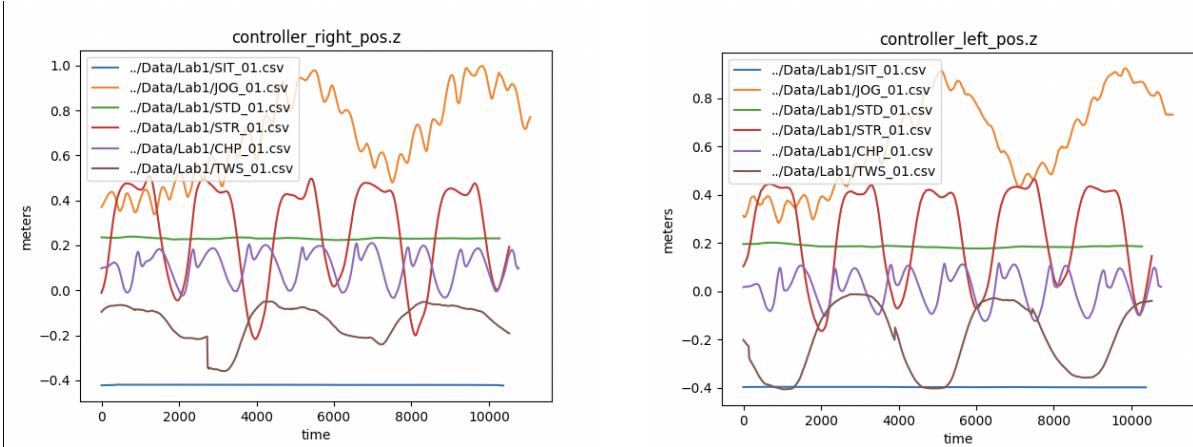
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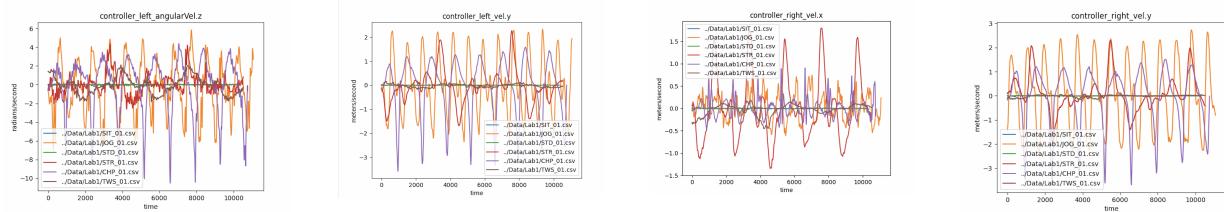
9 controller_left_angularVel.z    -0.026202   0.86724
1 controller_left_pos.x          0.185371   0.00395
4 controller_left_pos.y          -0.547144   0.00184
9 controller_left_pos.z          -0.176211   0.01659
2 controller_left_rot.x          34.831511   178.09087
8 controller_left_rot.y          191.523141  15371.36035
5 controller_left_rot.z          68.462971   6249.43259
9 controller_right_vel.x         -0.034676   0.02215
4 controller_right_vel.y         -0.015731   0.00161
2 controller_right_vel.z         0.002070   0.02718
7 controller_right_angularVel.x  -0.051953   0.79827
9 controller_right_angularVel.y  -0.049094   2.19042
2 controller_right_angularVel.z  -0.137427   0.75931
7 controller_right_pos.x         0.348277   0.01018
6 controller_right_pos.y         -0.584471   0.00215
2 controller_right_pos.z         -0.112539   0.01144
7 controller_right_rot.x         43.550112   95.32463
0 controller_right_rot.y         203.640563  15010.13406
5 controller_right_rot.z         189.637604  25495.53633
1

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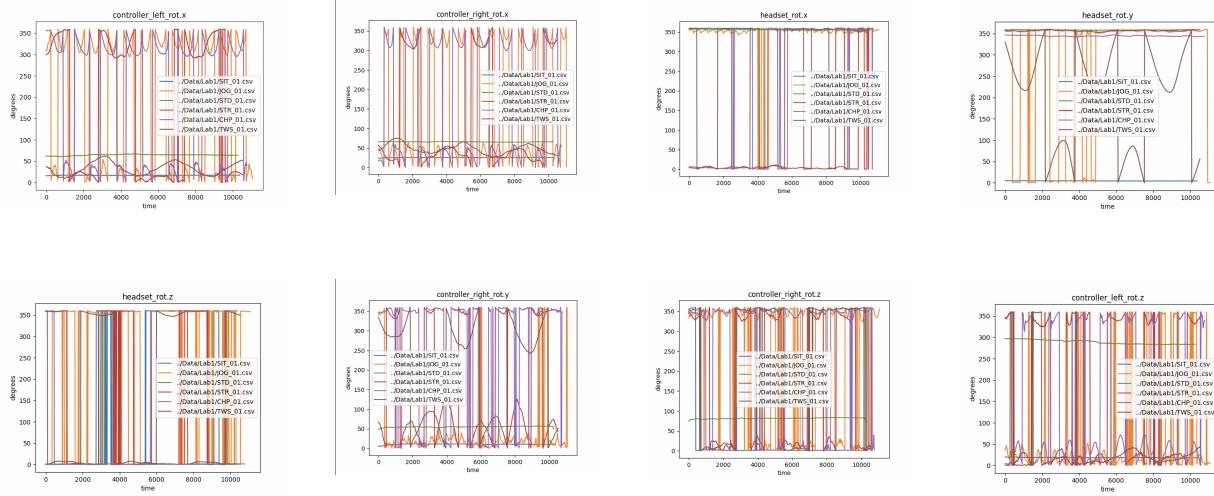


