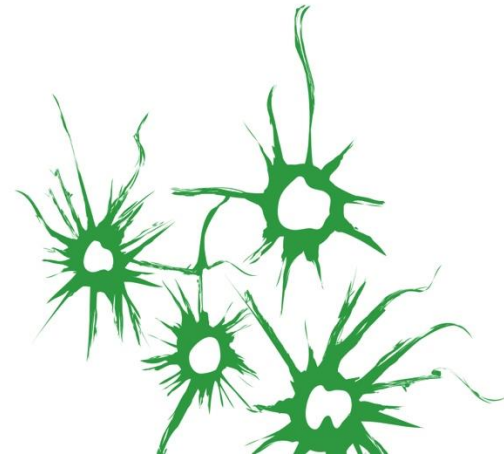
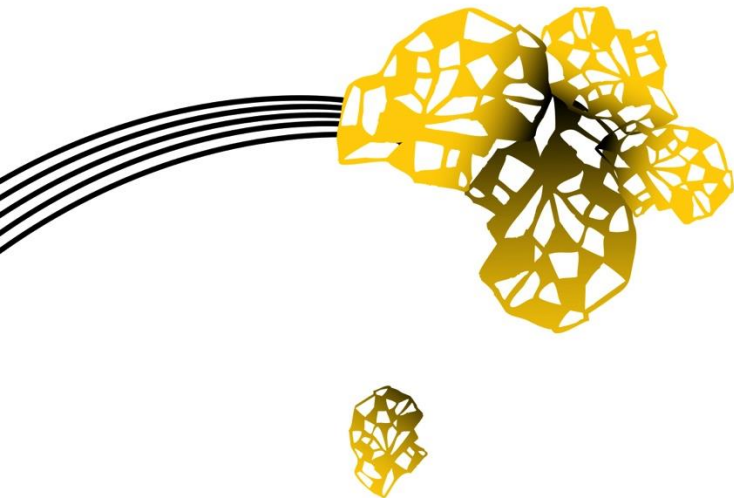


# DATA VIEWS

JOOST N. KOK

ELECTRICAL ENGINEERING, MATHEMATICS AND COMPUTER SCIENCE



# DATA SCIENCE & AI

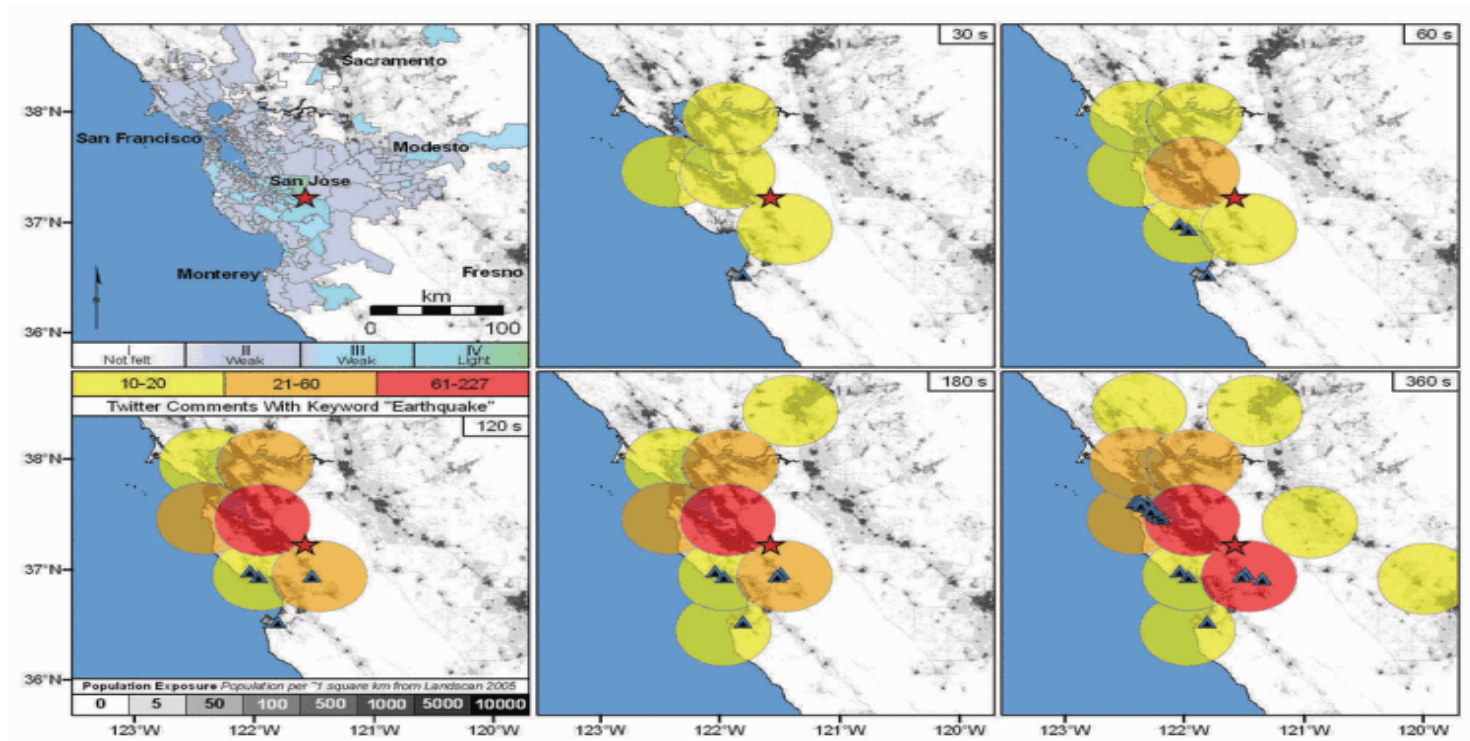
## THE COMPUTATIONAL TURN

---

Correlations follow directly from the data

- Availability of large quantities of data
- Large progress in methods
- Excellent computational infrastructure

Reason about the correlations to find the causal structures



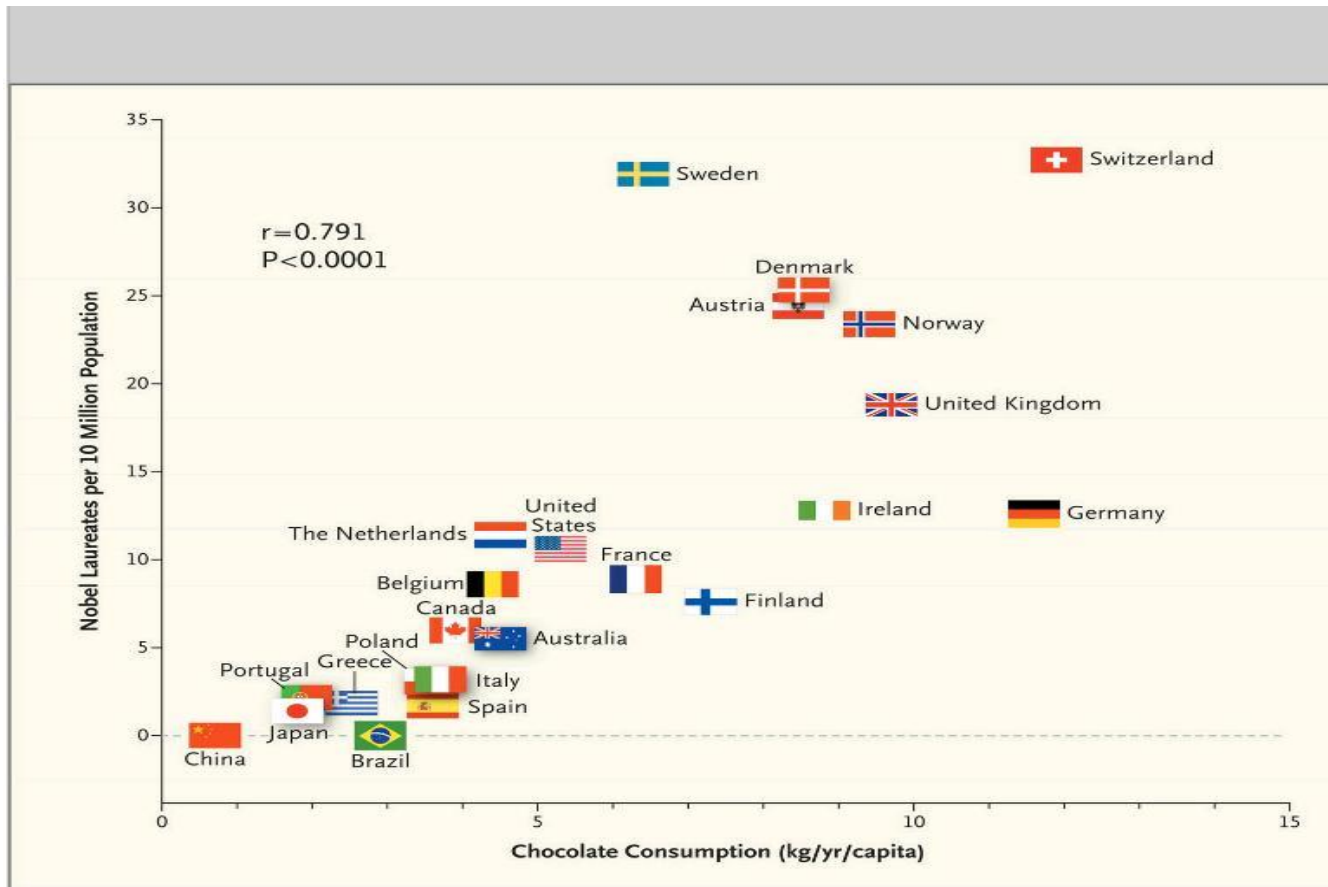
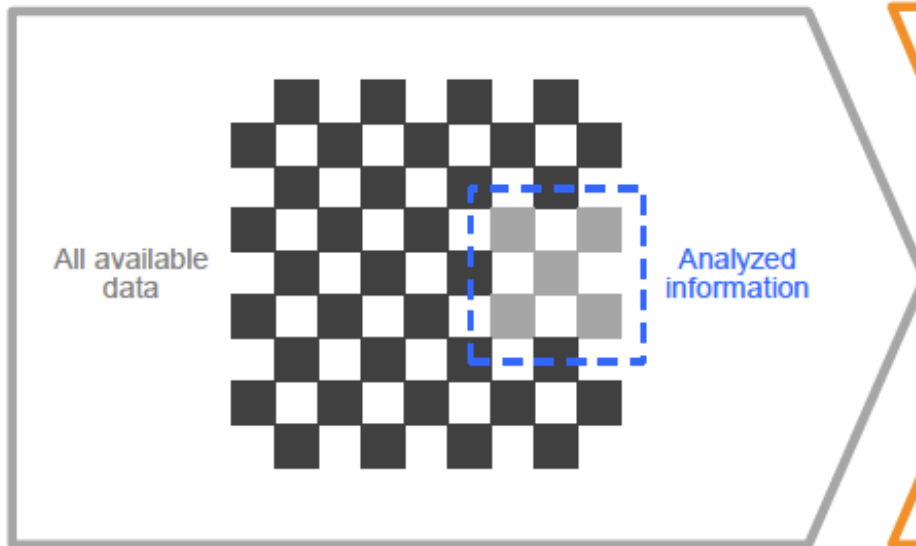


