

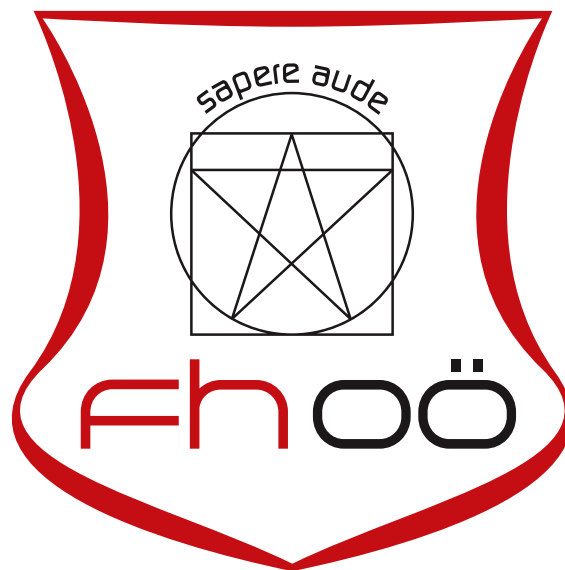
MACHINE LEARNING

Submission Assignment 01

von

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November 07, 2023

Task 1: Overview of the Dataset

How many samples and features are in the dataset ?

Samples: 2160

Features: 423 (Without counting participantNr and sampleNr as features)

What are the features datatypes?

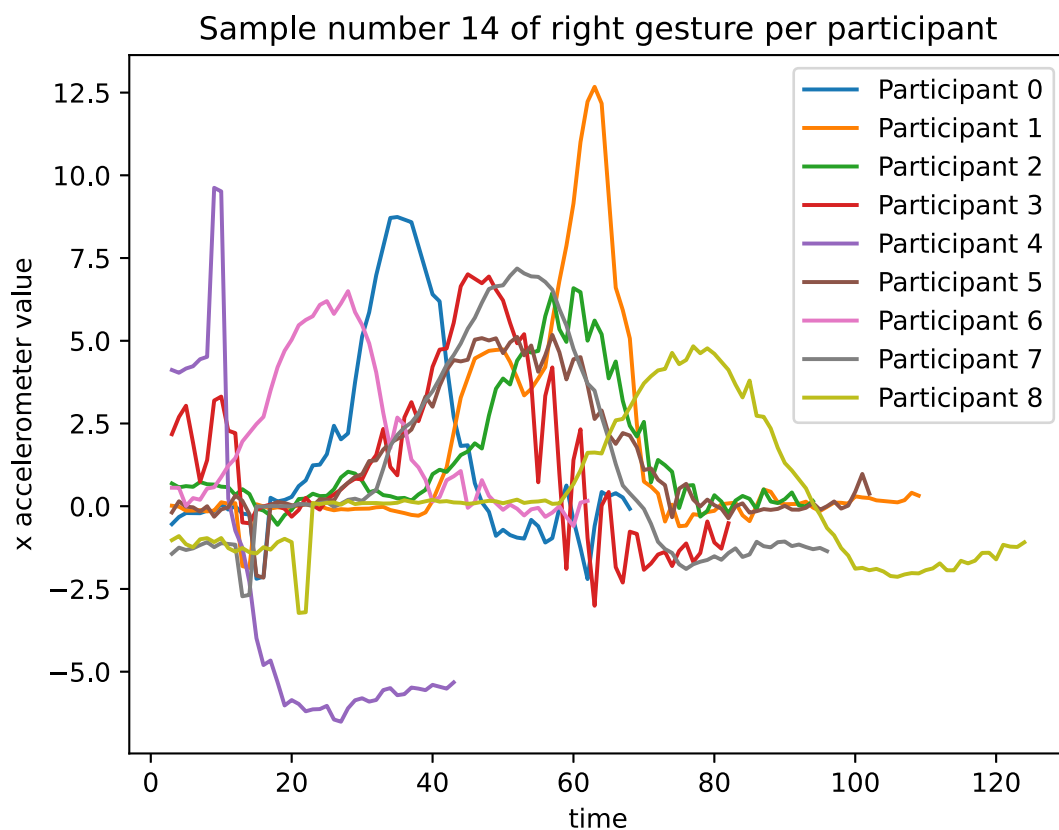
float64

Are the gestures balanced ?

Yes, the gestures are balanced the dataset contains 270 samples for each of the 9 classes

Task 2: Visualizations

I did this exercise, before we had the infos for our second assignment, therefore I tried to plot at least something.



