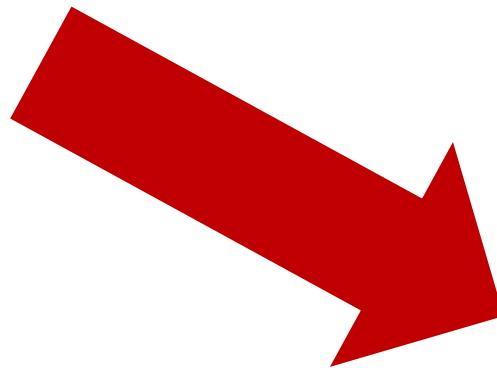


Smart Play Sets



08 januari 2019

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Project goal

- Motor skill problems: 5-10% of the children

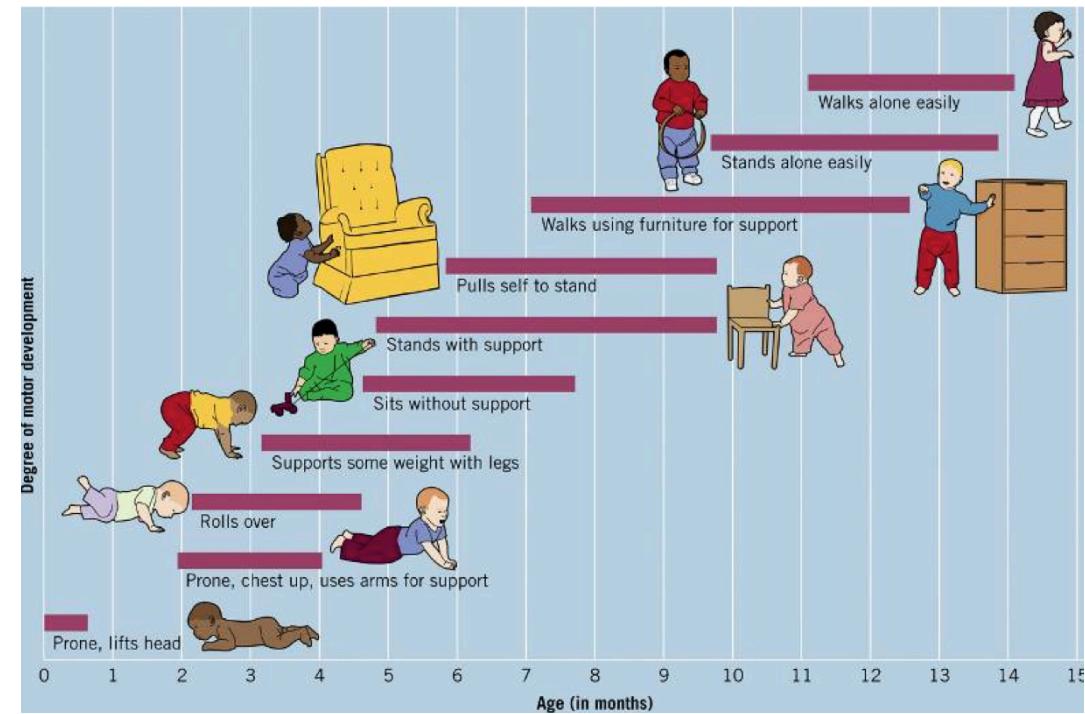


- Own learning curve for each child

- Monitoring instead of 1 measurement



- Start therapy in time → prevent



Current tests

Movement ABC



- Valid and reliable
- Trained evaluator
- Boring
- Takes a lot of time

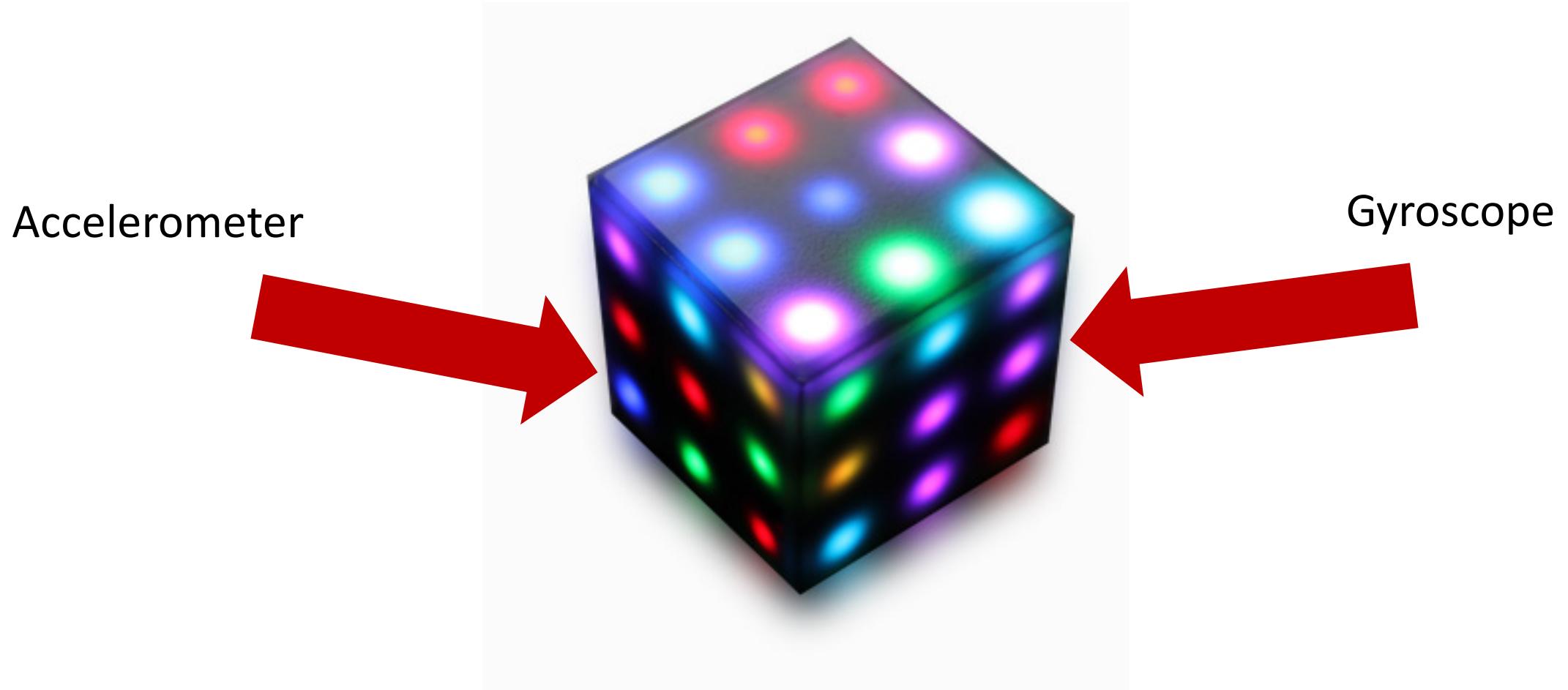
Teacher's observation



- Not valid
- Lots of experience needed
- Daily tasks
- Fast

Not enough time → Children not tested → No monitoring at all

Possible solution: FuturoCube



Research question

Is it possible to use the FuturoCube to detect fine motor skill problems in children?

- What is the best approach (i.e. machine learning method) to predict the class label based on the data from the RR game?
- Which features are most important in predicting the class label based on the data from the RR game?
- *Which game is better in predicting the class label?*
- *Which level or combination of levels (within one game) is better in predicting the class label?*

Experiment

- **97 children**
 - 45 boys
 - 52 girls
- **6-9 years old**
- **Binary MABC score**
 - 50x motor skill problems
 - 47x no motor skill problems
- **15 min MABC test**
 - 3 subtests
- **10 min FuturoCube**
 - Roadrunner game
 - Maze game