Figure 1. Correlation between Countries' Annual Per Capita Chocolate Consumption and the Number of Nobel Laureates per 10 Million Population.

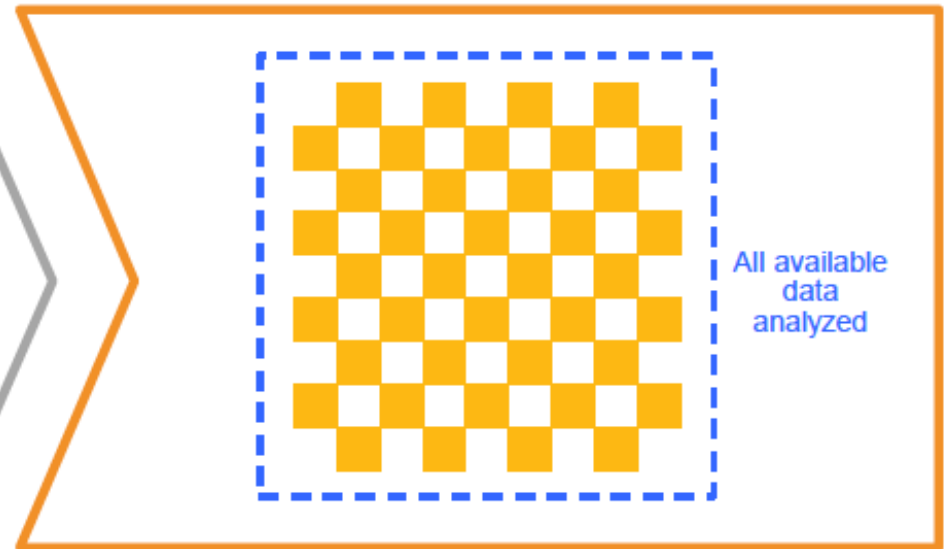
New England Journal of Medicine (Messerli, 2012)

## TRADITIONAL APPROACH



Analyze small subsets  
of data

## BIG DATA APPROACH



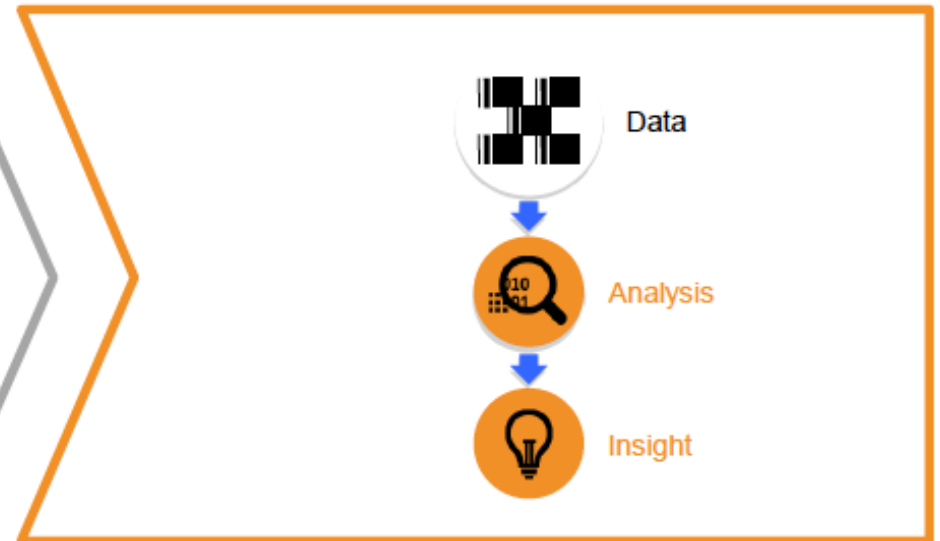
Analyze  
"all" data

## TRADITIONAL APPROACH



Analyze data *after* it's been processed and landed in a data warehouse or data mart

## BIG DATA APPROACH



Analyze data *in motion* as it's generated, in real-time

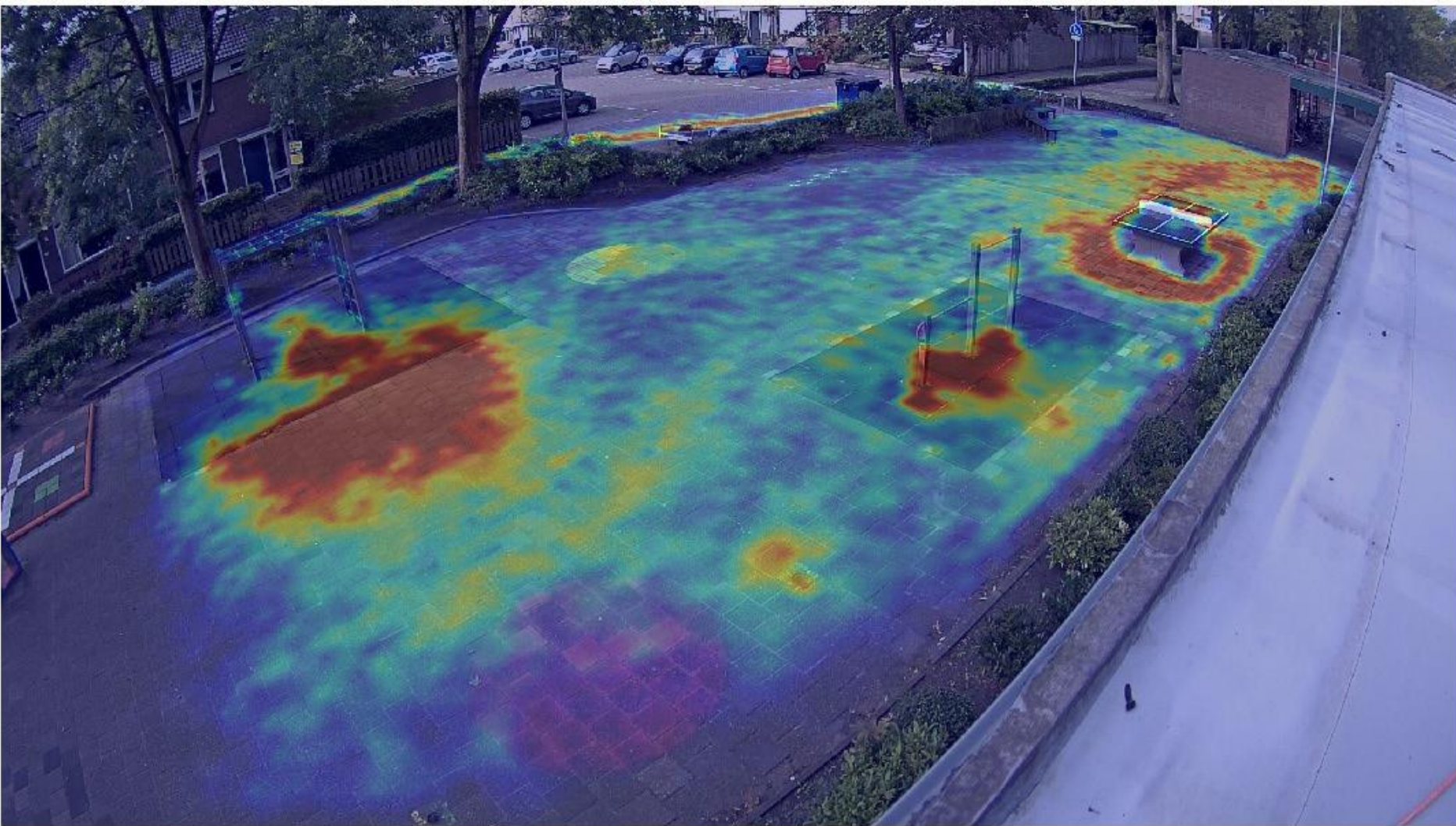


# Using sensors to measure playground dynamics

18 January 2016

How do playground interactions contribute to children's social competence? Developmental psychologists Carolien Rieffe (Leiden University) and Guida Veiga (University of Évora, Portugal) joined forces with the Leiden Institute of Advanced Computer Science to investigate this. A paper on their study is currently in press.