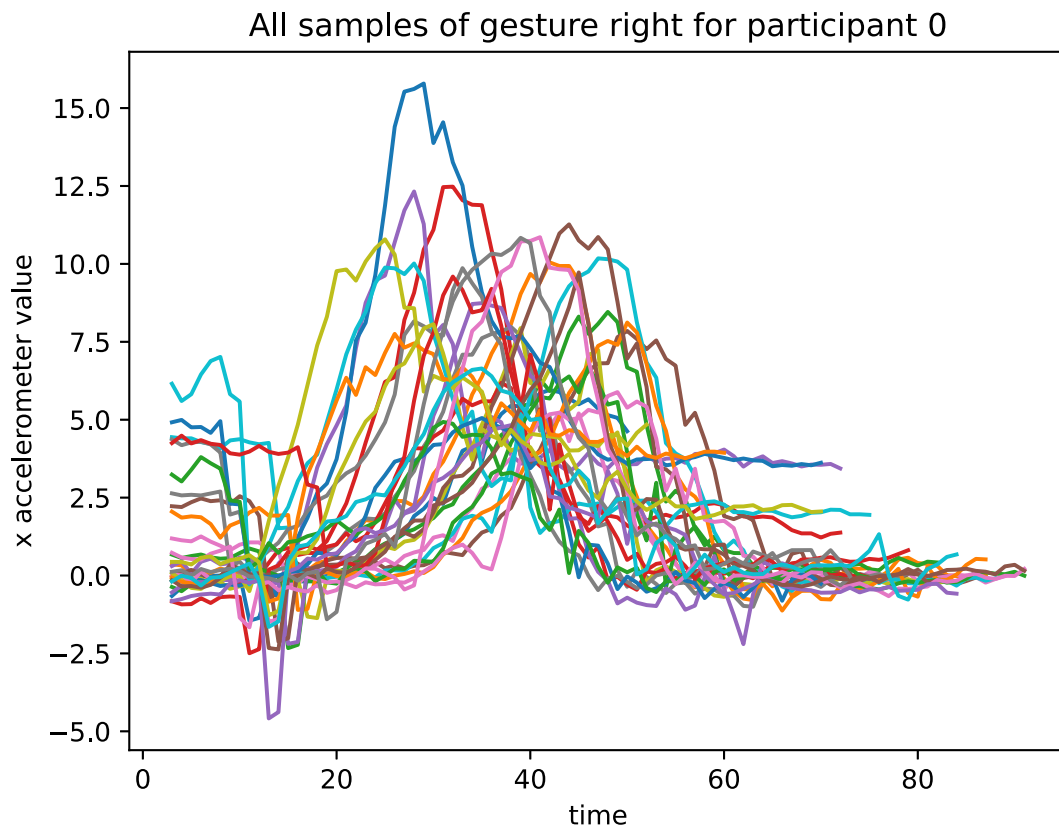
Is there a trend visible ?

Yes we can see the trend that the gesture looks very similar for each participant. The gesture consists of one huge peak that has a different breadth depending on the speed in which the gesture was executed e.g. Participant 4

executed the gesture very fast and the gesture of participant 8 was the slowest one.

Are there differences between the participants visible ?

Yes we can see that each participant has a different delay, speed and strength while the pattern looks similar.



Is there a trend visible ?

Yes we can see that the participant executed all his samples almost identical. There are very less differences between the samples comparing to the figure of all participants.

Task 3: Calculations

----- Calculations for all Participants -----

	left	right	up	down	square	triangle	circleCw	circleCcw
Mean Length	76.644444	79.940741	78.833333	76.633333	188.007407	150.744444	145.592593	138.748148
Median Length	77.000000	78.000000	76.000000	76.000000	179.000000	146.000000	143.000000	138.000000
MAD	12.654486	13.861838	13.697531	12.202222	37.563841	27.801481	22.504527	18.261015
STD	17.213709	20.683763	22.245128	19.761468	44.217693	39.470725	32.634576	23.604145
1st Quartile	66.000000	68.000000	69.000000	66.000000	153.250000	127.250000	126.000000	123.250000
3rd Quartile	85.000000	90.000000	86.000000	86.000000	221.000000	170.000000	161.750000	152.000000
Inner Quartile Range	19.000000	22.000000	17.000000	20.000000	67.750000	42.750000	35.750000	28.750000

----- Calculations for Participant 0 -----

	left	right	up	down	square	triangle	circleCw	circleCcw
Mean Length	73.400000	75.066667	67.966667	72.000000	184.800000	146.866667	146.900000	137.233333
Median Length	77.500000	75.000000	70.000000	73.000000	187.000000	148.000000	146.000000	140.000000
MAD	9.386667	8.733333	9.837778	10.400000	21.200000	18.466667	16.826667	12.720000
STD	12.280065	10.795699	12.360904	12.578032	26.038963	24.195658	28.031202	19.516012
1st Quartile	66.250000	68.500000	58.250000	63.250000	167.000000	131.750000	136.750000	130.250000
3rd Quartile	82.000000	83.750000	75.500000	80.750000	204.500000	159.500000	155.750000	148.500000
Inner Quartile Range	15.750000	15.250000	17.250000	17.500000	37.500000	27.750000	19.000000	18.250000

----- Calculations for Participant 1 -----

	left	right	up	down	square	triangle	circleCw	circleCcw
Mean Length	77.666667	80.000000	77.033333	74.900000	201.866667	158.500000	143.633333	126.766667
Median Length	78.000000	81.500000	74.500000	66.000000	201.500000	158.500000	139.000000	127.500000
MAD	10.466667	11.800000	13.304444	18.720000	23.600000	15.233333	27.117778	16.648889
STD	12.763994	14.063894	19.610840	43.373558	28.637729	19.920099	52.260279	20.802326
1st Quartile	70.000000	71.250000	64.500000	60.250000	184.250000	148.000000	121.500000	110.500000
3rd Quartile	86.750000	91.750000	83.750000	74.750000	220.500000	170.000000	153.000000	139.750000
Inner Quartile Range	16.750000	20.500000	19.250000	14.500000	36.250000	22.000000	31.500000	29.250000

----- Calculations for Participant 2 -----

	left	right	up	down	square	triangle	circleCw	circleCcw
Mean Length	64.100000	65.366667	74.966667	62.433333	167.100000	132.766667	117.900000	114.100000
Median Length	64.000000	64.500000	73.000000	62.000000	164.500000	129.500000	111.000000	112.000000
MAD	11.240000	9.857778	13.960000	10.833333	12.053333	15.437778	15.753333	11.713333
STD	14.133233	13.171242	20.423927	13.528217	18.985203	35.657067	22.722236	17.751833
1st Quartile	55.000000	57.250000	62.250000	49.500000	156.250000	120.500000	104.000000	102.250000
3rd Quartile	74.250000	72.000000	78.000000	69.750000	173.250000	134.000000	125.750000	122.000000
Inner Quartile Range	19.250000	14.750000	15.750000	20.250000	17.000000	13.500000	21.750000	19.750000