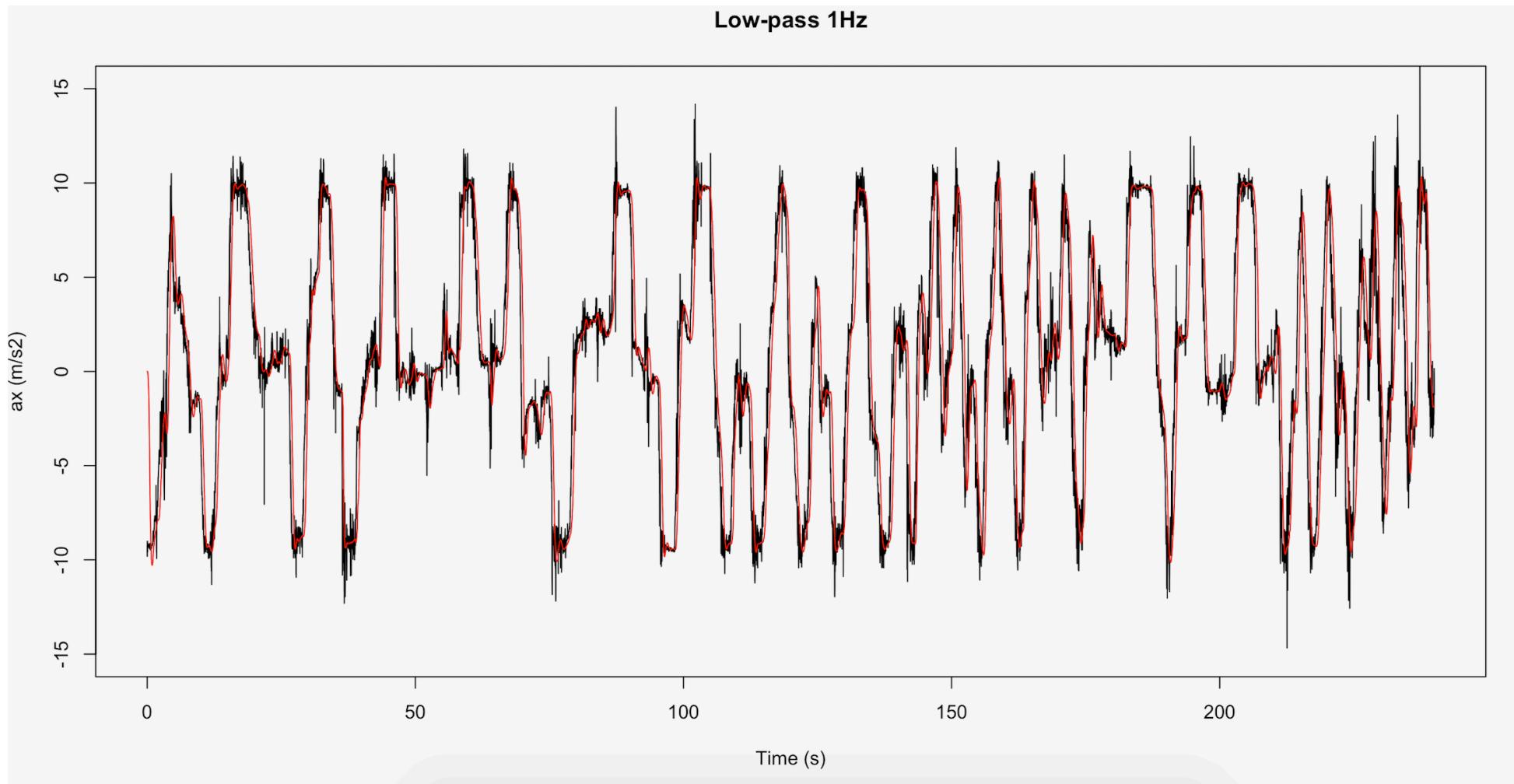
Data

General information of participant

Game state data

Sensor data

Data example



Data - participant

Name	Meaning
ID	ID number of participant
mabc_percentile_score	Percentile score of fine motor skills: the higher the better
mabc_binary_score	Class label: binary score of fine motor skills 0 = No motor skill problems 1 = Likely to have motor skill problems
gender	0 = male 1 = female
age_precice	Age in years

Data - Game

Name	Meaning
Index_runner*	Square index of the dot on the cube
Side_runner*	Side number of the dot on the cube
Square_runner*	Square number of the dot on the cube
Python_tijd	Time: Can only be used to compare variables within one game
Spel	RR = roadrunner game; M = maze game
Permutation	Defines order of levels
Round	Warmup; 1; 2; 3; 4; 5; 6
Level	0 = easy; 1 = middle; 2 = hard
times_level_played_before	How many time the same level is played before [0;1]
Snelheid (only in RR game)	Velocity of the dot; the lower the easier the game
Incorrect (only in Maze game)	0 if player was on correct path; 1 if player's location was incorrect
* See next slide for documentation	

Cube – index and square/side numbers

			4,0	4,1	4,2							
			4,3	4,4	4,5							
			4,6	4,7	4,8							
2,0	2,1	2,2	0,0	0,1	0,2	3,0	3,1	3,2	1,0	1,1	1,2	
2,3	2,4	2,5	0,3	0,4	0,5	3,3	3,4	3,5	1,3	1,4	1,5	
2,6	2,7	2,8	0,6	0,7	0,8	3,6	3,7	3,8	1,6	1,7	1,8	
			5,0	5,1	5,2							
			5,3	5,4	5,5							
			5,6	5,7	5,8							

Figure 1: Side and squares numbers used in PAWN.

			36	37	38						
			39	40	41						
			42	43	44						
18	19	20	0	1	2	27	28	29	9	10	11
21	22	23	3	4	5	30	31	32	12	13	14
24	25	26	6	7	8	33	34	35	15	16	17
			45	46	47						
			48	49	50						
			51	52	53						

Figure 2: Square indexes used in PAWN.