[publications.tno.nl/publication/34616450/tHet1v/vlasblom-2014-intelligente.pdf](https://publications.tno.nl/publication/34616450/tHet1v/vlasblom-2014-intelligente.pdf)





# Data analysis is really helping the Dutch national women's football team

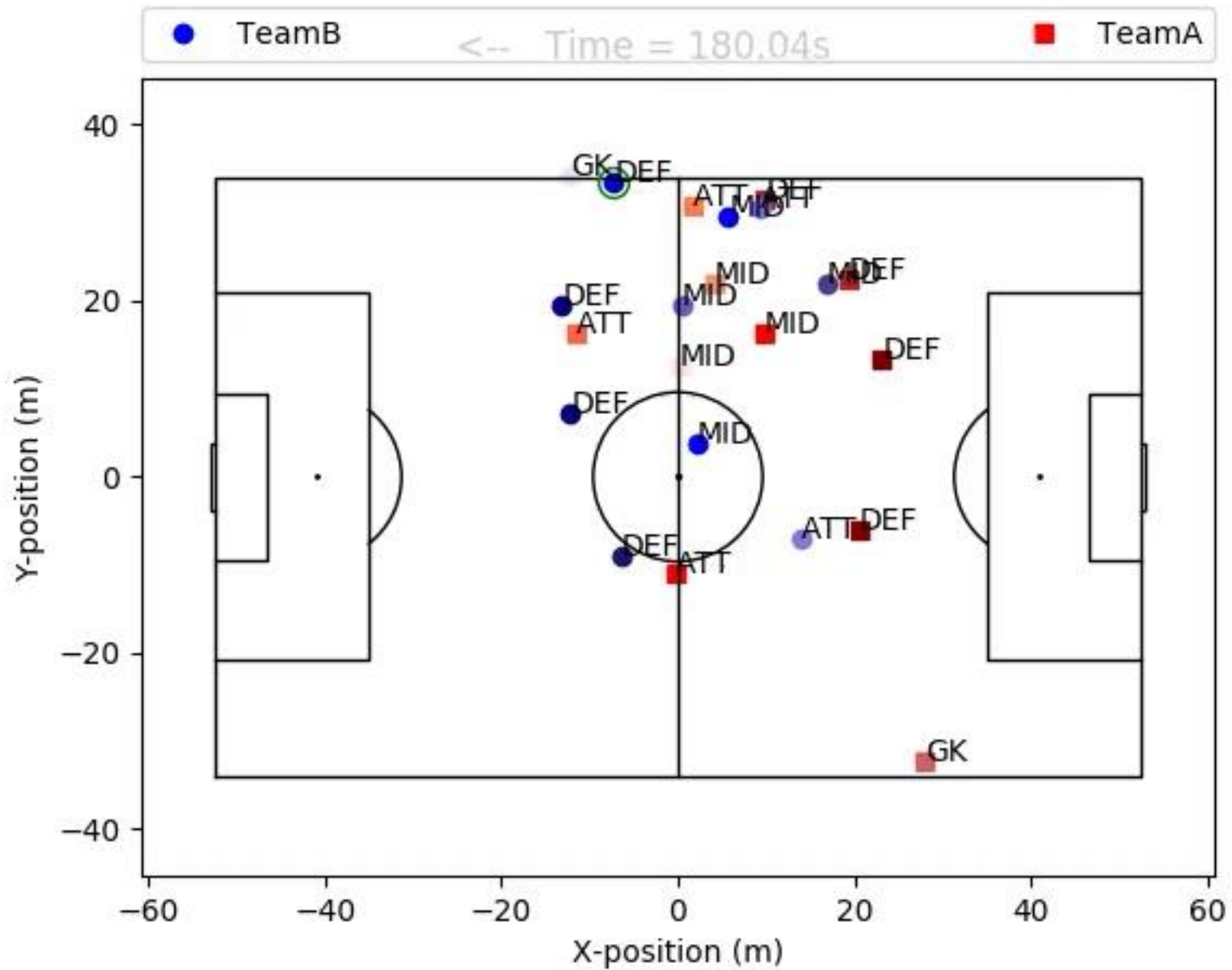
10 July 2017

The European Football Championship for Women, in the Netherlands this summer, is the background for a large and innovative data research project. The Dutch football union is working together with Leiden University and Sportinnovator. The research is expected to uncover links that have thus far remained hidden.

## Optimise the game

To be able to perform optimally in top sport calls for optimal conditions. In the past, good shoes and a decent ball were enough, but today help comes from super computers. Scientists at Leiden University's Sport Data Center know how to use the data to optimise the game. A large data study is expected to give new insights.





## Main elements

### 1 Camera installation

- 14 camera's with pitch view
- Recording, encoding and storing video
- Connected and powered over ethernet

### 2 Network installation

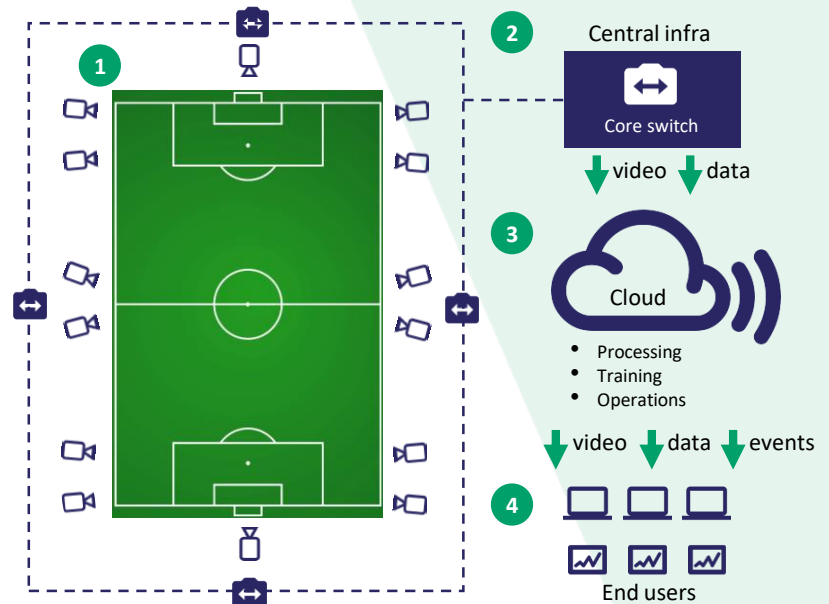
- 4 edge switches that merge 1 to 6 video data streams
- 1 core server that connects internal network to external network and cloud

### 3 BallJames platform

- Processing cloud with GPU's and CPU's to detect and track players and ball
- Training cloud to incrementally retrain our deep-learning models
- Operations cloud where internal administration, scheduling and maintenance is run

### 4 End user front-end

- API for direct access to Live Stream data
- Portal for after-match downloads, insights and much more



# WOMEN'S EURO 2017

## SHOWCASE FOR SPORT DATA VALLEY

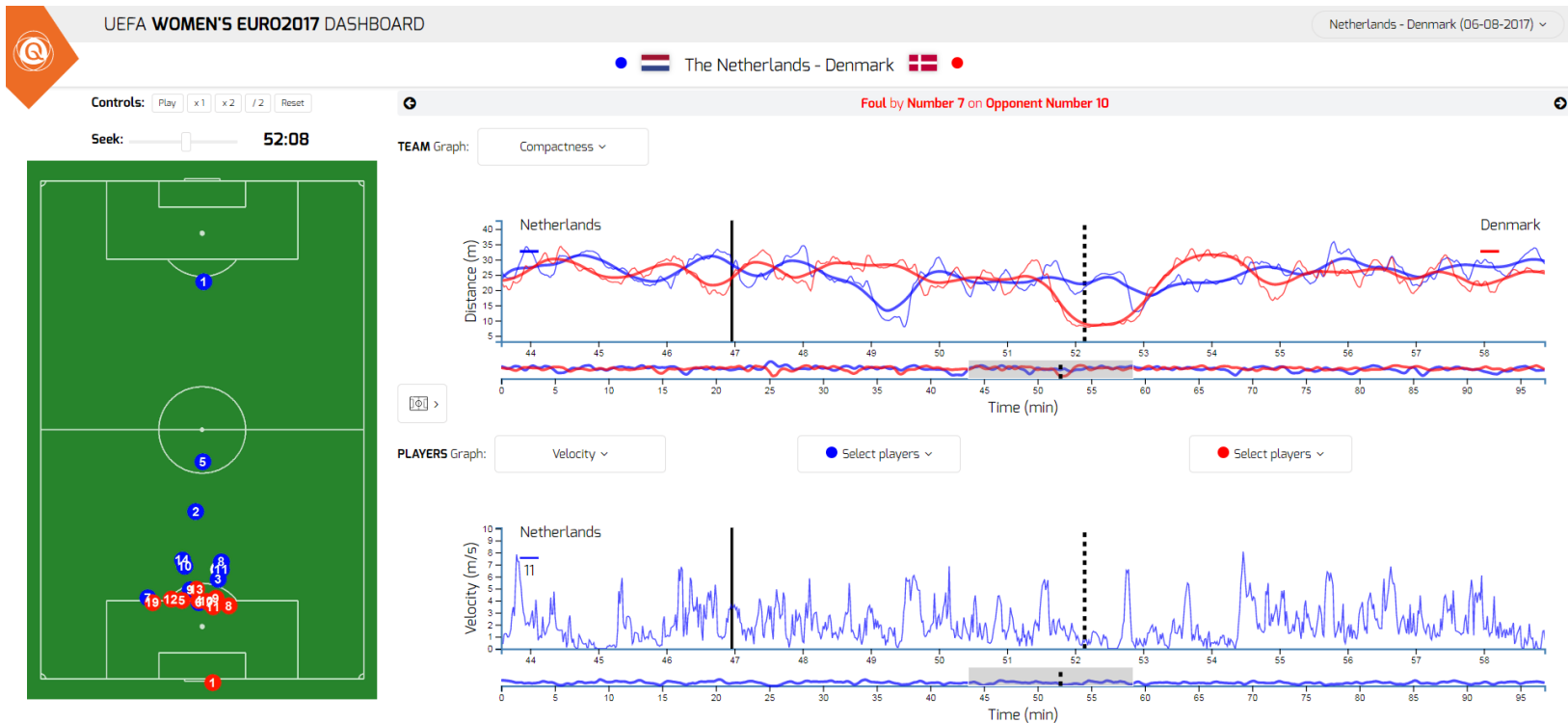
- Cooperation between KNVB, Sportinnovator & Sport Data Center.
- Use WEURO to collect data and add value to the data
- Knowledge institutions & Companies
- Data available in the Sport Data Valley