----- Calculations for Participant 3 -----

	left	right	up	down	square	triangle	circleCw	circleCcw
Mean Length	81.633333	81.933333	81.766667	82.166667	151.466667	139.566667	126.300000	126.100000
Median Length	76.500000	79.500000	76.000000	83.000000	149.500000	135.500000	126.000000	123.000000
MAD	12.426667	11.328889	13.940000	8.833333	13.564444	12.384444	13.720000	14.253333
STD	22.395325	14.924946	27.641402	11.386875	17.968811	15.105795	17.226984	19.545438
1st Quartile	72.250000	73.250000	71.000000	76.000000	138.500000	126.750000	115.750000	114.500000
3rd Quartile	87.750000	90.250000	83.000000	88.500000	157.500000	149.750000	140.750000	136.750000
Inner Quartile Range	15.500000	17.000000	12.000000	12.500000	19.000000	23.000000	25.000000	22.250000

----- Calculations for Participant 4 -----

	left	right	up	down	square	triangle	circleCw	circleCcw
Mean Length	57.800000	65.433333	68.966667	71.666667	135.033333	101.900000	142.333333	139.866667
Median Length	59.500000	68.000000	62.500000	70.000000	133.500000	102.500000	135.500000	138.000000
MAD	6.640000	8.471111	16.824444	6.844444	8.571111	8.246667	15.177778	8.591111
STD	8.168062	10.861775	39.365207	8.960963	10.739817	11.024581	19.268222	11.025780
1st Quartile	51.750000	58.250000	56.000000	67.250000	130.000000	92.250000	130.250000	134.250000
3rd Quartile	62.000000	70.750000	72.000000	77.000000	142.750000	108.000000	154.750000	146.750000
Inner Quartile Range	10.250000	12.500000	16.000000	9.750000	12.750000	15.750000	24.500000	12.500000

----- Calculations for Participant 5 -----

	left	right	up	down	square	triangle	circleCw	circleCcw
Mean Length	82.700000	86.100000	84.766667	78.566667	241.800000	179.033333	158.900000	152.200000
Median Length	82.000000	84.500000	85.000000	78.500000	241.000000	178.000000	158.500000	148.500000
MAD	8.680000	10.706667	11.515556	10.366667	19.986667	15.635556	11.300000	14.386667
STD	12.362764	13.264810	14.719640	12.059288	25.947427	19.628416	13.236183	18.505172
1st Quartile	75.250000	75.250000	75.000000	70.000000	221.250000	163.750000	148.250000	139.500000
3rd Quartile	87.250000	96.000000	96.000000	86.750000	255.250000	189.500000	168.500000	166.750000
Inner Quartile Range	12.000000	20.750000	21.000000	16.750000	34.000000	25.750000	20.250000	27.250000

----- Calculations for Participant 6 -----

	left	right	up	down	square	triangle	circleCw	circleCcw
Mean Length	77.200000	85.700000	88.500000	80.900000	156.633333	132.000000	142.066667	134.266667
Median Length	76.000000	86.000000	84.000000	81.000000	156.000000	133.000000	129.500000	131.000000
MAD	9.040000	13.520000	12.733333	9.173333	13.117778	12.266667	22.106667	10.520000
STD	12.172326	19.704979	18.470386	11.827350	17.018212	17.288625	43.627683	13.085747
1st Quartile	67.500000	72.500000	77.250000	73.250000	145.500000	125.000000	125.000000	124.000000
3rd Quartile	80.750000	91.000000	94.000000	89.500000	166.000000	140.000000	138.500000	140.500000
Inner Quartile Range	13.250000	18.500000	16.750000	16.250000	20.500000	15.000000	13.500000	16.500000

----- Calculations for Participant 7 -----

	left	right	up	down	square	triangle	circleCw	circleCcw
Mean Length	89.366667	90.033333	82.033333	80.533333	254.166667	189.566667	178.233333	174.033333
Median Length	88.500000	89.000000	77.000000	81.000000	253.000000	193.000000	177.500000	174.000000
MAD	12.282222	12.702222	10.040000	9.031111	13.311111	12.291111	11.648889	14.233333
STD	16.016120	16.873737	12.535421	11.218007	16.563531	15.269269	14.495382	18.574145
1st Quartile	78.000000	76.500000	73.000000	71.500000	242.500000	183.000000	166.750000	164.000000
3rd Quartile	97.000000	95.750000	89.000000	86.750000	266.250000	199.500000	187.750000	183.750000
Inner Quartile Range	19.000000	19.250000	16.000000	15.250000	23.750000	16.500000	21.000000	19.750000