Game - Permutations

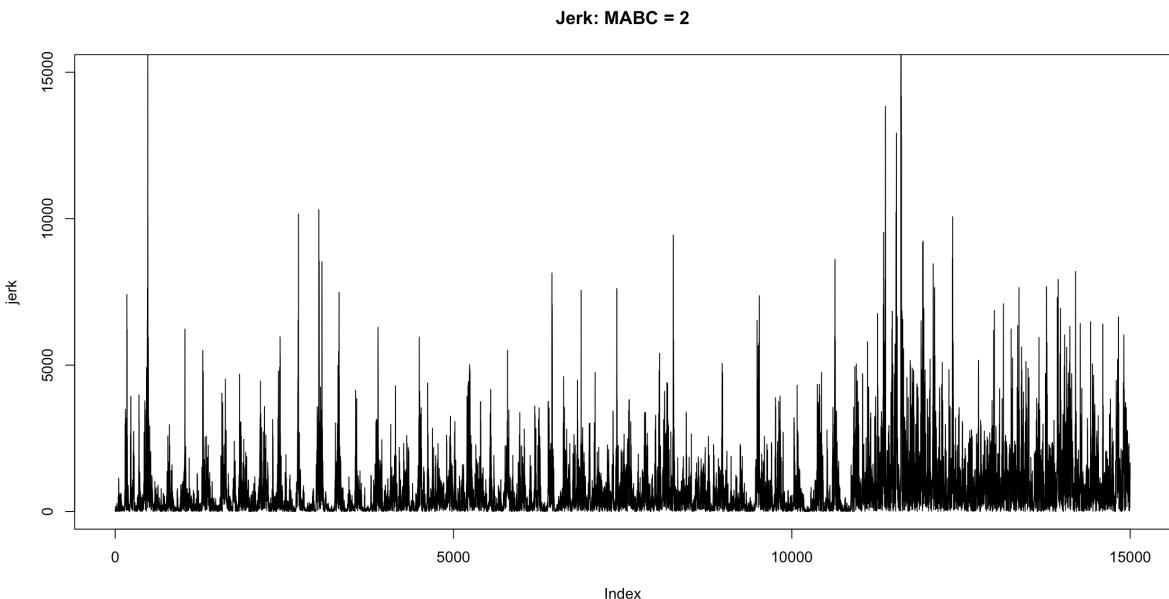
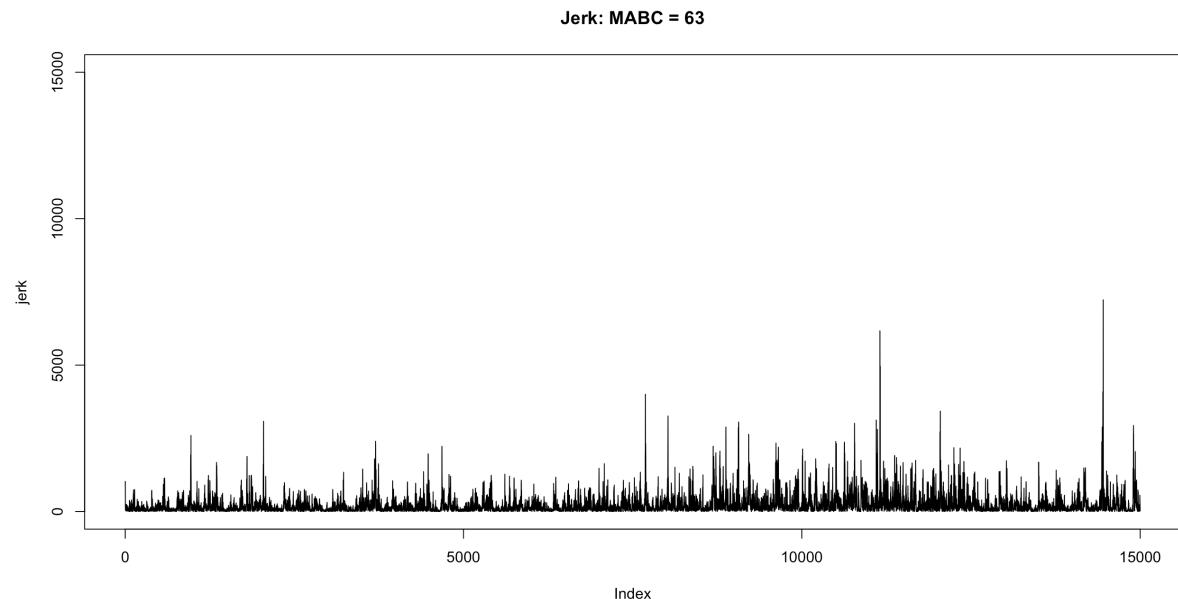
- Roadrunner game: 10 permutations, 30 seconds per round
Warmup for each participant. After that, see table
- Maze game had no permutations, 60 seconds per round
Order for each participant: Warmup, level 0, level 1, level 0, level 1

Permutation	Order of LoD's
0	0, 1, 2, 0, 1, 2
1	0, 1, 2, 0, 2, 1
2	0, 1, 2, 1, 2, 0
3	0, 1, 2, 1, 0, 2
4	0, 2, 1, 0, 1, 2
5	0, 2, 1, 0, 2, 1
6	0, 2, 1, 2, 0, 1
7	0, 2, 1, 2, 1, 0
8	0, 1, 0, 2, 1, 2
9	0, 2, 0, 1, 2, 1