# PERFORMANCE ANALYSIS DASHBOARD

[HTTPS://FFBPAD.APPSPOT.COM/](https://ffbpad.appspot.com/)

[HTTPS://TINYURL.COM/SOCCERLAB](https://tinyurl.com/soccerlab)

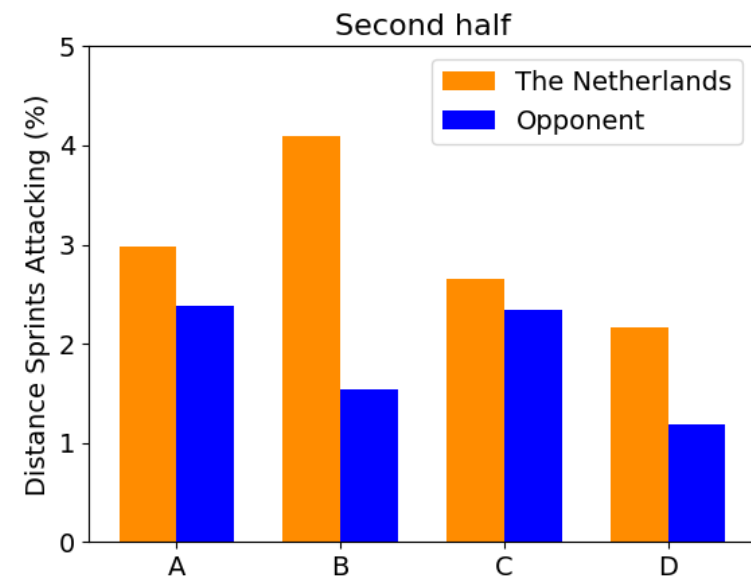
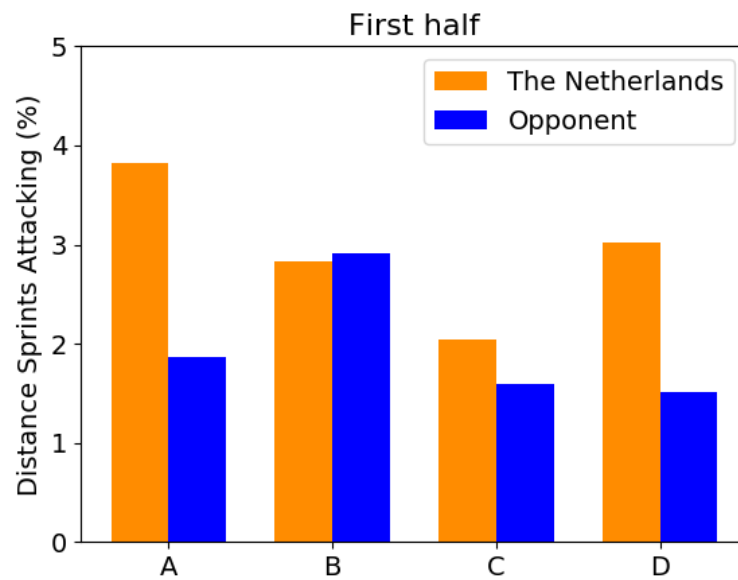