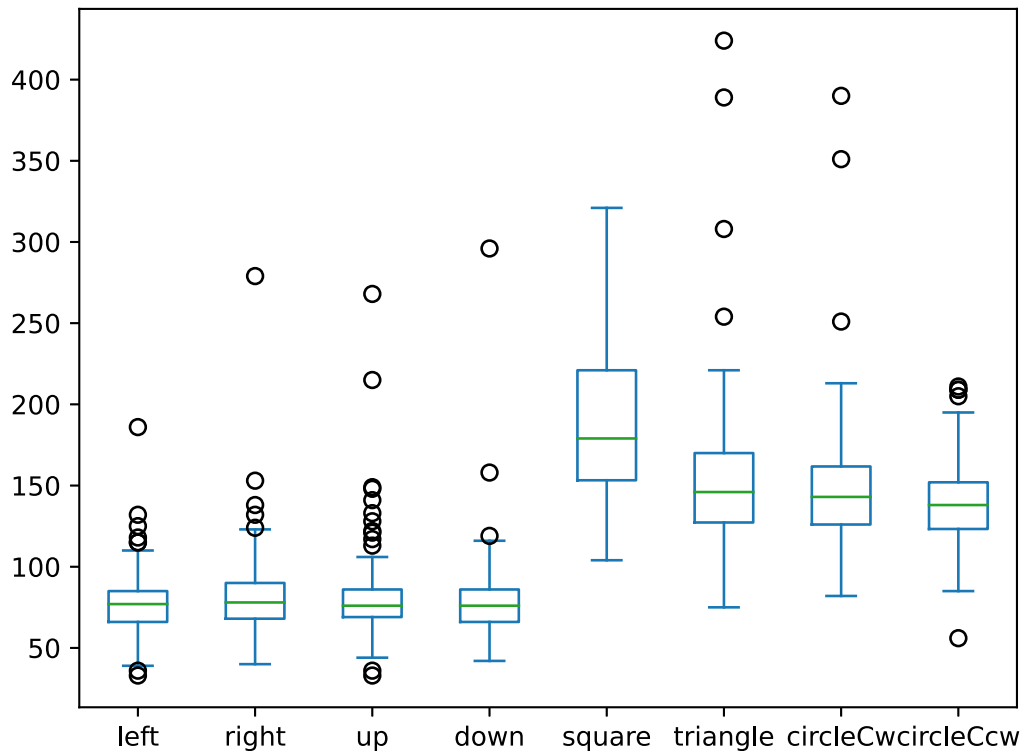
----- Calculations for Participant 8 -----

	left	right	up	down	square	triangle	circleCw	circleCcw
Mean Length	85.933333	89.833333	83.500000	86.533333	199.200000	176.500000	154.066667	144.166667
Median Length	85.500000	84.000000	82.500000	86.000000	194.000000	159.500000	154.500000	148.000000
MAD	11.866667	20.055556	9.200000	12.071111	22.840000	37.833333	14.600000	12.222222
STD	15.699623	39.300858	13.790927	18.650568	31.417544	66.965637	17.928850	14.304770
1st Quartile	79.250000	72.500000	78.000000	74.750000	181.750000	145.250000	141.750000	131.500000
3rd Quartile	96.750000	95.000000	92.000000	90.000000	218.500000	170.750000	168.250000	154.000000
Inner Quartile Range	17.500000	22.500000	14.000000	15.250000	36.750000	25.500000	26.500000	22.500000

----- Part 4 -----

Task 4: Correlation between gesture lengths

I did this exercise, before we had the infos for our second assignment, therefore I used a boxplot, which shows the correlation very good.



Is there a trend visible?

Yes we can see a trend between the gesture lengths and the gesture types. The very primitive gestures left, right, up and down are very usually very short, still we can always see some outliers, which can e.g. be caused by a delayed start, as we already saw in the plots of assignment 2

The “longest gesture” is of course the square, which makes sense, because the square gesture consists of 4 movements right, down left, and up, the second longest gesture is the triangle, which also makes sense, because it consists of 3 movements.

Task 5: Vectorized commands

How many gestures have a length of more than 100 acceleration values?

In total 1114

P0	P1	P2	P3	P4	P5	P6	P7	P8
116	118	110	122	111	131	132	136	138

How many gestures have a length below 100?

In total 1035

P0	P1	P2	P3	P4	P5	P6	P7	P8
124	120	126	117	129	108	107	103	101

How many participants performed at least half of their left gestures in less than 70 acceleration values?

2 Participants

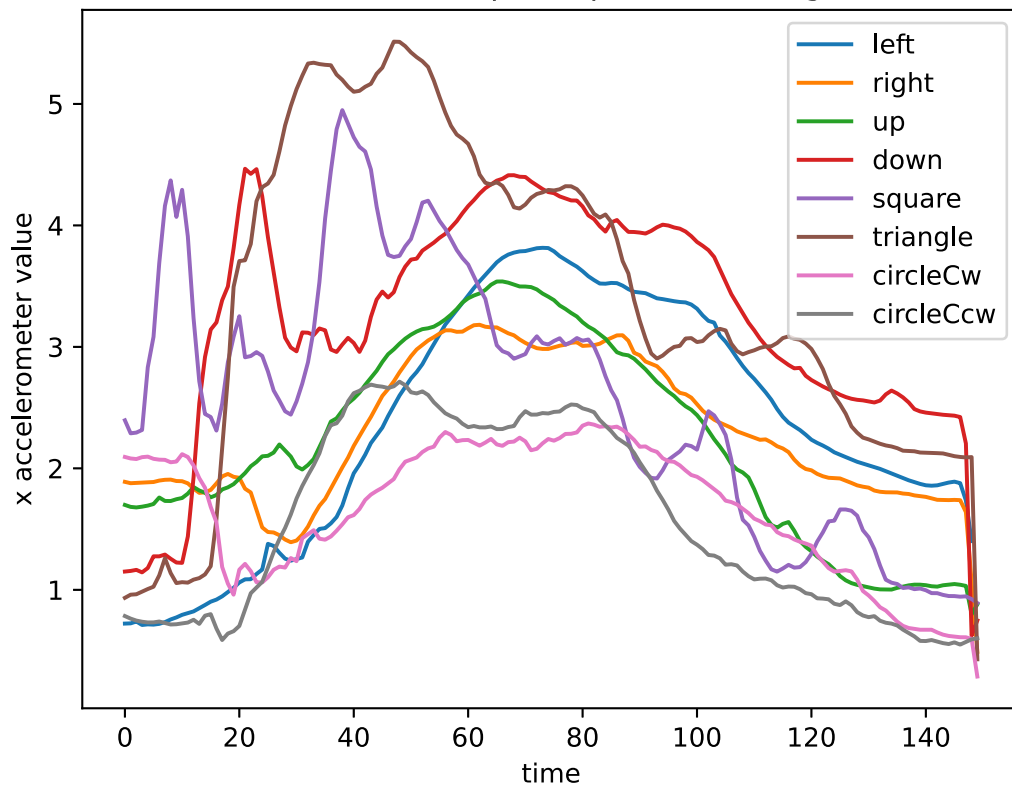
How many participants needed more than 200 acceleration values to perform at least half of their square gestures?