Additionally,

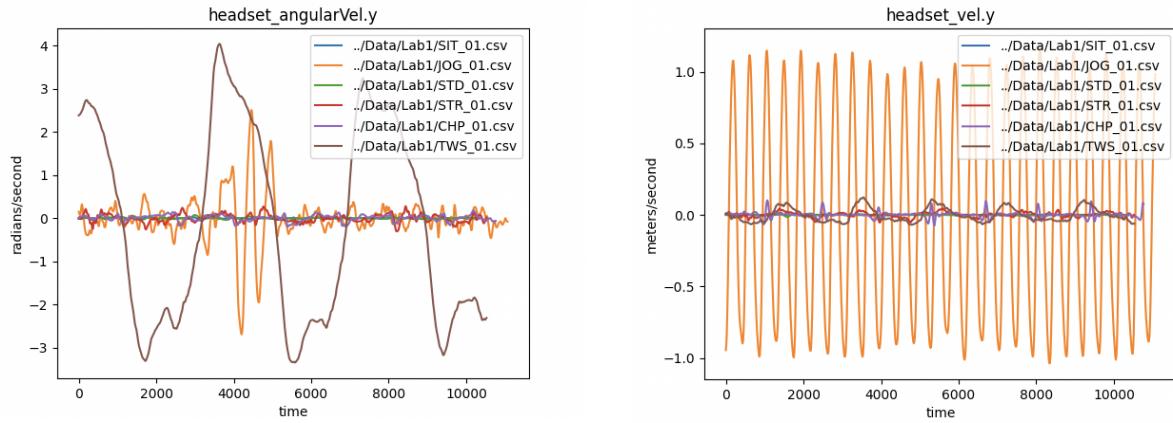


While measurements of controller velocity did provide helpful distinctions for certain activities such as jogging, for stationary activities such as sitting and standing these measurements are unable to aid in distinguishing between the two activities whereas other attributes display activity patterns that aid in the discrimination of all 6 activities.

Q4: Which attributes are less useful for distinguishing the differences between activities? Why?



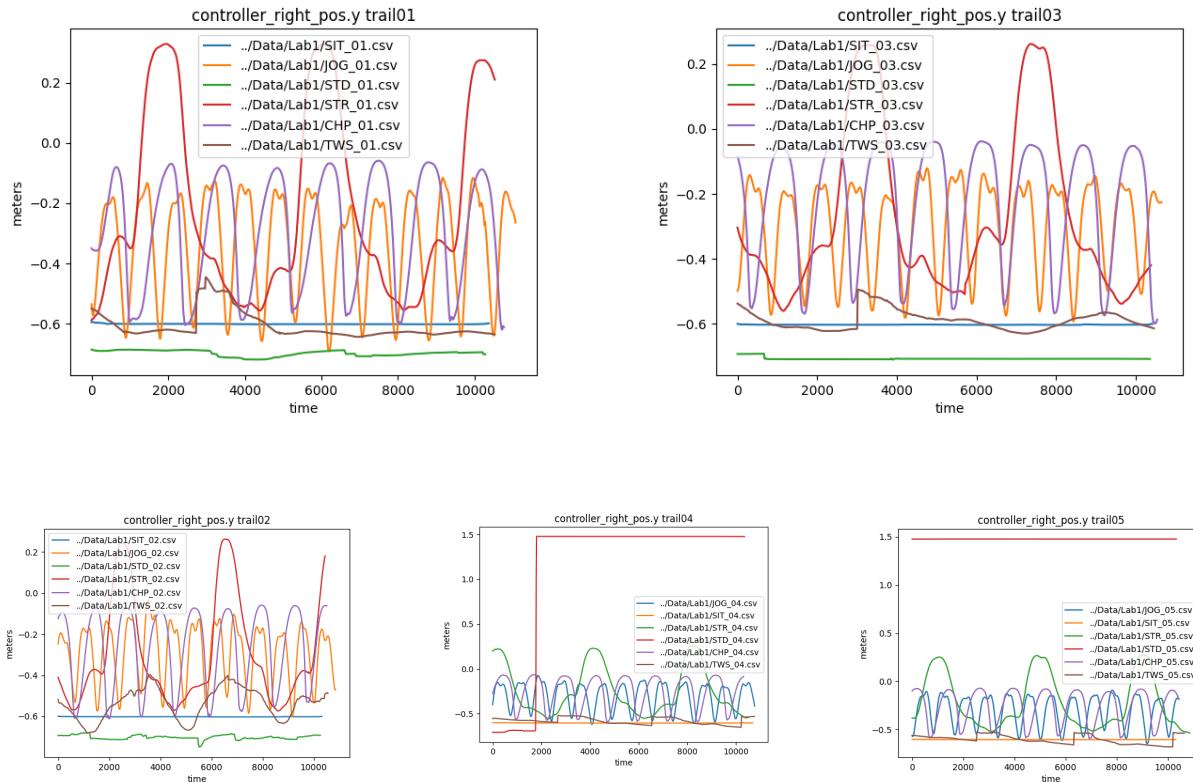
Measurements of rotation across most sensors (headset, left controller, and right controller) and most dimensions (x, y, and z) are less helpful for distinguishing between activities. Upon generating graphs to display the patterns of activity for the first trial of each activity, the patterns displayed in the graph are incredibly hard to interpret. Aside from being difficult to interpret due to the numerous vertical lines displayed, there is not an easily distinguishable difference between the patterns displayed for rotation across the different sensors and dimensions for most of the activities recorded. Due to the difficulty in interpretation as well as pattern identification and distinction, measurements of rotation are less useful compared to other attributes when attempting to disguise between the activities recorded.