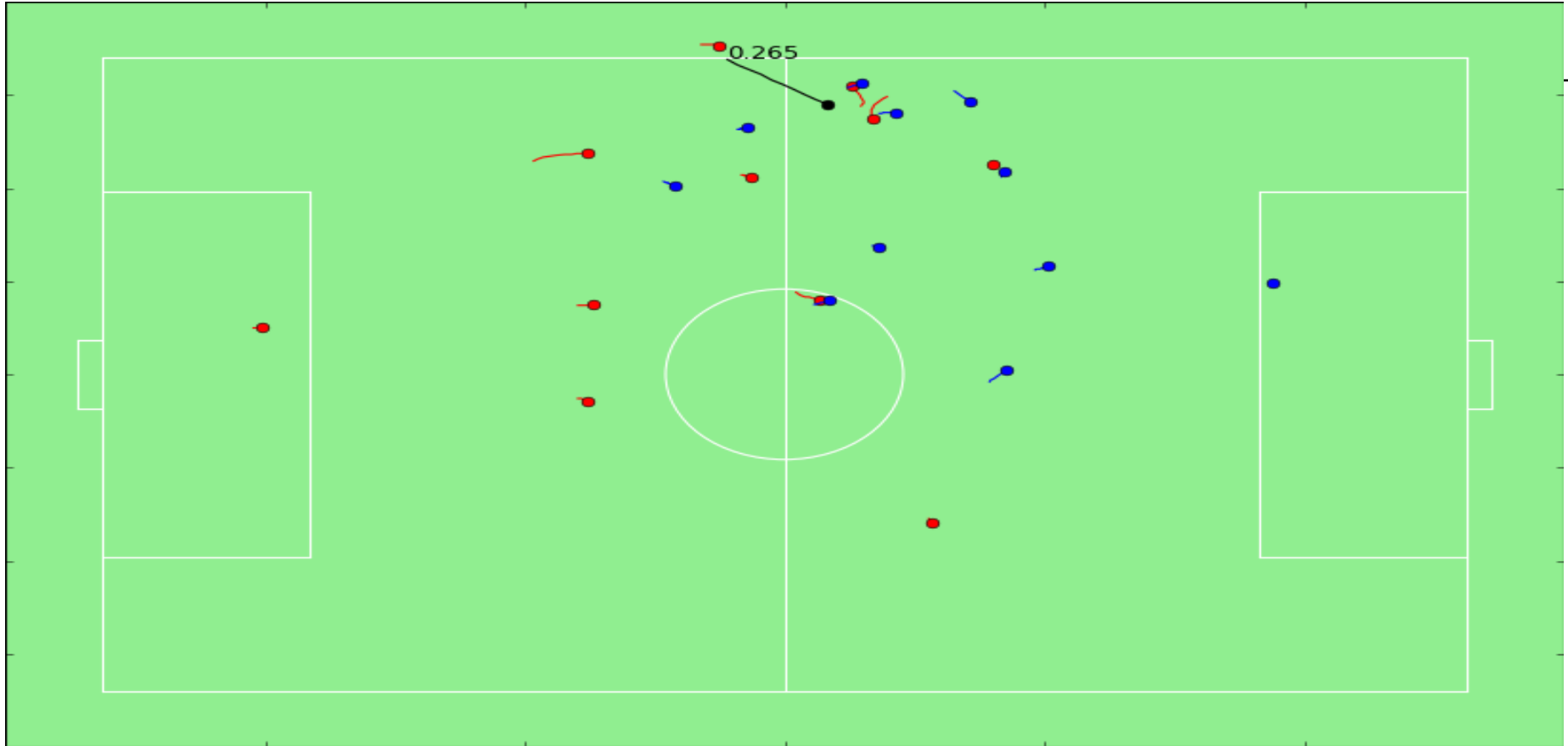


# SPRINTS



ATTACKING: DISTANCE > 24 KM/H





# EVENT PREDICTION

IN-GAME, NEAR REAL-TIME

## In-game event prediction

**Minutes**

5 90

**X**

Minutes

**Y**

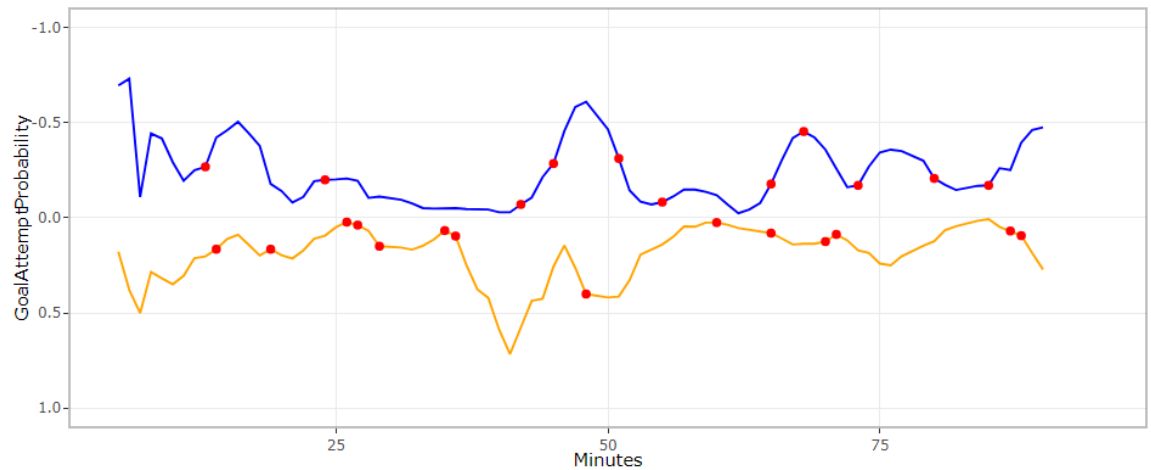
GoalAttemptProbability

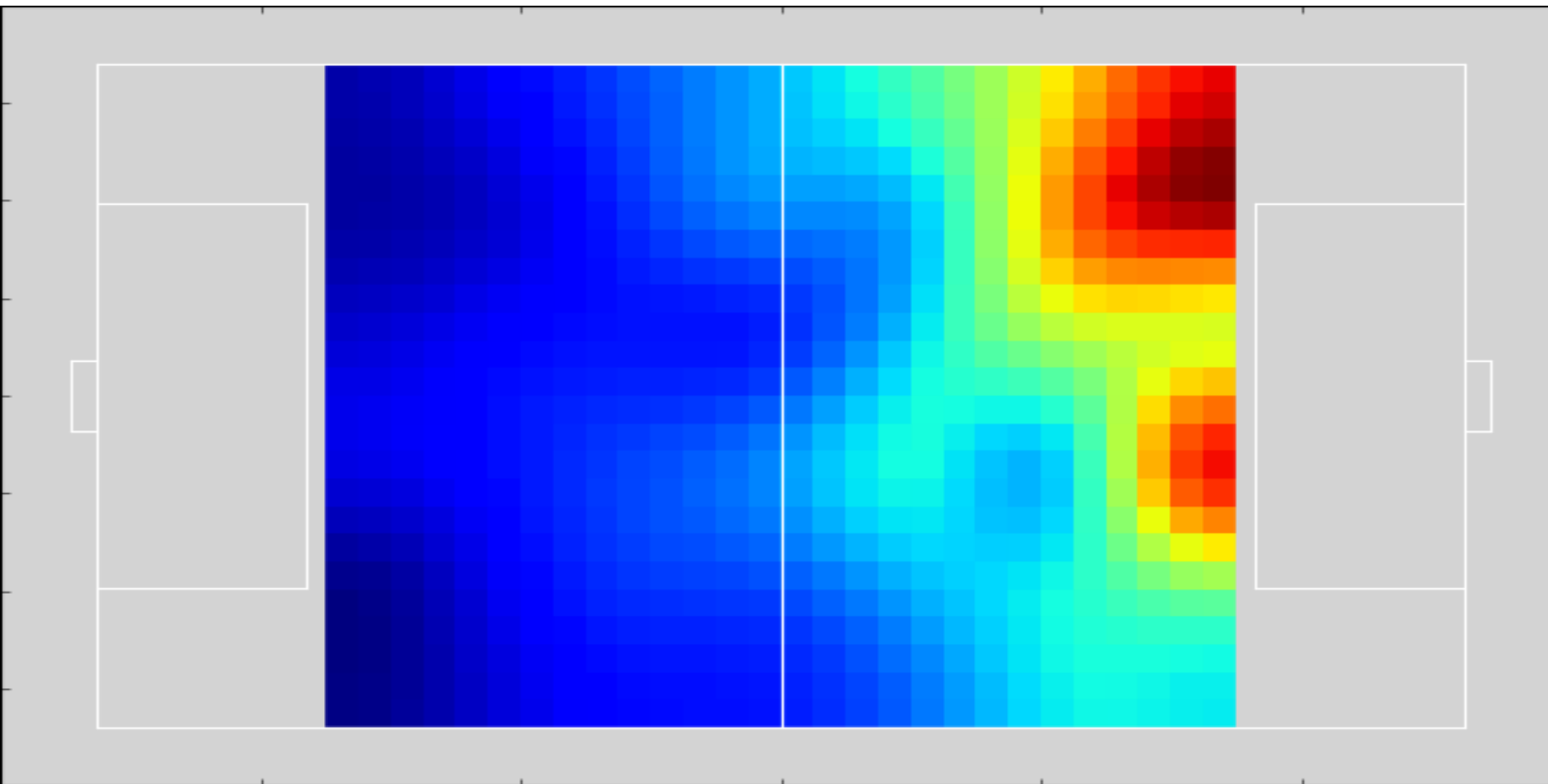
**Event**

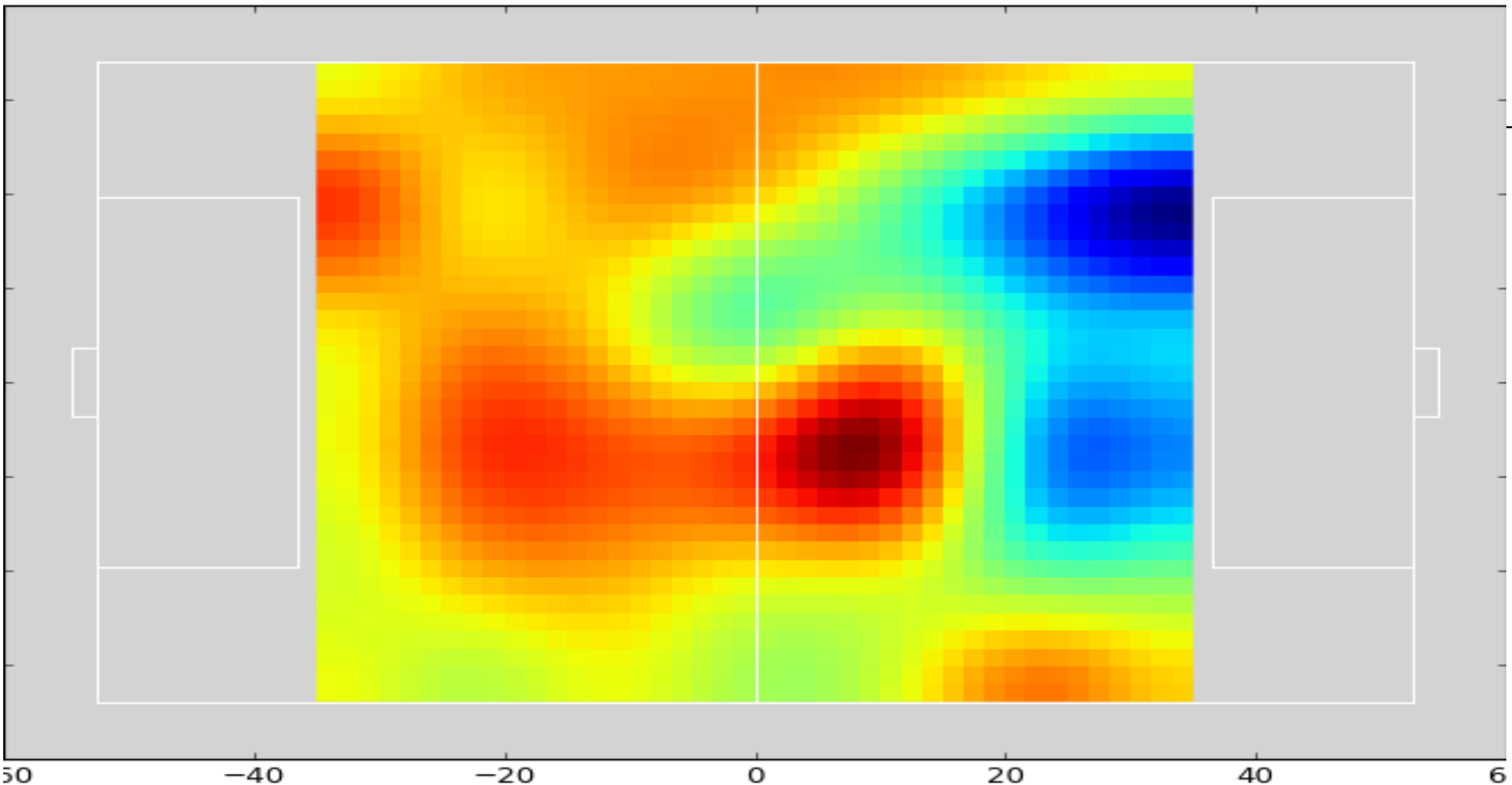
GoalAttempt

**Game**

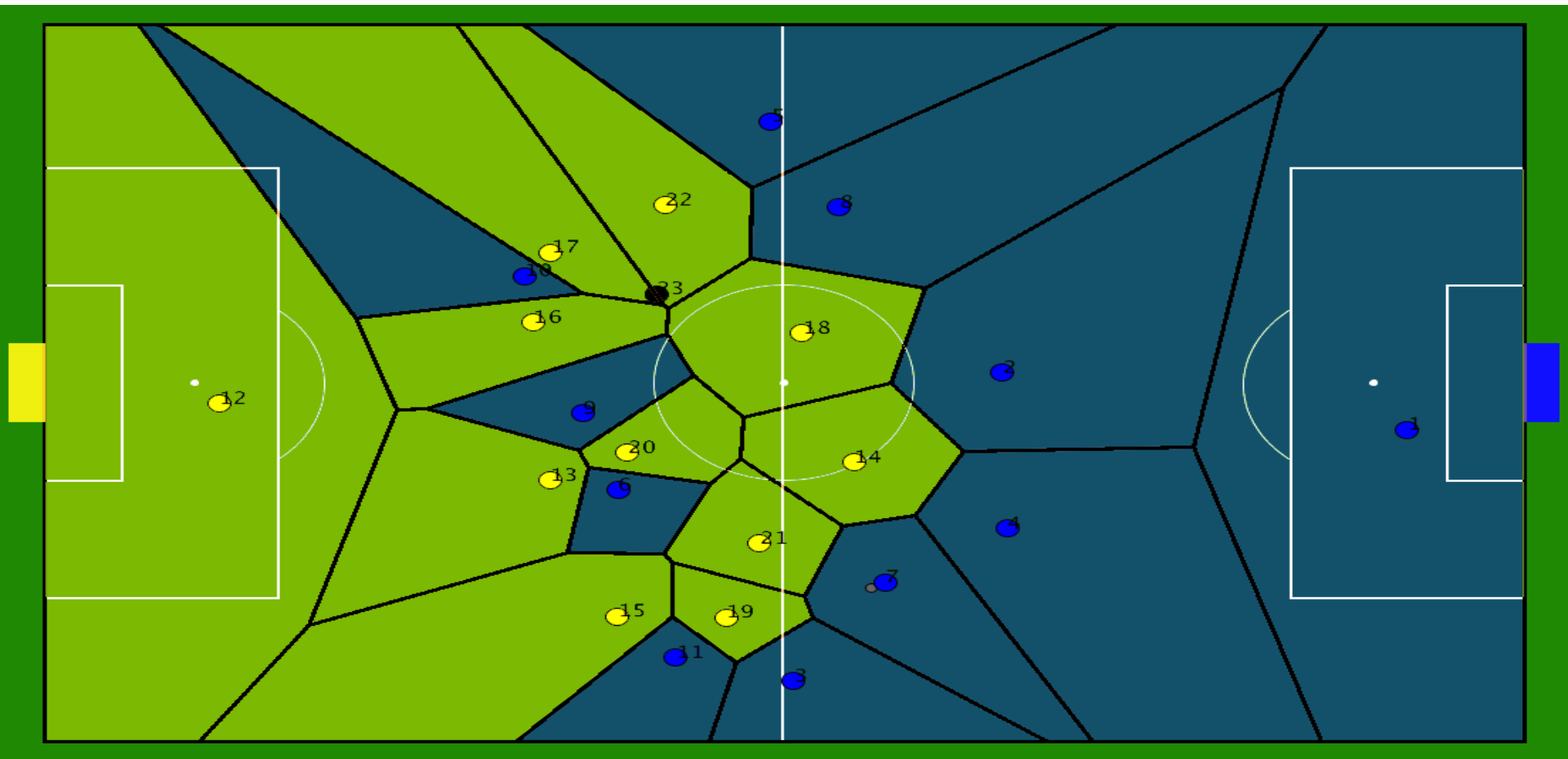