2 Participants

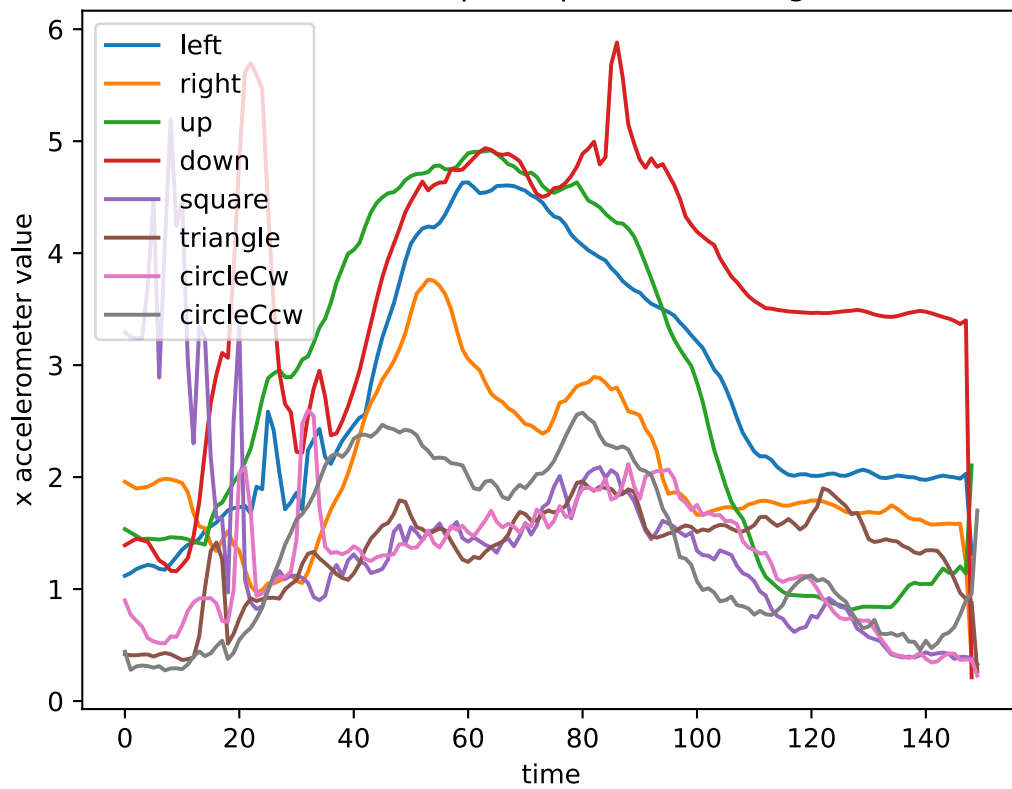
Task 2: Visualizations (after we got assignment 2)

I tried to create some plots with the code we got for assignment 2. I interpolated the data to get samples with equal lengths. Then I used the median of each datapoint for each gesture. I'm not sure if using the median is that clever, but I did not find a better way. On the internet I read that DTW makes sense for such tasks, but I didn't get it working.

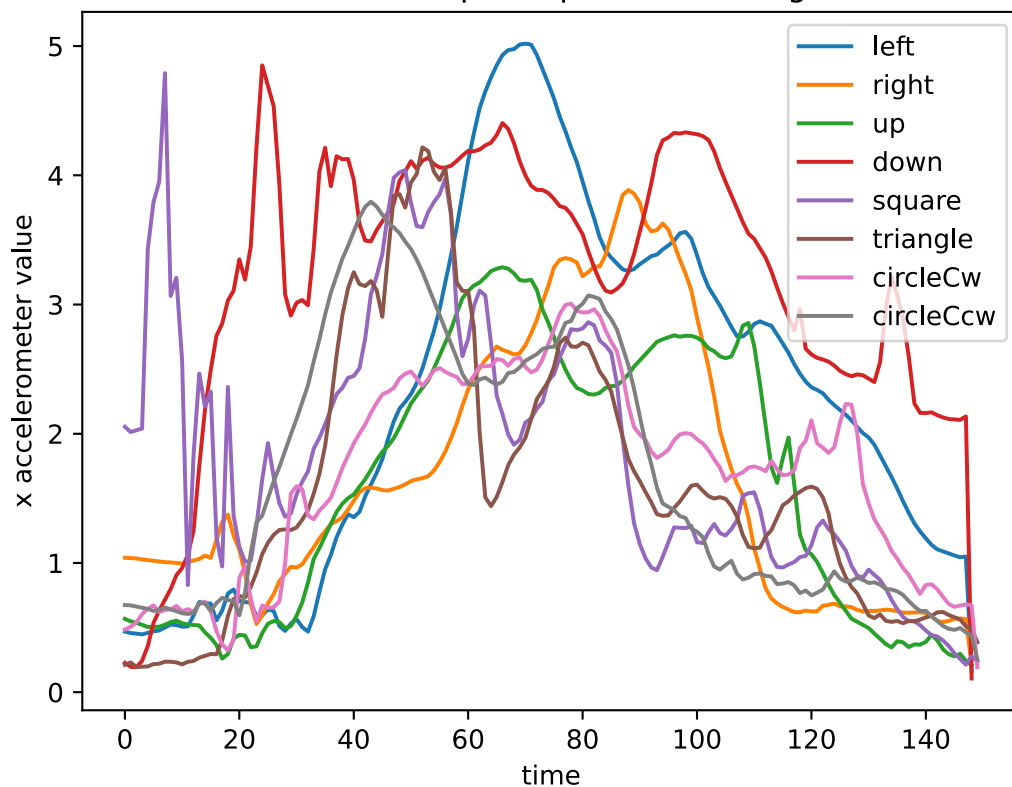
Median Curve for all participants and all gestures