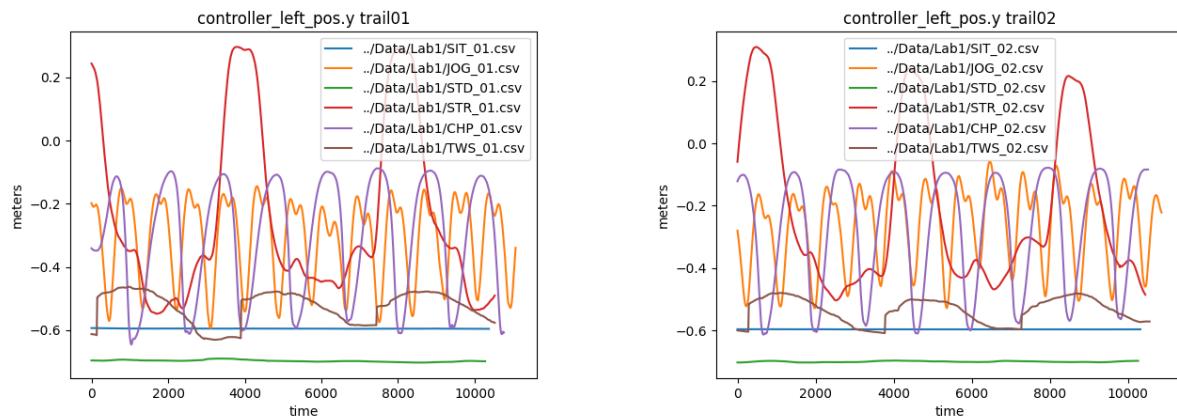
Additionally, it is worth mentioning attributes that provide helpful distinctions for a singular activity, but not for the other 5 activities. An example is the angular velocity for y for the headset which provides a clear pattern distinction for twisting in the generate graph, but does not display distinct patterns to help distinguish between the remaining 5 activities. Similar is the headset velocity for y which provides a clear pattern distinction for jogging, but does not display distinguishable patterns of activity for the remaining 5 activities. While these attributes are helpful in identifying a singular activity, since they are unable to effectively distinguish between the remain 5 activities recorded this renders them less helpful when compared to attributes that can be used individually to distinguish between all 6 activities.

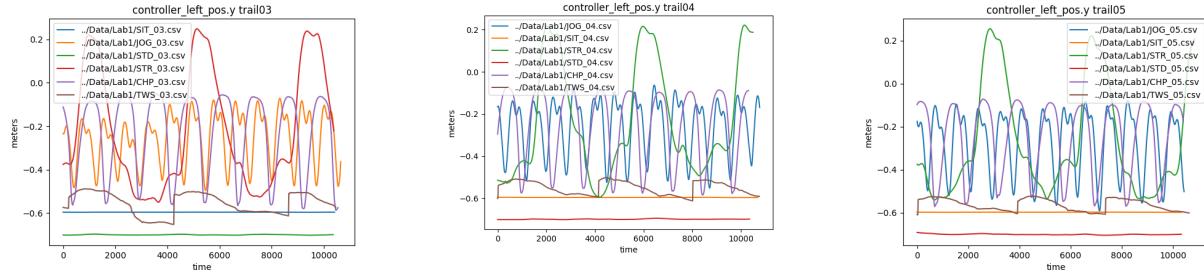
Q5: Compute the mean and variance of the significant attributes across all data samples, then present them in a table for all six activities. Also, include visualizations that highlight how motion patterns differ between activities for certain attributes in your report. Explain how the statistics and visualizations support your answer to #3

