Hogeschool van Amsterdam
Bewegen, Sport en Voeding

Universiteit Leiden

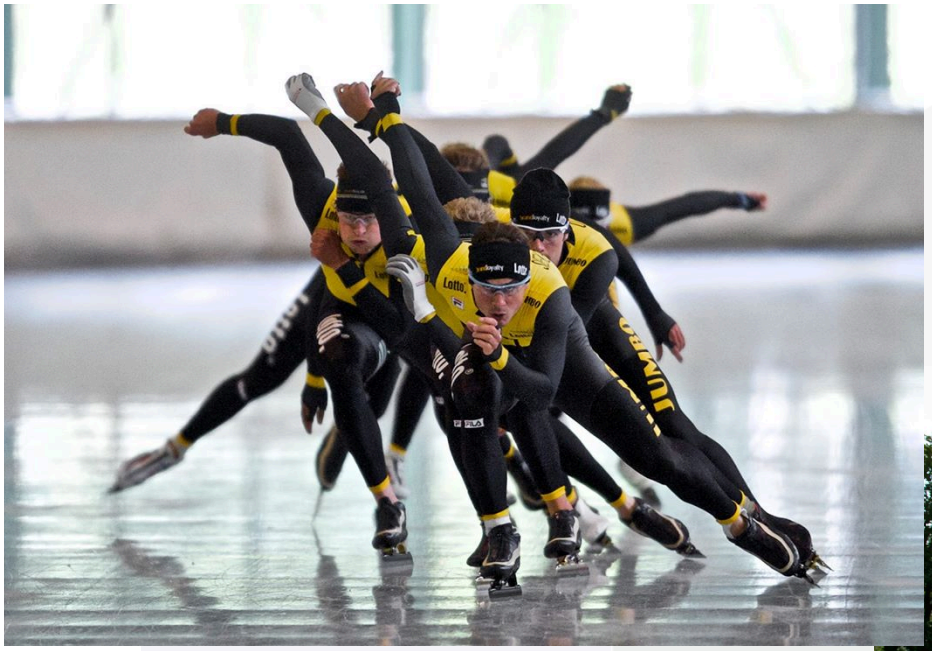
Monitoring and Analysing Professional Speed Skaters

COMMIT/
NWO

Hogeschool van Amsterdam
Bewegen, Sport en Voeding

Universiteit Leiden

LottoNL-Jumbo Speed Skating Team



Trainer: Jac Orie

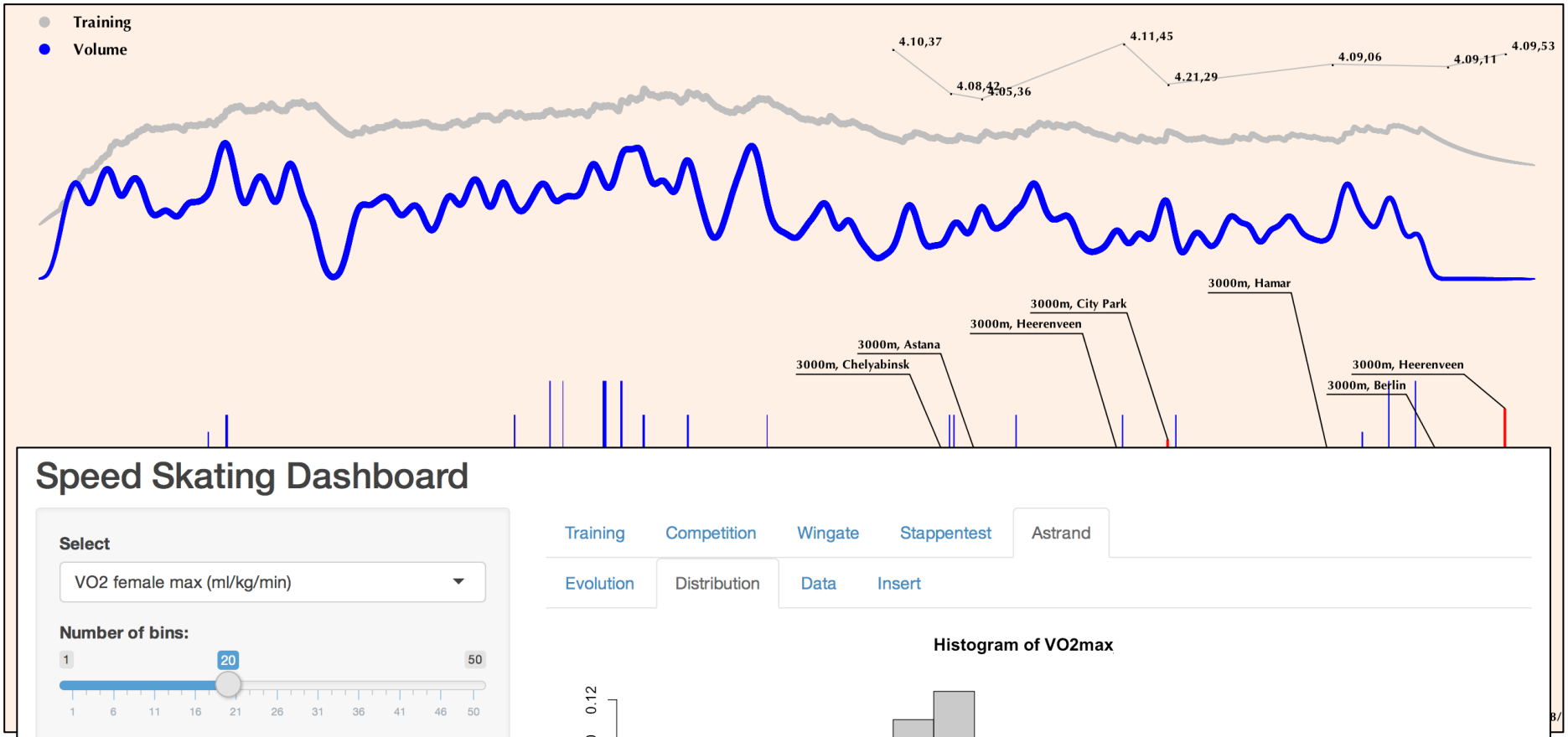
Skaters: Sven Kramer, Wouter Olde Heuvel, Kjeld Nuis, …