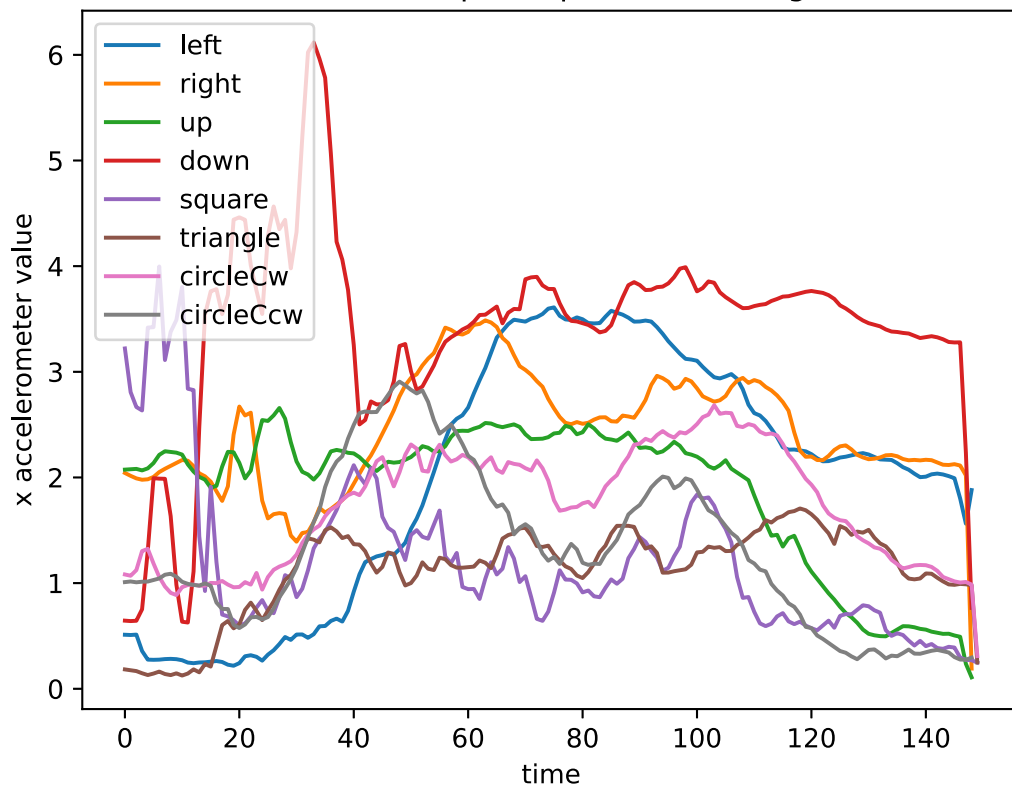
Median Curve for participant 0 and all gestures