controller_right_pos.y



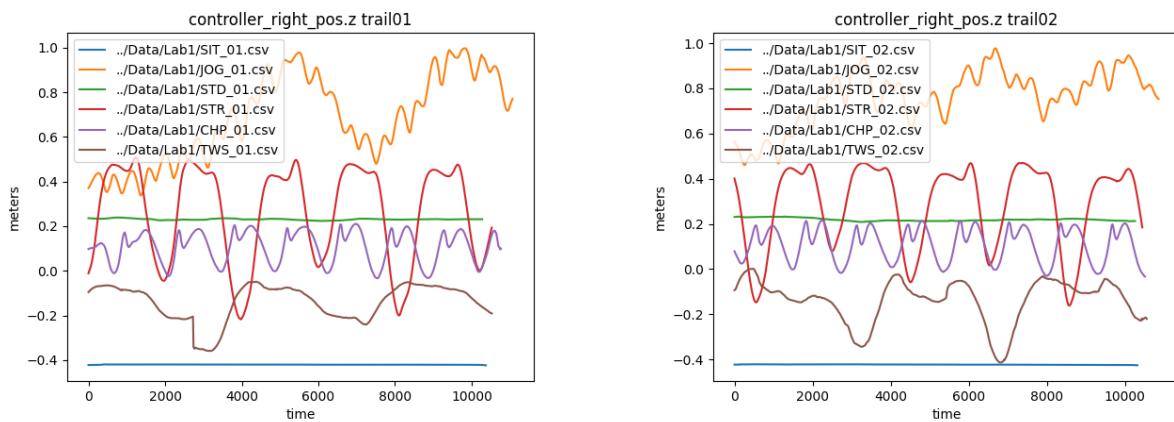
controller_left_pos.y

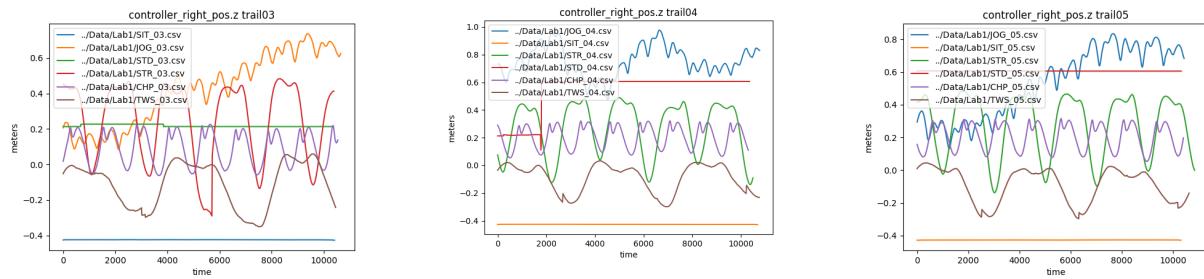




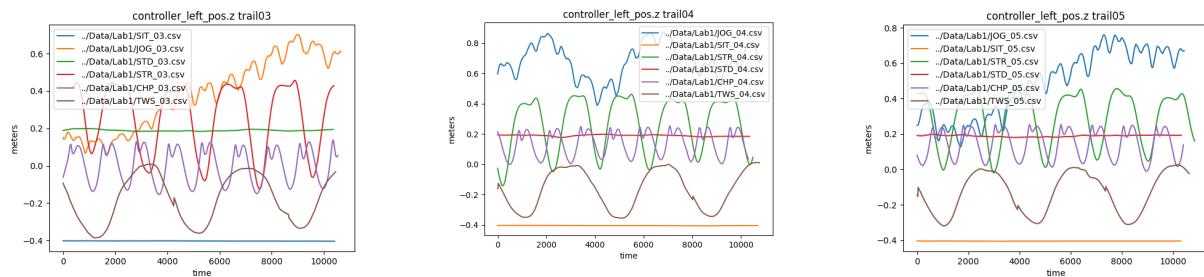
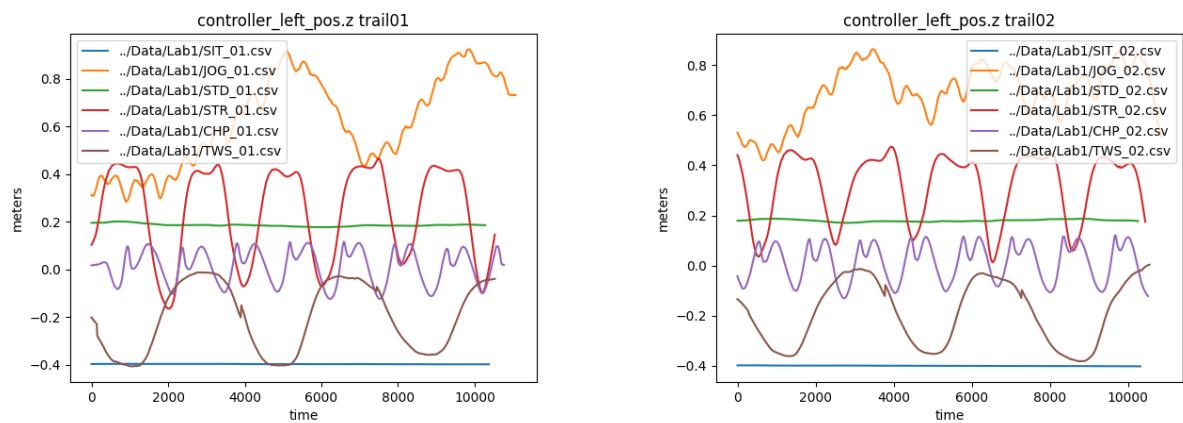
By graphing the y position for both controllers (right and left) for the recorded trials, this attribute displays patterns of activity that aid in distinguishing the sensor traces of the different activity. Both standing and sitting display a straight line since they involve little hand movement, however sitting is lower due to the change in body position. An important consideration for analyzing future data as well as designed a ML model, is how to distinguish between sitting and standing using positional data when accounting for standing on platforms or sitting on surfaces at different heights. The pattern displayed for stretching demonstrates the highest peaks/amplitude which makes sense since the stretching motion required the furthest extension of the arms/hands in terms of vertical direction. Twisting displays a pattern of peaks, however, the peaks for twisting are the shortest out of the various patterns displayed for the activities measured which makes sense since twisting did not require hand movement. The peaks displayed by the measurements for jogging and chopping are similar in height, midway between stretching and twisting, which makes sense since they require moderate vertical movement of the hands. Additionally, you can distinguish between the two because the graph for chopping is smoother while the peaks for jogging display small disturbances which makes sense given the volatility of jogging where's chopping is a more controlled movement. Thus, the y position of the controller proves helpful in distinguishing between the sensor traces of the 6 activities measured. However, it appears the data for trial 4 and 5 for controller_right_pos_y has some variations/discrepancies which have led to deviations from these trends that should be accounted for during future testing and data analyzation.