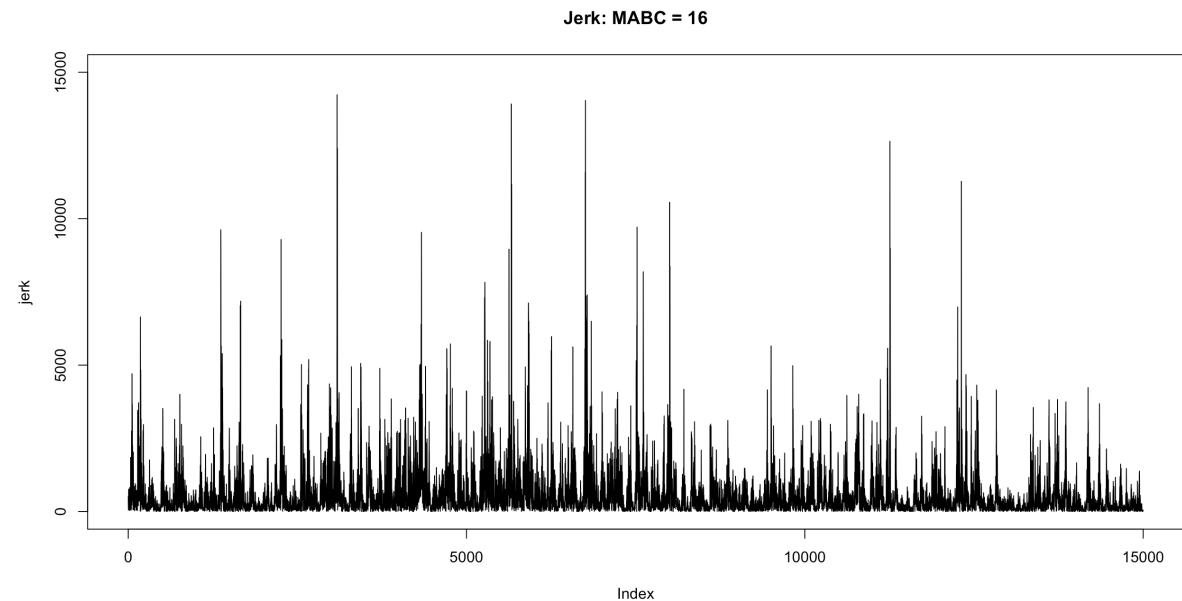
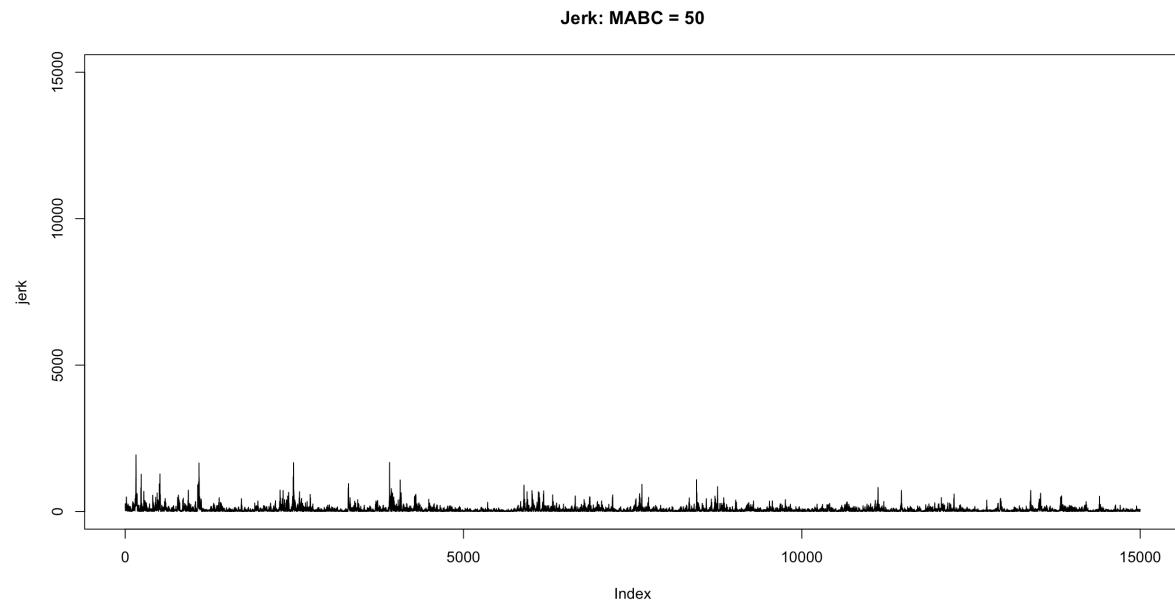
Data - Sensor