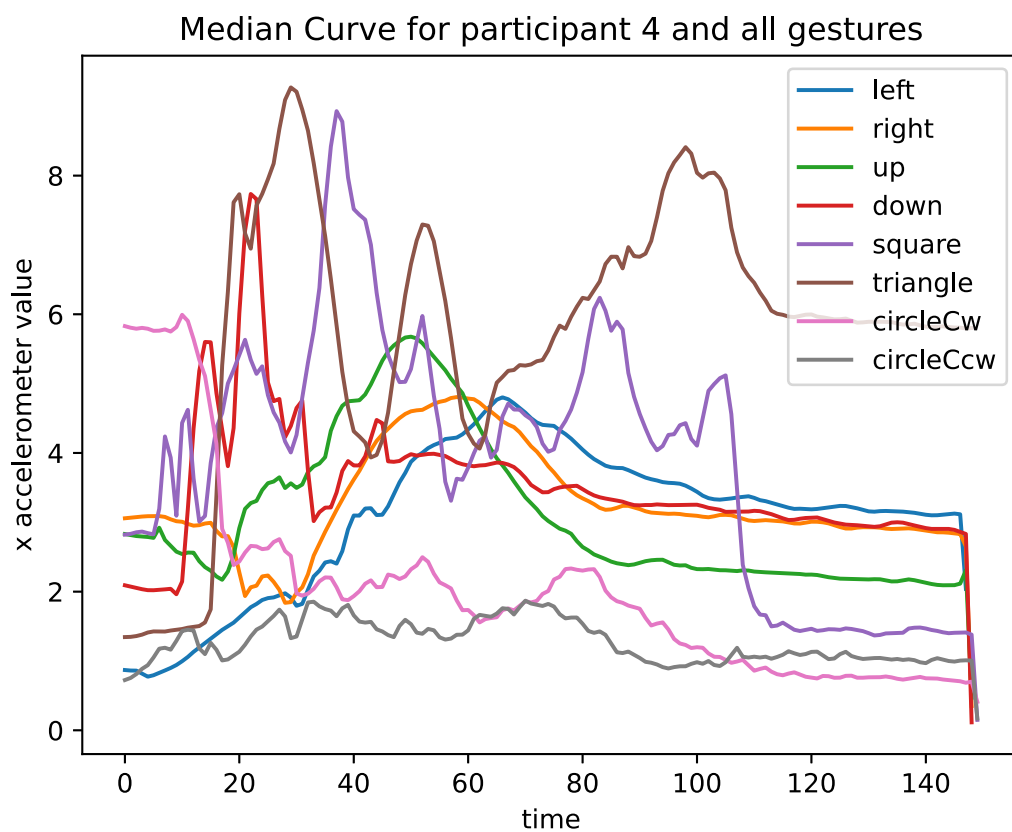
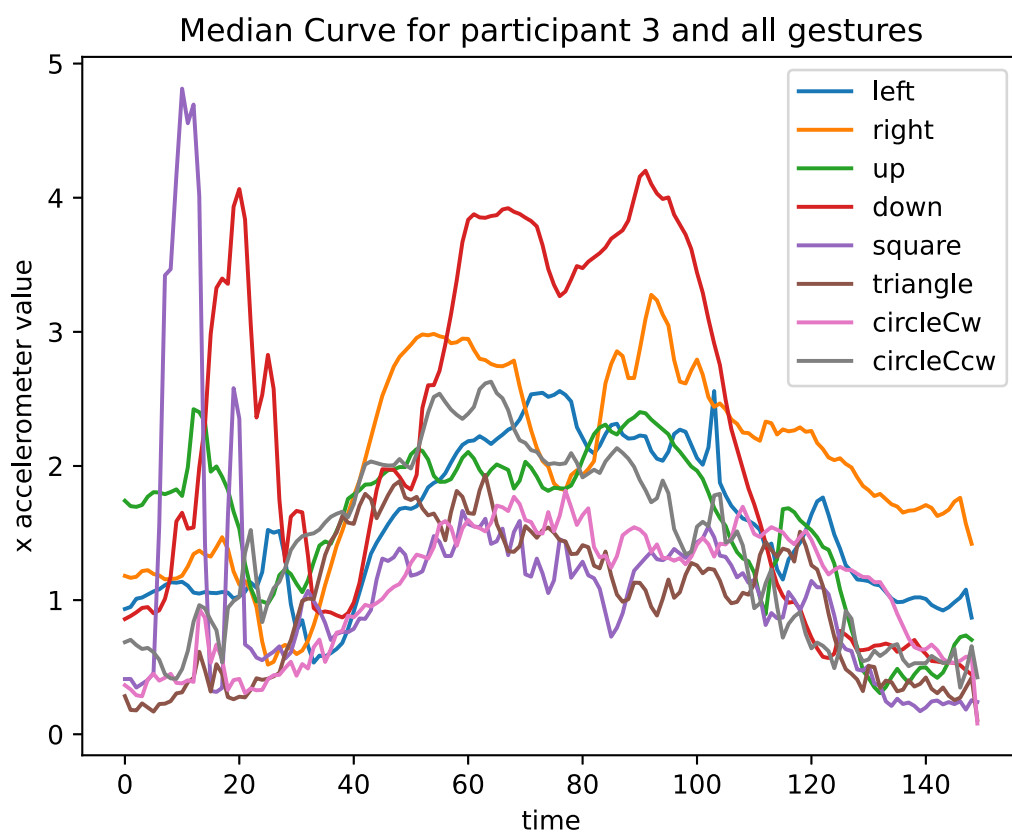