controller_right_pos.z



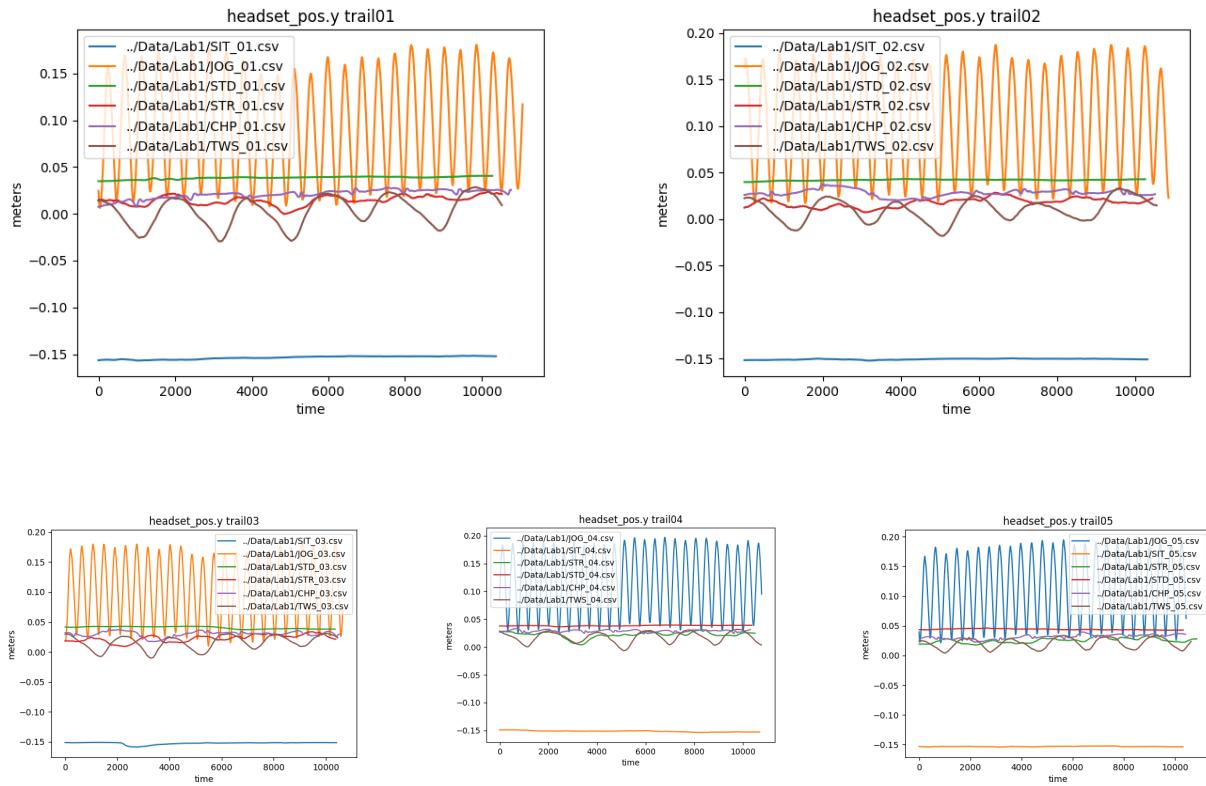


controller_left_pos.z



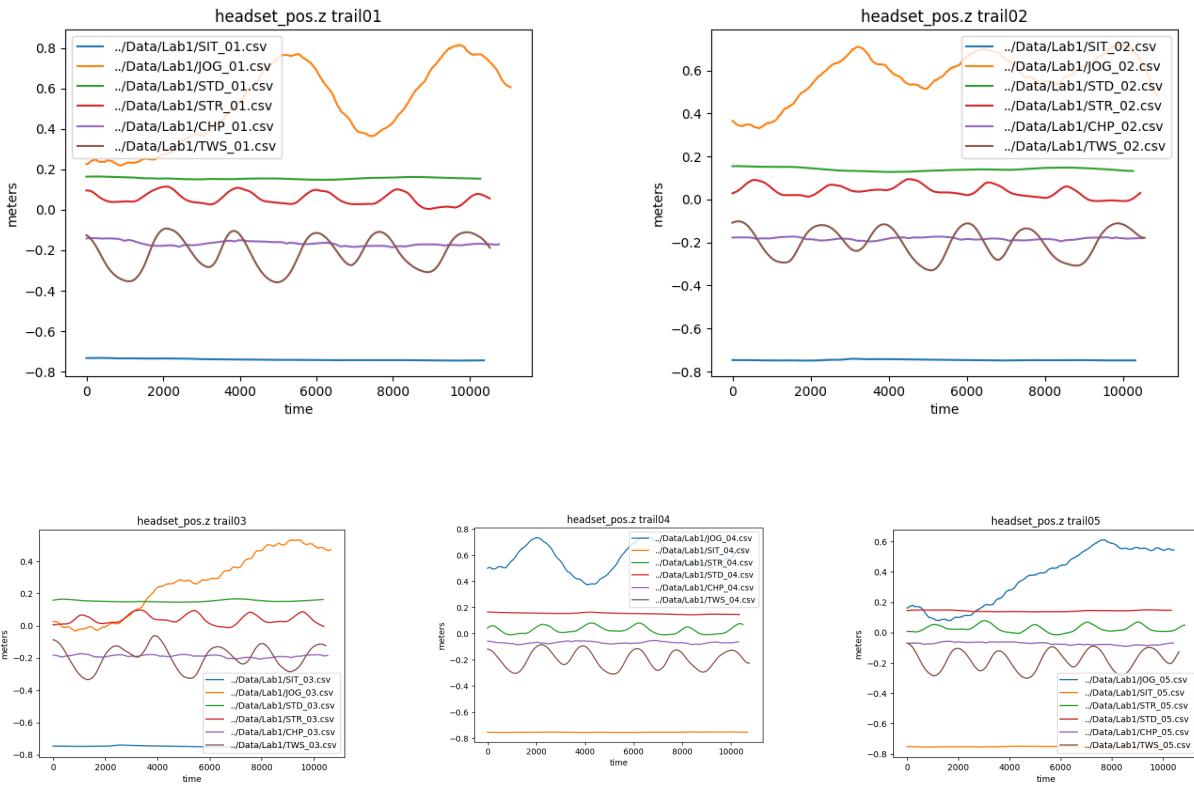
Controller position z for both the right and left controller also proved helpful in distinguishing between the sensor traces between different activity types. Again, both sitting and standing display horizontal lines with sitting towards the bottom of the graph and standing displayed higher above it towards the midline of the graph. Jogging is centered towards the top of the graph and displays large, wide peaking with volatility demonstrated by the continuous little peaks. Stretching is centered more towards the midline of the graph and displays more frequent peaking as well as a smoother line. Chopping is centered below the midline and displays short peaks at a higher frequency than the other activities with small dips at the top of each peak. Twisting is centered close to the bottom and displays larger and less frequent peaks compared to some of the other activities. The distinctness of each of the patterns displayed enables controller position z as one of the more helpful attributes in distinguishing activities based on the provided sensor traces.

headset_pos.y



Headset position y is also helpful for distinguishing between the sensor traits for the various activities. Headset position y is the lowest for sitting, displayed a straight unchanging line near the bottom of the graphs around -0.15 meters. This makes sense as the position of the head during the trials for sitting was lower relative to all other activities and sitting is a stationary activity. Contrarily, standing also displays a straight line since it is also a stationary activity but is located closer to the top of the graphs around 0.04 meters. Additionally, it is centered closer to the data for the other 4 activities excluding sitting which makes sense given all 4 of those activities required standing which placed the head at a similar vertical height. Jogging likewise displays a very unique and distinguishable pattern. It displays frequent peaks with high amplitude relative to all of the other data plotted which makes sense since the jogging invokes up/down movement of the body during the activity and consequently results in variation of the vertical position of the head during the activity unlike the other activities. Twisting also displayed a distinct peaking pattern however, with a much lower amplitude than jogging which make sense since twisting is a more stationary movement and thus results in less variation in the vertical position of the head. Arms stretching and chopping display relatively similar data patterns centered close to the data for standing which make sense since all three activities involved standing at equal height. However, arms stretching and chopping do not display straight lines and instead display like standing which makes sense since standing is completely stationary however arms chopping and stretching do involve movement and are likely to invoke small displacements of head position during activity.