Historical Training Data

- 15 years of data collected
- Some 40 athletes, currently nine: seven men, two women
- Some 30 Olympic medals + numerous championships
- Daily training details
  - Morning and afternoon training
  - Six days per week
  - Training type, intensity (subjective), duration, load
- Roughly bi-weekly physical test, aerobic, anaerobic
- Competition data
  - Corrected for track-differences

Hogeschool van Amsterdam
Bewegen, Sport en Voeding

Universiteit Leiden



Speed Skating Dashboard

Select

VO2 female max (ml/kg/min)

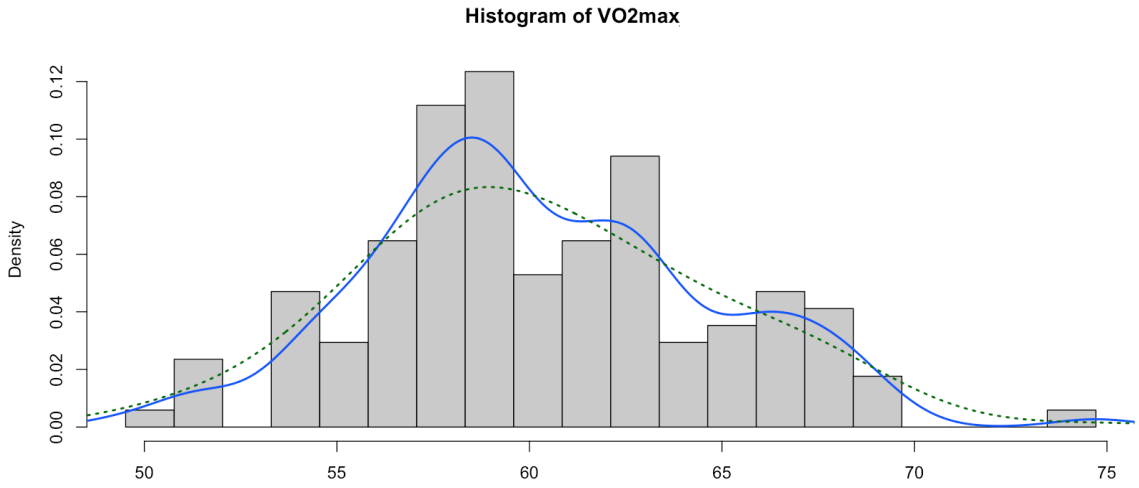
Number of bins:

1 20 50

1 6 11 16 21 26 31 36 41 46 50

Training | Competition | Wingate | Stappentest | Astrand

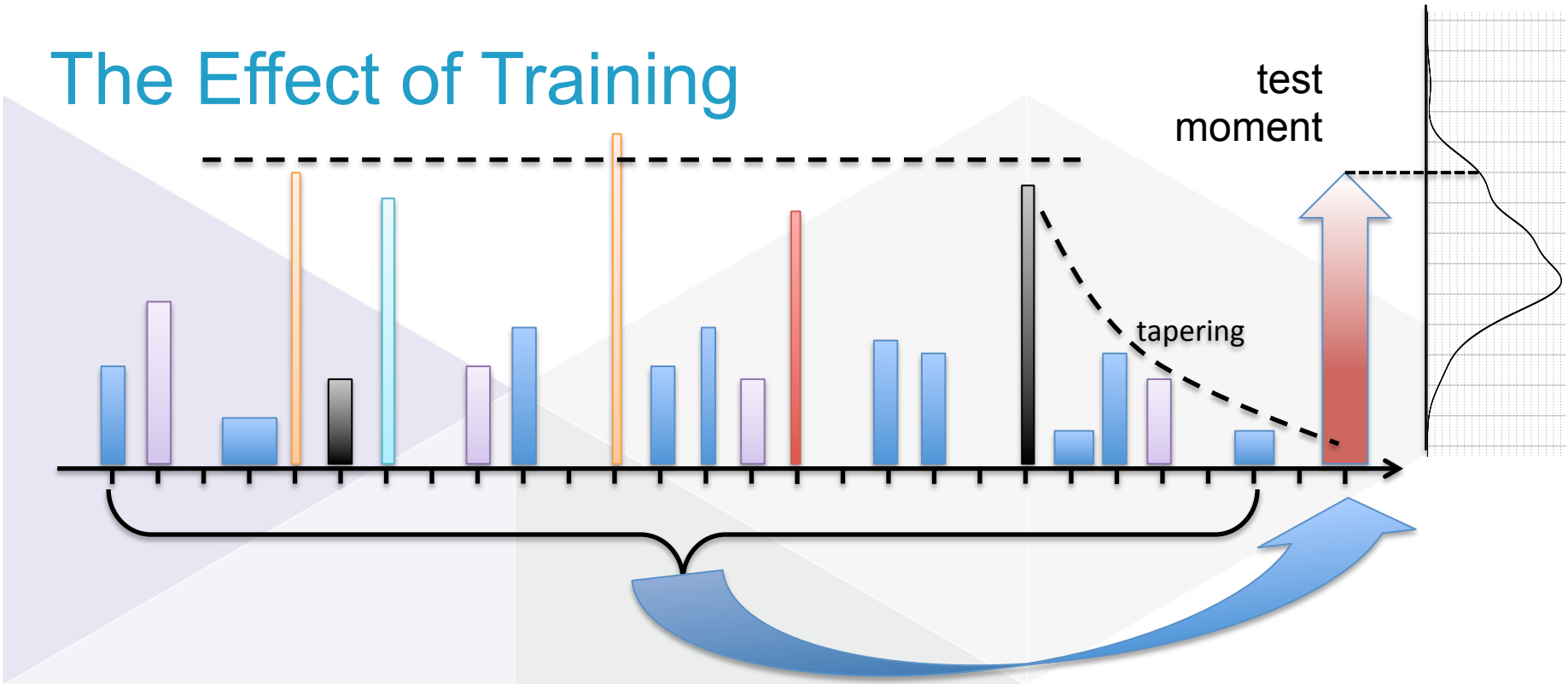
Evolution | Distribution | Data | Insert



Research Questions

- *What factors in the training routines affect performance?*
  - load, periodisation, sickness, atmospheric conditions
  - data mining challenge
- *How predictive are pre-season tests for the season results?*
  - classical statistics
- *Do athlete-specific properties play a role in training ⇒ performance?*
  - single-athlete models vs. group models
- *What factors in daily life affect performance?*
  - rest and recuperation, nutrition
  - sensoring

The Effect of Training



Aggregation Types and Determiners

Within each window:

• COUNT		How many exercises?
• SUM	duration, load	How many minutes, …?
• MAX	duration, intensity, load	Did you recently …?
• STDDEV	duration, intensity, load	How varying was …?