Austria V Switzerland

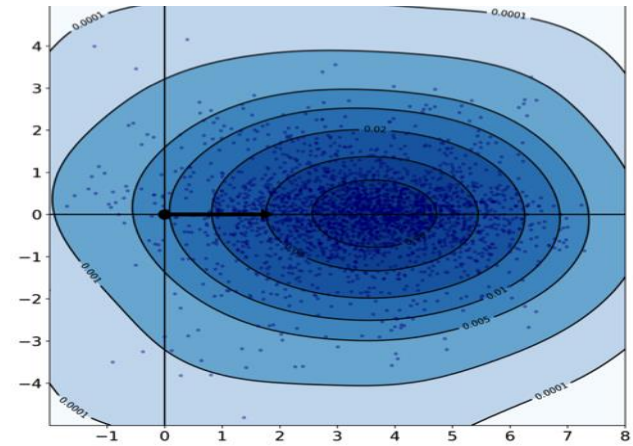
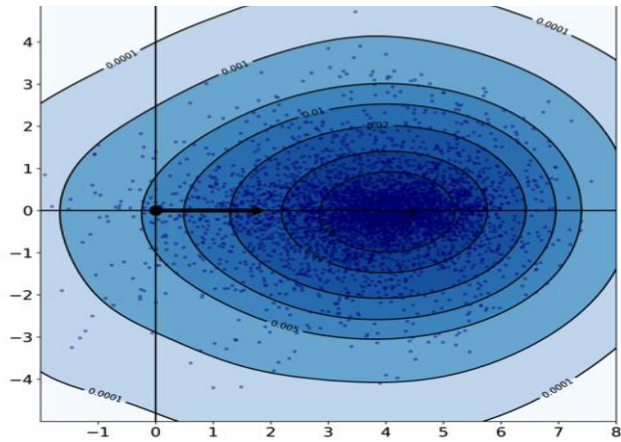


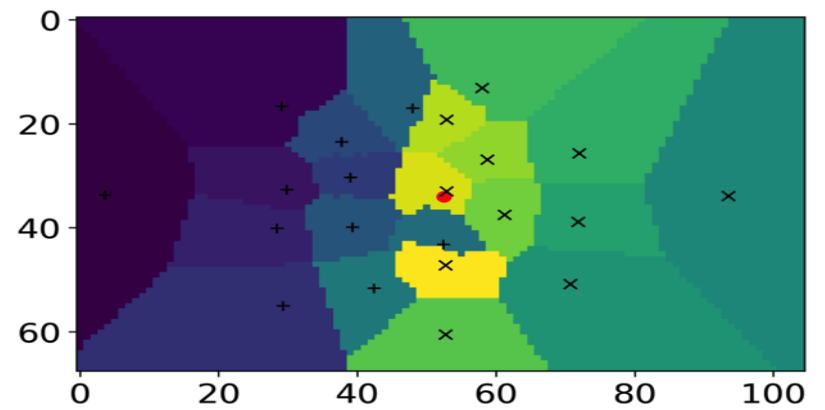
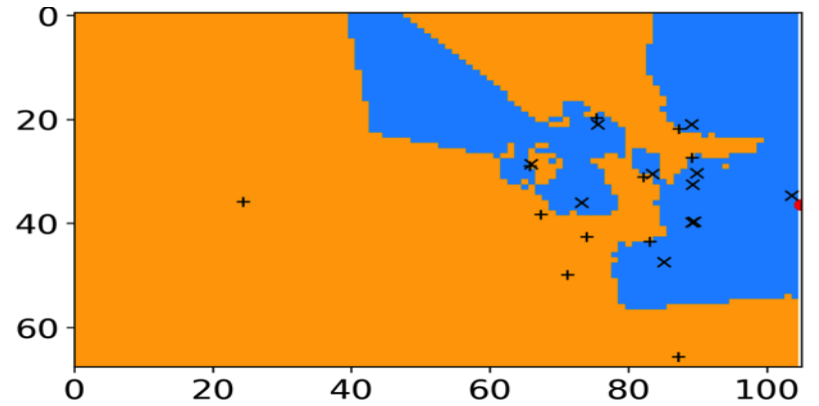
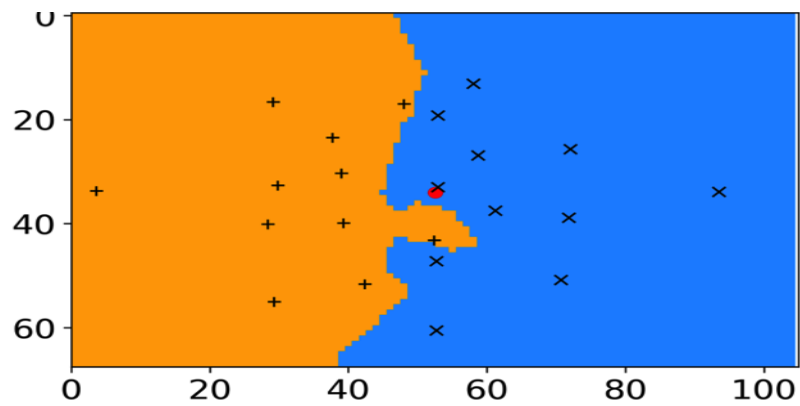














*Kids First*



**FootballEquals  
Foundation**  
WE **SCORE** GLOBAL GOALS

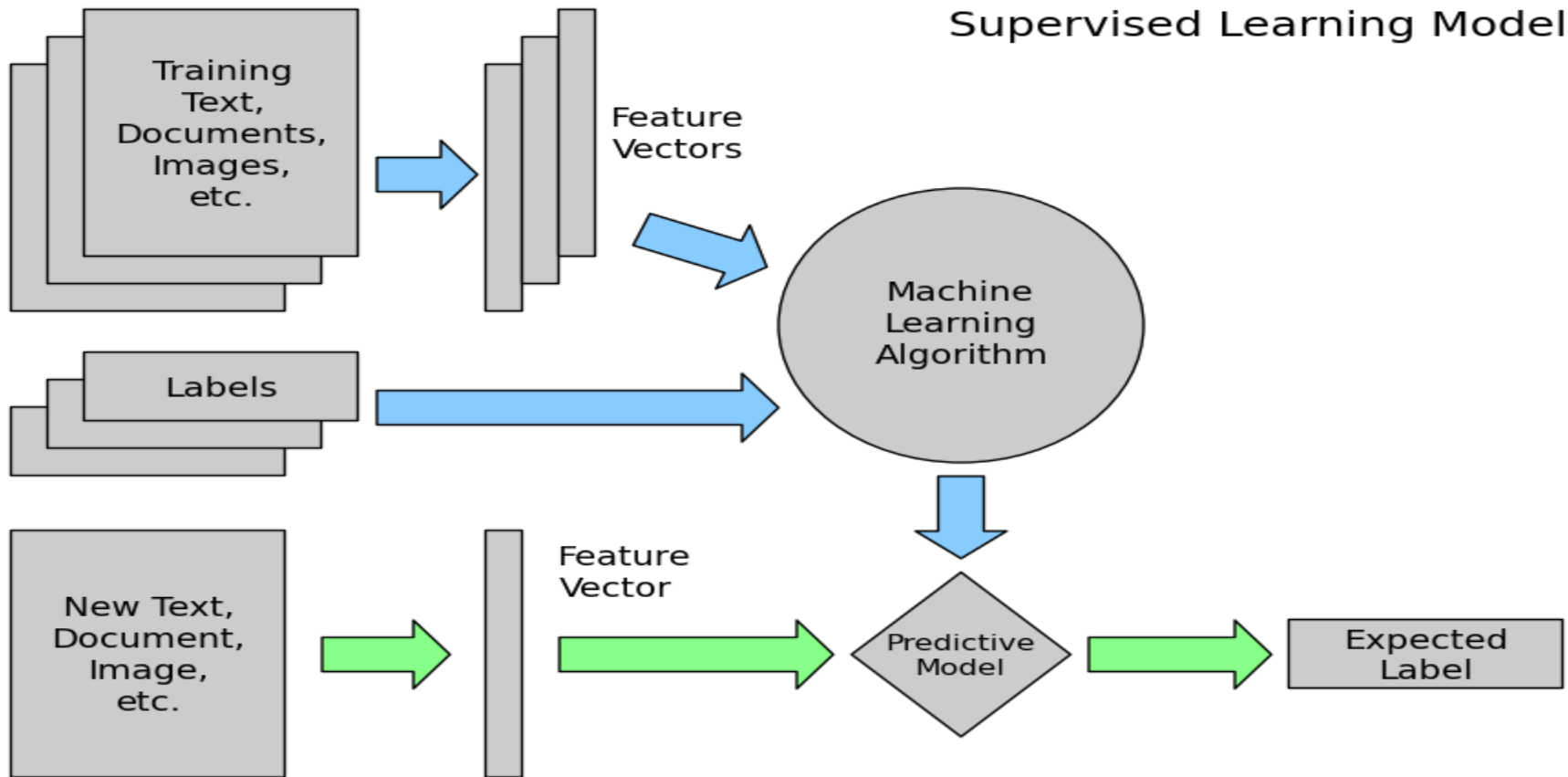
UNIVERSITY OF TWENTE.