`headset_pos.z`



Headset position z also displayed patterns useful for distinguishing between the sensor traits for the various activities. Again, sitting and standing are straight lines with sitting towards the bottom of the graph at negative y-value and standing much higher on the graph in the positive y-values. Jogging displays wider peaks centered towards the top of the graph. Twisting displayed moderately sized more frequent peaks centered closed toward the midline of the graph around -0.2 meters. Arms stretching displays peaks with very short aptitude's centered around the midline of the graph at approximately 0.05 meters. Arms chopping displays a relatively straight line with minor disturbances centered between sitting and standing at approximately -0.1 meters.

standing	mean	variance	arms chopping	mean	variance
controller_right_pos.y	-0.038102	0.112552	controller_right_pos.y	-0.258049	0.032316
controller_left_pos.y	-0.699233	0.000004	controller_left_pos.y	-0.260953	0.030356
controller_right_pos.z	0.338406	0.003662	controller_right_pos.z	0.152669	0.006238
controller_left_pos.z	0.185440	0.000023	controller_left_pos.z	0.074859	0.006263
headset_pos.y	0.040919	0.000001	headset_pos.y	0.028466	0.000014
headset_pos.z	0.148153	0.000038	headset_pos.z	-0.125028	0.000073
sitting	mean	variance	arms stretching	mean	variance
controller_right_pos.y	-0.602589	5.048157e-07	controller_right_pos.y	-0.248151	0.075474
controller_left_pos.y	-0.596047	8.307124e-08	controller_left_pos.y	-0.232776	0.071305
controller_right_pos.z	-0.423812	3.825666e-07	controller_right_pos.z	0.267002	0.039433
controller_left_pos.z	-0.401815	6.102387e-07	controller_left_pos.z	0.275097	0.028399
headset_pos.y	-0.152078	1.436504e-06	headset_pos.y	0.020770	0.000027
headset_pos.z	-0.747877	6.377553e-06	headset_pos.z	0.036345	0.000748
jogging	mean	variance	twisting	mean	variance
controller_right_pos.y	-0.306082	0.022561	controller_right_pos.y	-0.584471	0.002152
controller_left_pos.y	-0.271082	0.016645	controller_left_pos.y	-0.547144	0.001849
controller_right_pos.z	0.650021	0.026603	controller_right_pos.z	-0.112539	0.011447
controller_left_pos.z	0.591192	0.023933	controller_left_pos.z	-0.176211	0.016592
headset_pos.y	0.108004	0.002805	headset_pos.y	0.013672	0.000136
headset_pos.z	0.475942	0.023691	headset_pos.z	-0.196507	0.005003

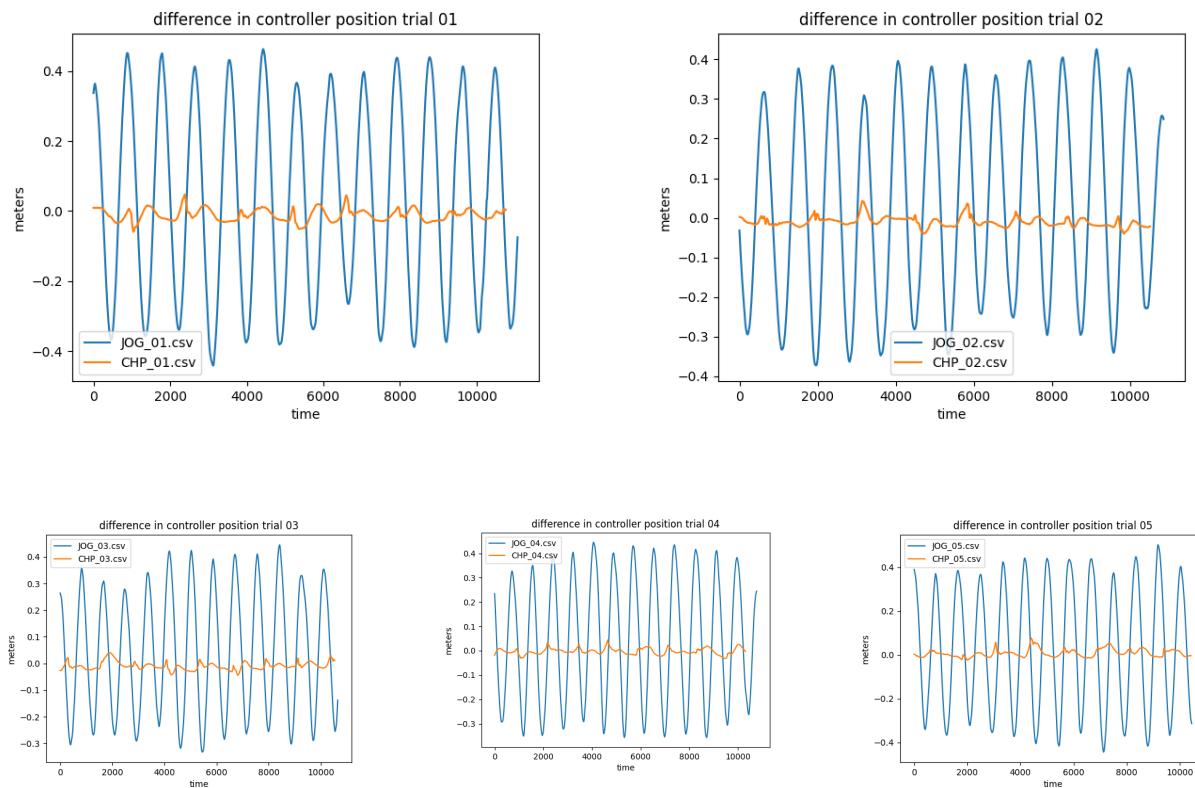
mean and variance of the significant attributes