Determiners

- of specific categories
- just in the morning/afternoon
- certain intensity ranges (zones)

```
...
COUNT(CASE WHEN DATEDIFF(c.date, e.date) <= 14 AND e.intensity > 5 THEN 1 ELSE 0 END)
AS count_duration_6789_14,
SUM(CASE WHEN DATEDIFF(c.date, e.date) <= 14 AND e.session = "am" THEN
e.duration*e.intensity ELSE 0 END) AS sum_load_am_14,
...
```

Some Initial Findings

- To increase *aerobic capacity*, make sure you
  - include at least one exercise longer than 3.5 hours
  - …over the period of 14 to 3 days before the test moment
  - avoid loads above 240 in the mornings, 2 days window

⇒ VO_2max will increase by 3.8%

  - total time in intensity zone [1, 4] above 850 min/w, 21 days window
  - average intensity above 3.8, 14 days window

⇒ VO_2max will increase by 11.1%

Data Science

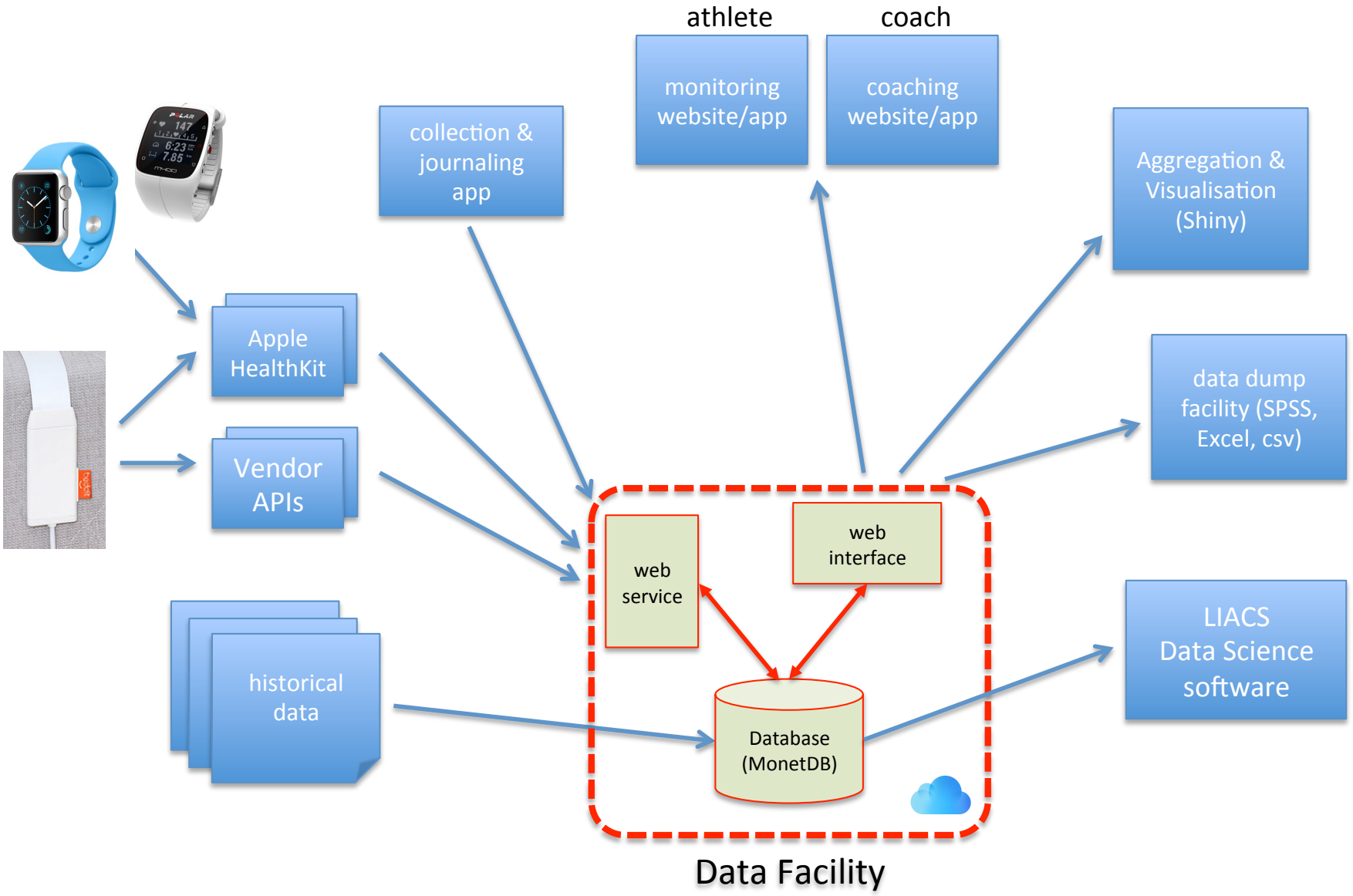
- Organising data
  - Loading and centralising historical data
    - data warehouse
  - Disclosing the information (webinterface, app)
  - Automating the analysis pipeline

- Collecting new and more data
  - Automating the spreadsheets
  - Immediate monitoring feedback
  - Sensoring
    - Power sensors in bikes
    - Beddit sleep sensor
    - Apple Watch, Polar, BioHarness