Name	Meaning
Ax_f	Filtered acceleration in X
Ay_f	Filtered acceleration in Y
Az_f	Filtered acceleration in Z
Acc	Total acceleration
Jerk	Derivative of acceleration
Cos_theta	Indicates difference between location of participant and correct location Number between 0 and 1: the higher the better

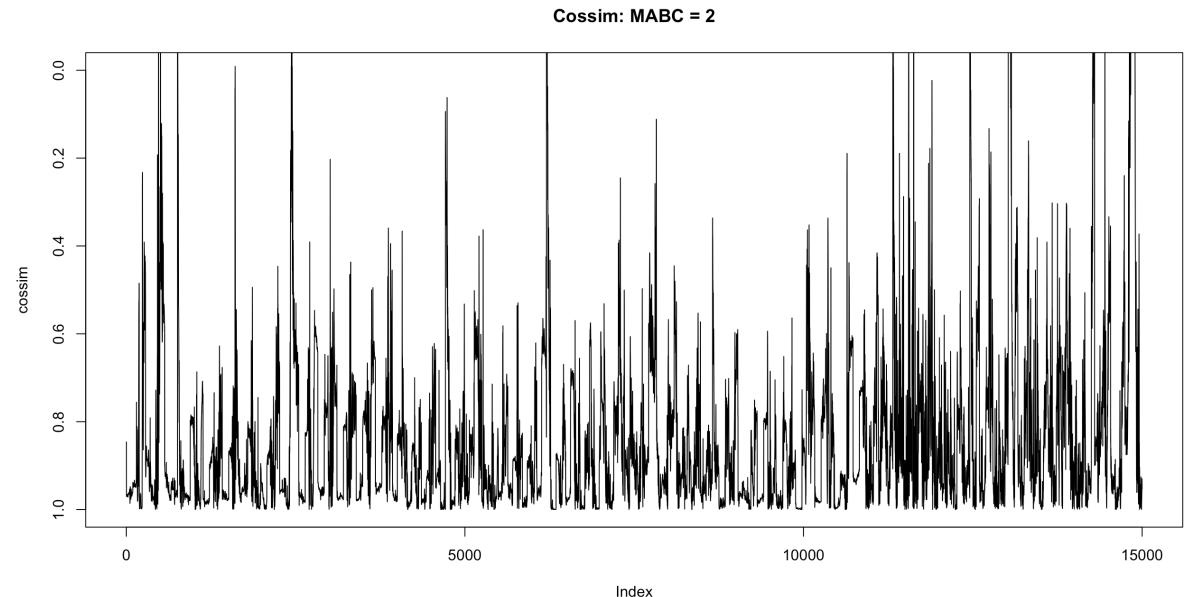
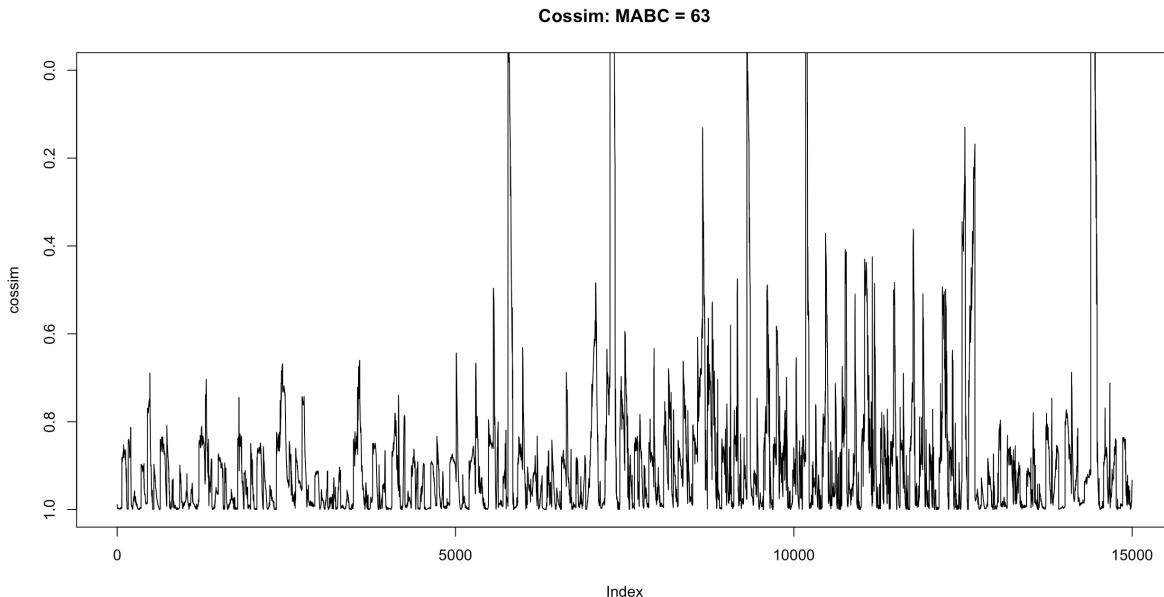
Differences in jerk