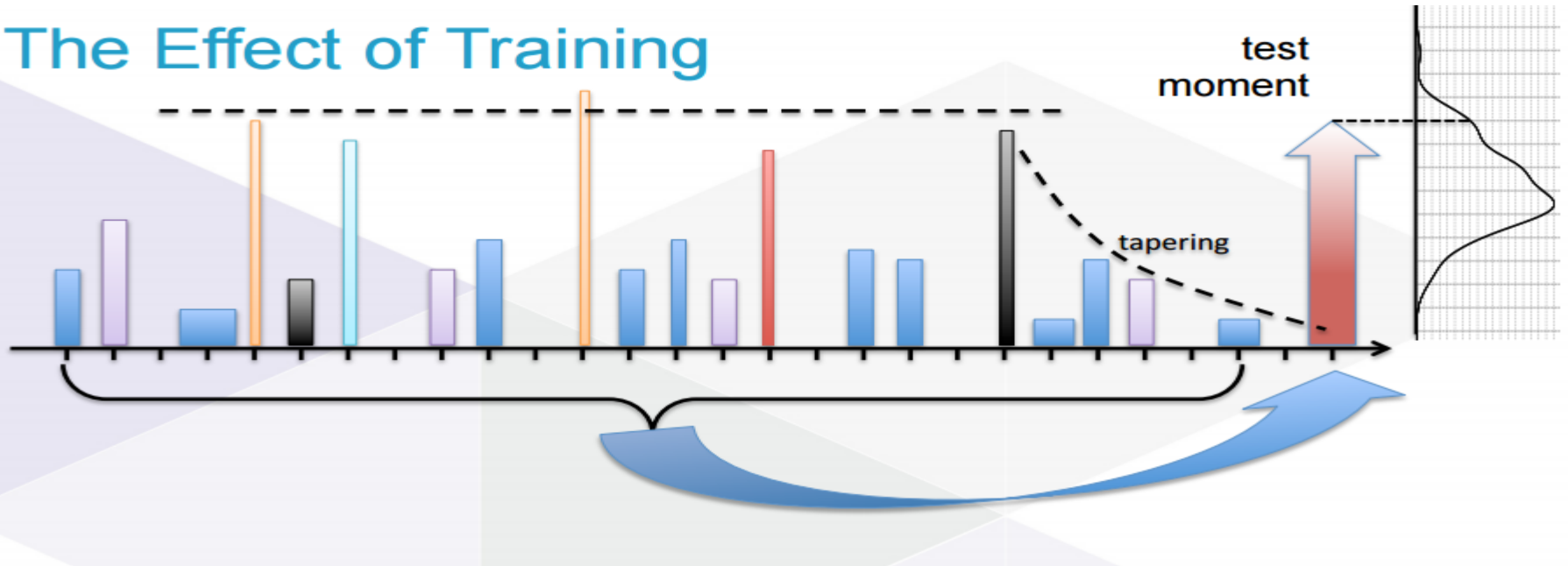


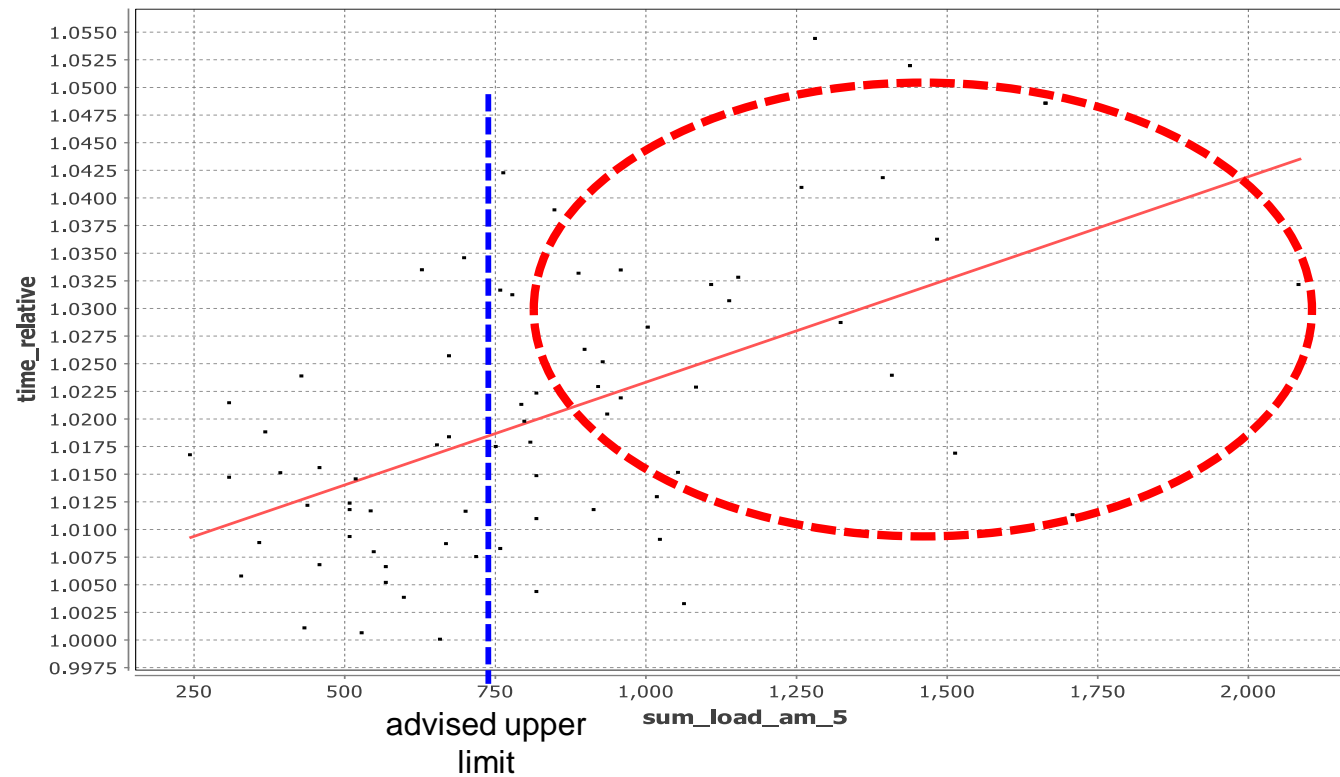


## Supervised Learning Model

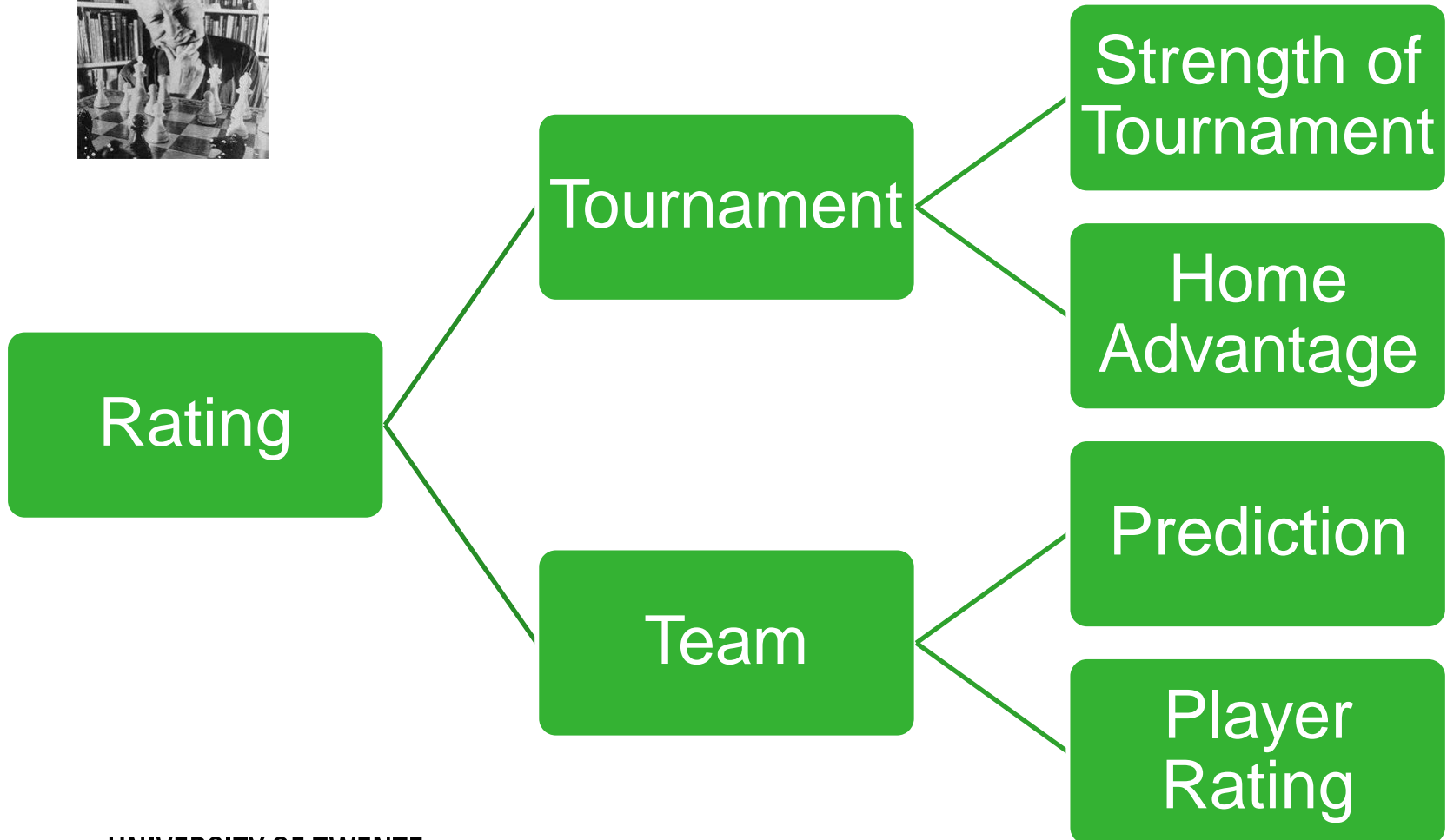


# The Effect of Training





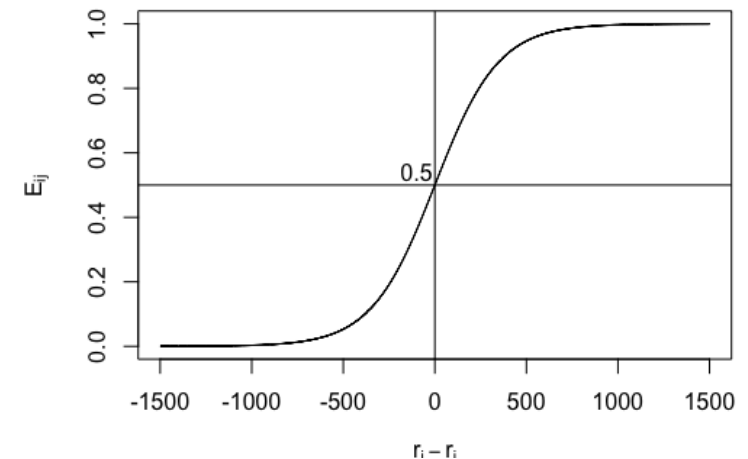






$$r_i^{\text{new}} = r_i^{\text{old}} + K (S_{ij} - E_{ij})$$

$$S_{ij} = \begin{cases} 1 & \text{if } i \text{ wins over } j, \\ 1/2 & \text{if } i \text{ and } j \text{ draw a tie,} \\ 0 & \text{if } i \text{ loses to } j. \end{cases}$$



$$PSE(i, j) = \sum_{m=1}^M (S_{ijm} - E_{ijm})^2 + (S_{jim} - E_{jim})^2$$

$$E_h = \frac{1}{1 + 10^{-(h + r_h - r_a)/400}}$$



John

Delete



From

0



to

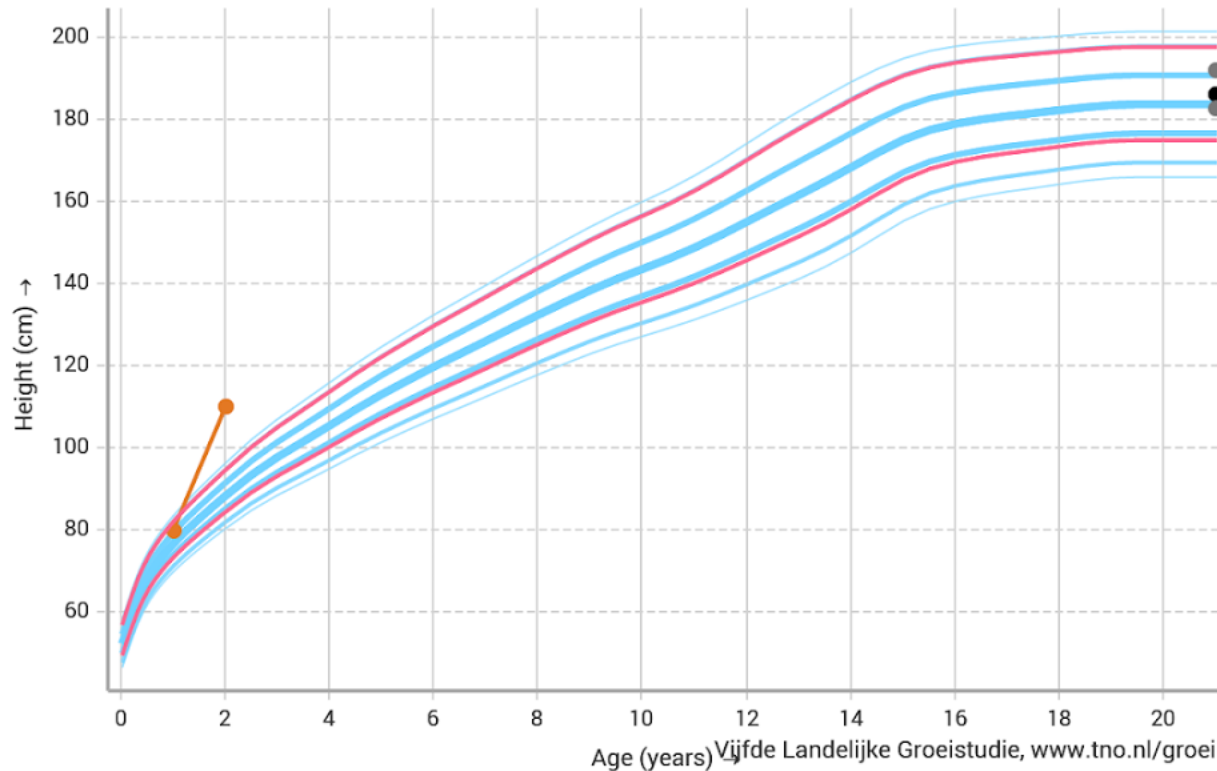
21



years

Recommended area

Choose...



## Record details



|                   |                             |
|-------------------|-----------------------------|
| Growth references | Netherlands                 |
| Gender            | Boy                         |