	Standing	Sitting	Jogging	Arms Chopping	Arms Stretching	Twisting
controller_right_pos.y Mean (meters)	-0.038102	-0.602589	-0.306082	-0.258049	-0.248151	-0.584471
controller_right_pos.y Var (meters)	0.112552	5.048157e-07	0.022561	0.032316	0.075474	0.002152
controller_left_pos.y Mean (meters)	-0.699233	-0.596047	-0.271082	-0.260953	-0.232776	-0.547144
controller_left_pos.y Var (meters)	0.000004	8.307124e-08	0.016645	0.030356	0.071305	0.001849
controller_right_pos.z Mean (meters)	0.338406	-0.423812	0.650021	0.152669	0.267002	-0.112539
controller_right_pos.z Var (meters)	0.003662	3.825666e-07	0.026603	0.006238	0.039433	0.011447
controller_left_pos.z Mean (meters)	0.185440	-0.401815	0.591192	0.074859	0.275097	-0.176211
controller_left_pos.z Var (meters)	0.000023	6.102387e-07	0.023933	0.006263	0.028399	0.016592
headset_pos.y Mean (meters)	0.040919	-0.152078	0.108004	0.028466	0.020770	0.013672
headset_pos.y Var (meters)	0.000001	1.436504e-06	0.002805	0.000014	0.000027	0.000136

	Standing	Sitting	Jogging	Arms Chopping	Arms Stretching	Twisting
headset_pos.z Mean (meters)	0.148153	0.747877	0.475942	-0.125028	0.036345	-0.196507
headset_pos.z Var (meters)	0.000038	6.377553e-06	0.023691	0.000073	0.000748	0.005003

While the graphs provide a clearer visualization the data from the table can be interpreted in a similar manner. For example, looking at the controller position y for both the right and left controllers (excluding the data point for standing for the right controller which is skewed relative to the other recorder data points) the values also provide a helpful distinction between activities. Standing and sitting have two of the smallest values for variance in y position of controller (eg. left controller: 0.000004 and 8.307124e-08) which makes sense since neither of these activities require hand movement and are completely stationary. Contrarily, the other activities displayed higher variance in the y position of the controllers. Arms stretching has the highest variance for the left controller at 0.071305 which makes sense since arms stretching required the largest range of motion in regards to controller movement. Jogging and arms chopping have the next highest and then twisting after that which makes sense as twisting involved little hand movement instead more torso rotation.

Q6: What additional features you could derive from the provided raw data that would be helpful for distinguishing between activity types? Compute at least one feature, then graph it and show how it can be used to distinguish between two different activities. (hint: think of attributes used in physics that can be derived from the raw data)



An additional feature that could be derived from the raw data collection is the difference between the y position for the controllers. This feature specifically looks at the difference between the position of the left controller and the right controller on the y-axis at specific time intervals. This additional feature would prove useful in helping to distinguish between activities due to the difference in arm positioning during different activities. While the singular position of each controller as

a function of time can provide effective insights that allow for detecting the corresponding activity, a feature that evaluates the position of the controllers along the y-axis in relation to each other provides an additional level of specificity to aid in activity detection. The example demonstrated above analyzes the differences in controller position for the activities of jogging and chopping specially. This feature is particularly useful in comparing these two activities as the motions of jogging and chopping recruit a similar span of the y-axis, leading to similar patterns of motion displayed from sensor tracking for the individual controllers. However, in the arms chopping motion that arms move in coordination whereas in the jogging motion that arms move opposite to each other. Thus, the y-position of two controller in the arms chopping motion should be relatively similar throughout the activity as measured through the sensors whereas in jogging the y-position of the two controllers will repeatedly become closer and further away from each other throughout the movement. The expected results are demonstrated in the above graphs which visualize this new feature. The graphs display a clear distinction between the activity of chopping which displayed relatively low variability in the position of the two controllers throughout the movement whereas the activity of jogging displays a continually changing (growing and shrinking) distance between the two controllers.