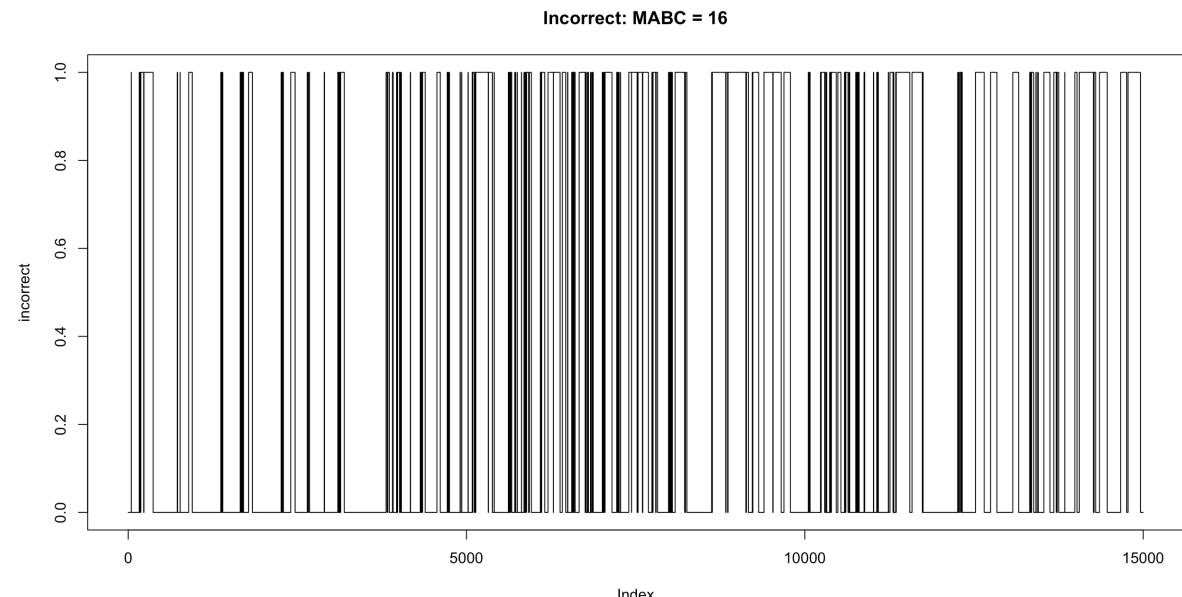
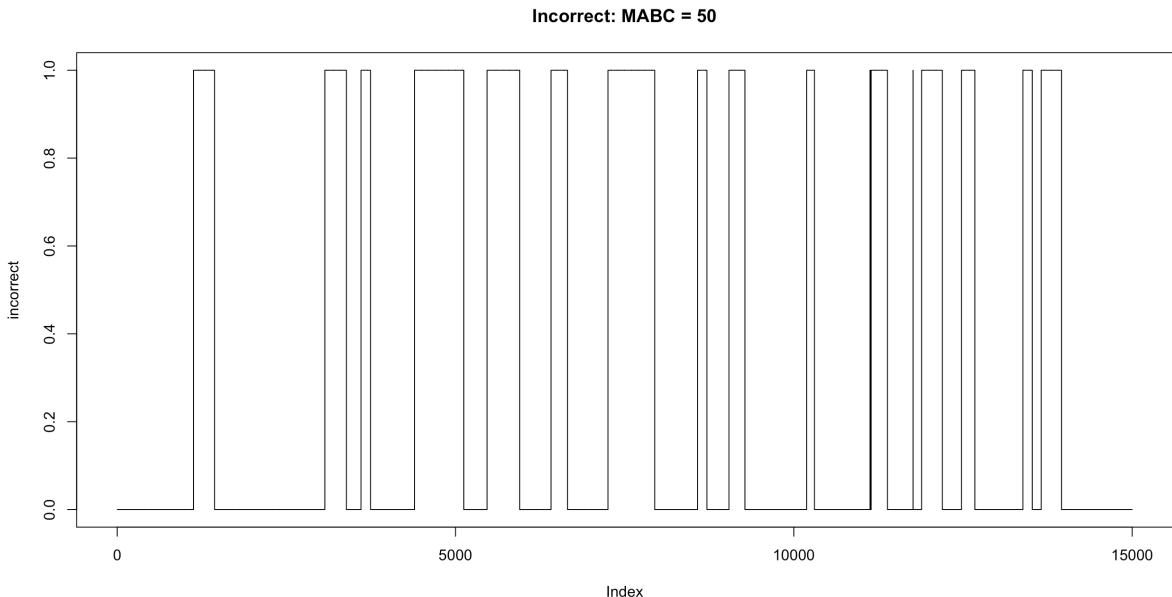
Differences in jerk