Median Curve for participant 1 and all gestures

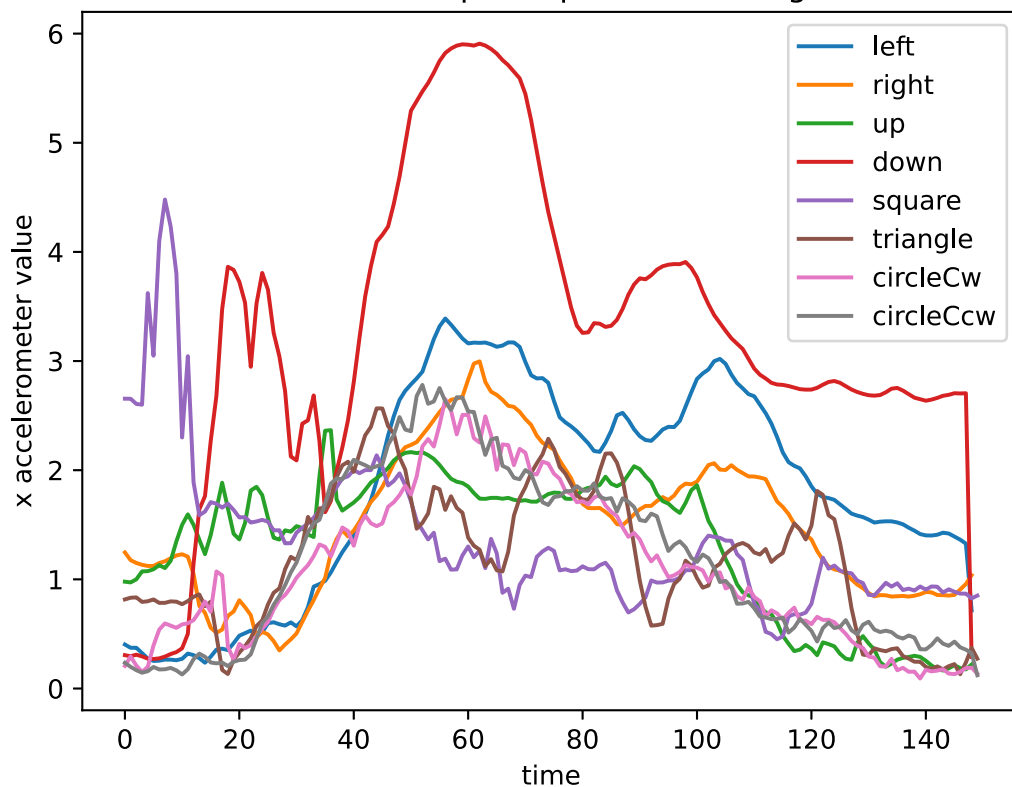


Median Curve for participant 2 and all gestures

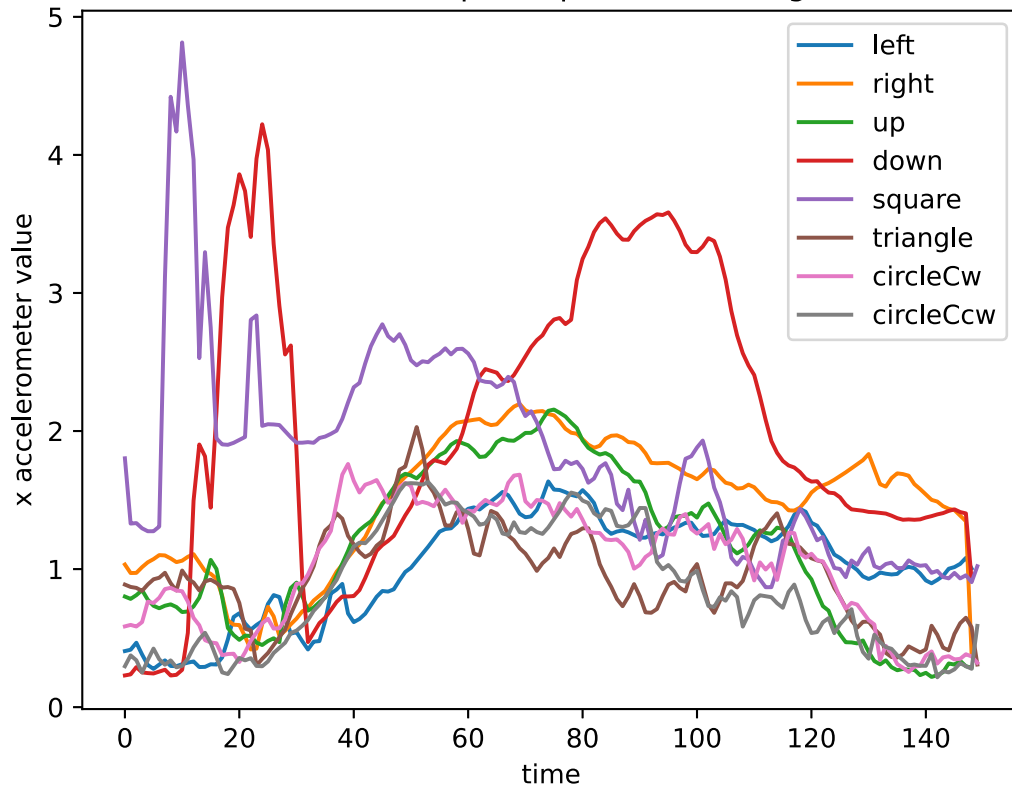




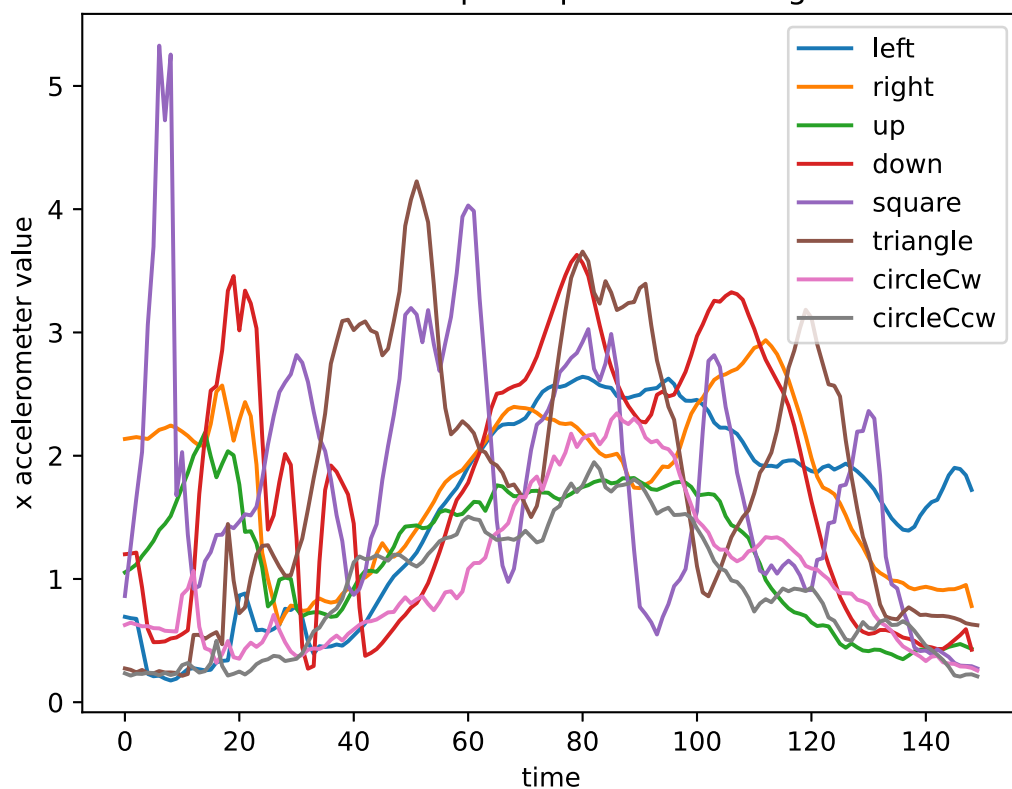
Median Curve for participant 5 and all gestures



Median Curve for participant 6 and all gestures



Median Curve for participant 7 and all gestures



Median Curve for participant 8 and all gestures