Hogeschool van Amsterdam
Bewegen, Sport en Voeding

Universiteit Leiden

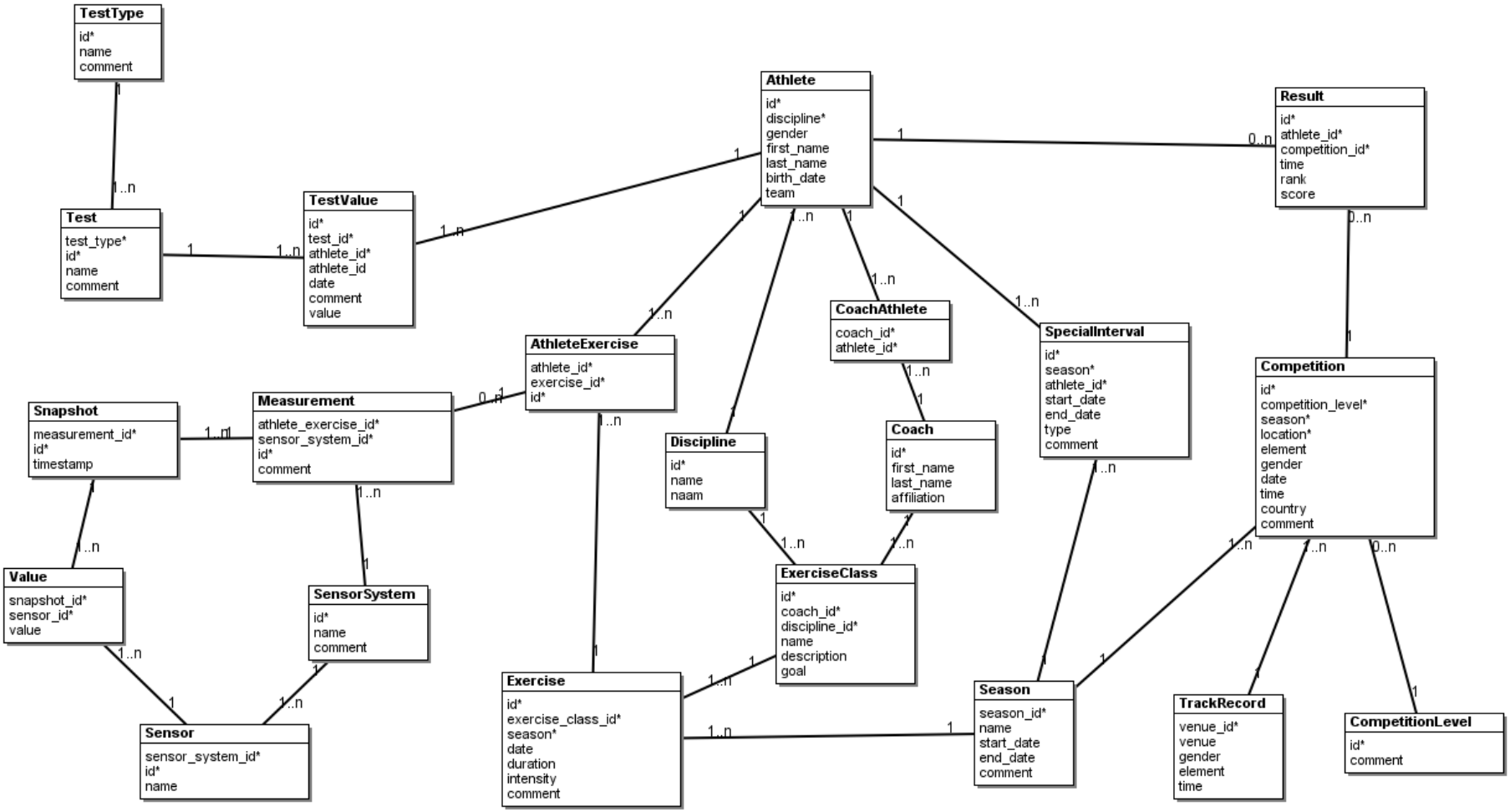
An Elite Sports Data Facility



Hogeschool van Amsterdam
Bewegen, Sport en Voeding

Universiteit Leiden

Database Schema



Hogeschool van Amsterdam
Bewegen, Sport en Voeding

Universiteit Leiden

Conclusion

- Longitudinal, detailed data has great potential
- Actionable results
- Data facility ⇒ Sports Data Valley
  - LottoNL-Jumbo
  - PSV
  - AISS rowing, basketball, swimming

COMMIT/
NWO