Differences in cosime similarity



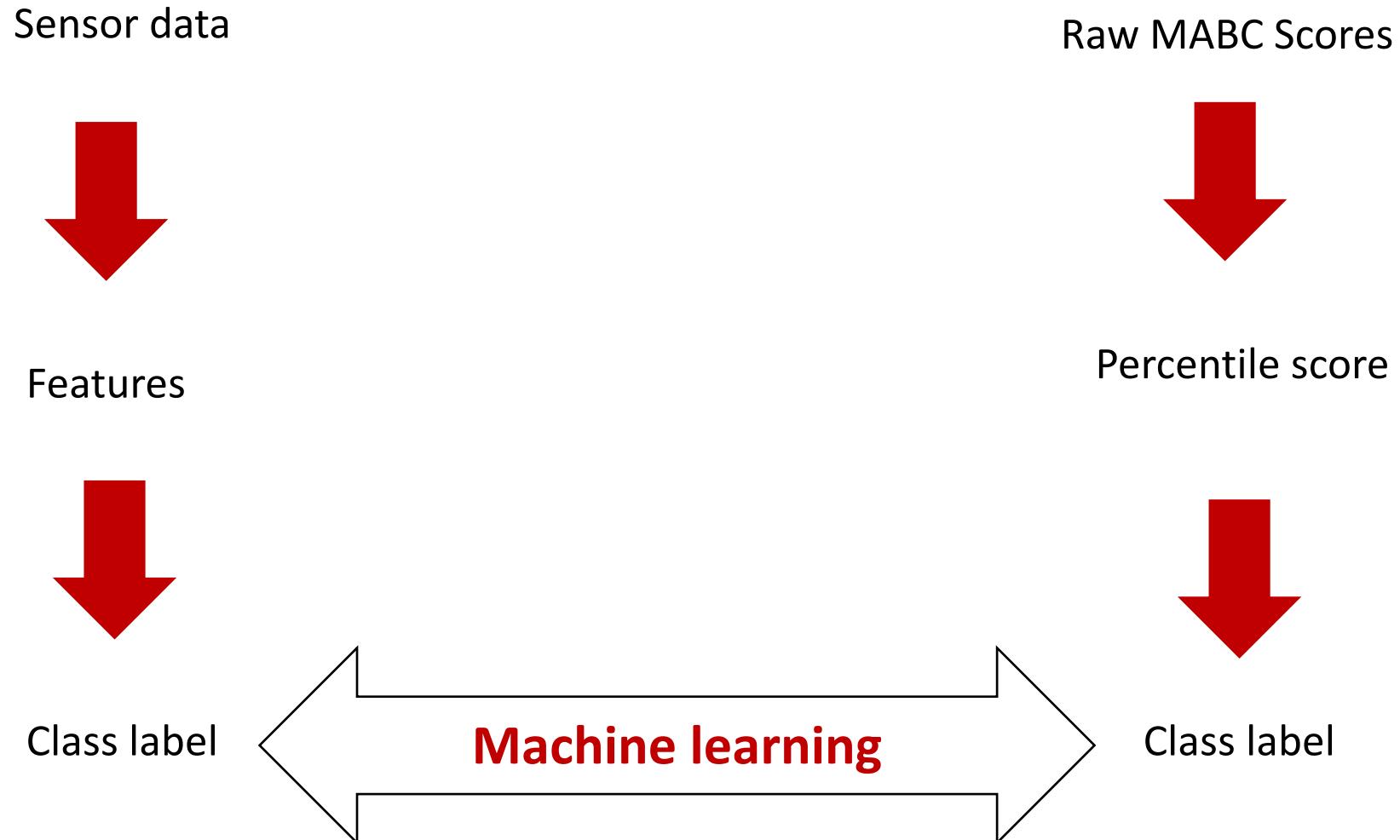
Differences in maze game



Tips and tricks

- **Keep goal in mind: Try to predict the correct class label (motor skill problems or not)**
- Data is already filtered
- Might be easier to start with **a** than with ax, ay, and az.
- Could be useful to visualize (part of) the data to get insight in it
- Selecting the best features may have more influence on the final predicting accuracy than selecting the best machine learning technique
- Exclude warm-up data to remove unreliable data

Detect motor skill problems



Getting the data

- Sign non disclosure agreement (NDA)
- Write down your email address on NDA
- I will send you the data together with these slides via SURFfilesender (email) before your next project meeting on Thursday

Contact

In case you have a question, don't hesitate to contact me.

a.e.brons@hva.nl

"Vragenuurtje"

15/1 11:00-12:00

24/1 11:00-12:00