| Date of birth     | 9-17-2013                   |
| Gestational age   | 40 wks 2 days               |
| Height of father  | 183 cm (-0.14 SDS, P44.6)   |
| Height of mother  | 178 cm (1.15 SDS, P87.4)    |
| Target height     | 186.47 cm (0.37 SDS, P64.5) |

## Measurements



9-17-2015 (2.000 yrs)

110 cm / 23 kg / BMI: 19.0



9-17-2014 (1.000 yrs)

80 cm / 10 kg / BMI: 15.6



Choose discipline:

Horizontal Bar Men

Rating History

Rating by Date

Age

potential winners

athletes overview

Info

About

## Top Athletes Now

How many:

☐ None ☒ 3 ☐ 5 ☐ 10

## Top Athletes Ever

How many:

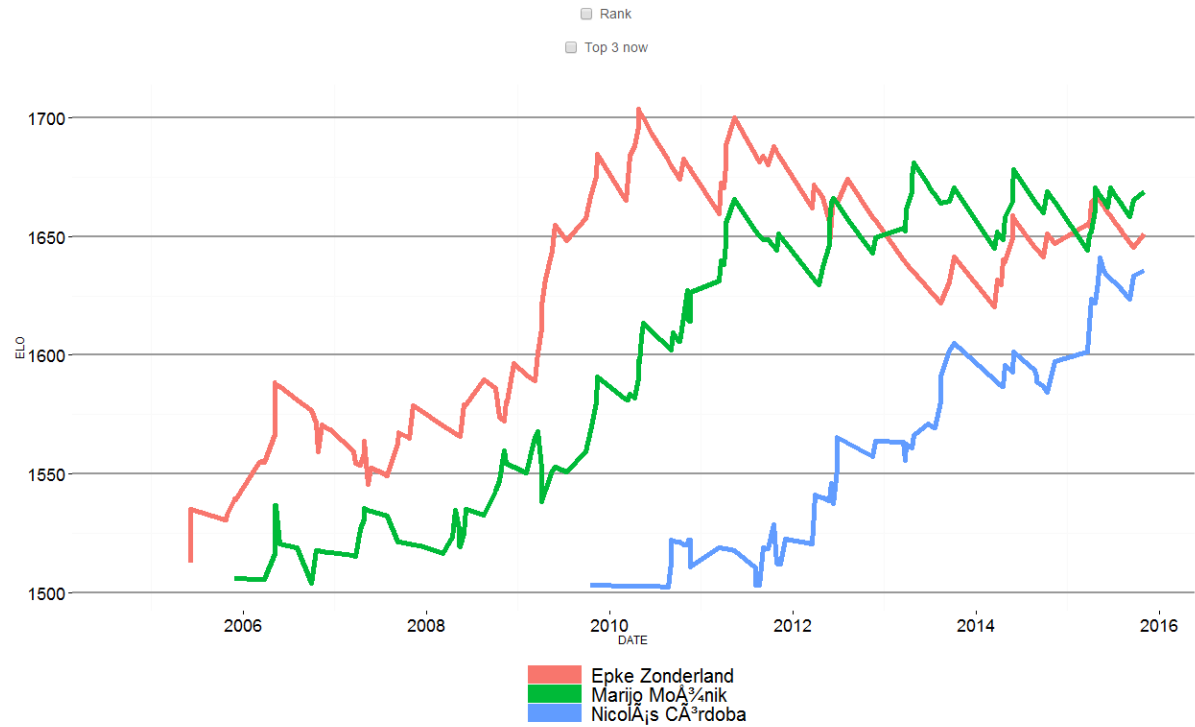
☒ None ☐ 3 ☐ 5 ☐ 10

## Other Athletes

Choose Athlete(s):

Please pick one or more athletes

Adam Rzepa  
Adam Wong  
Adan Santos  
Adelin Kotrong  
Adham Al-Sqour  
Adickson Trejo  
Aditya Rana





<https://www.sportinnovator.nl/sport-data-valley/>

UNIVERSITY OF TWENTE.



# Sport Data Valley

M E E R   D O E N   M E T   D A T A

**SPORTDATAVALLEY.NL**