A Gap in the Education of Future Sport Scientists?

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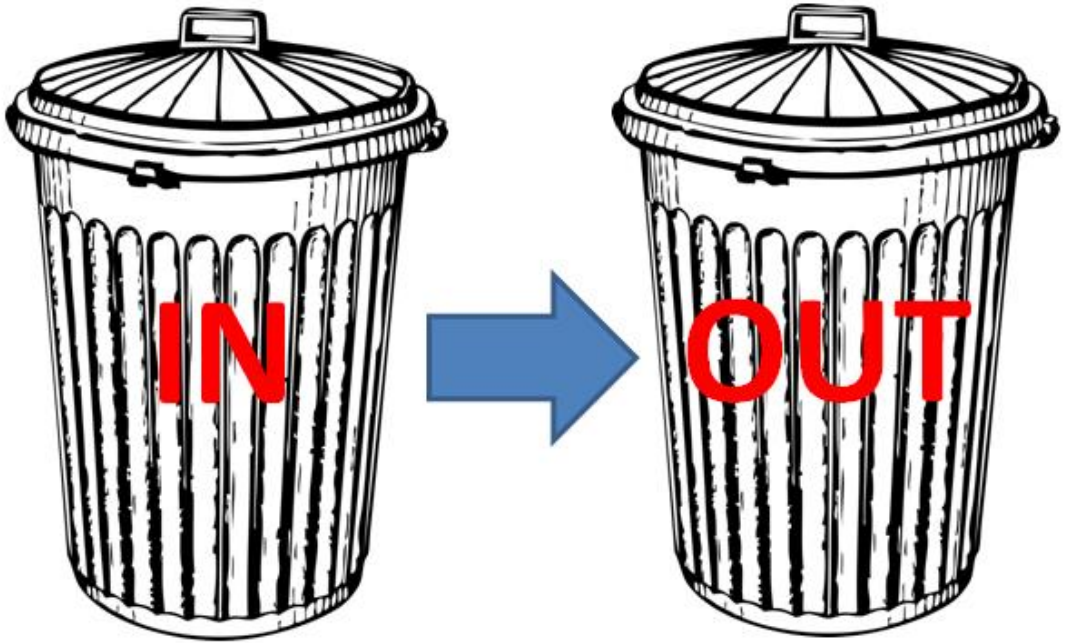
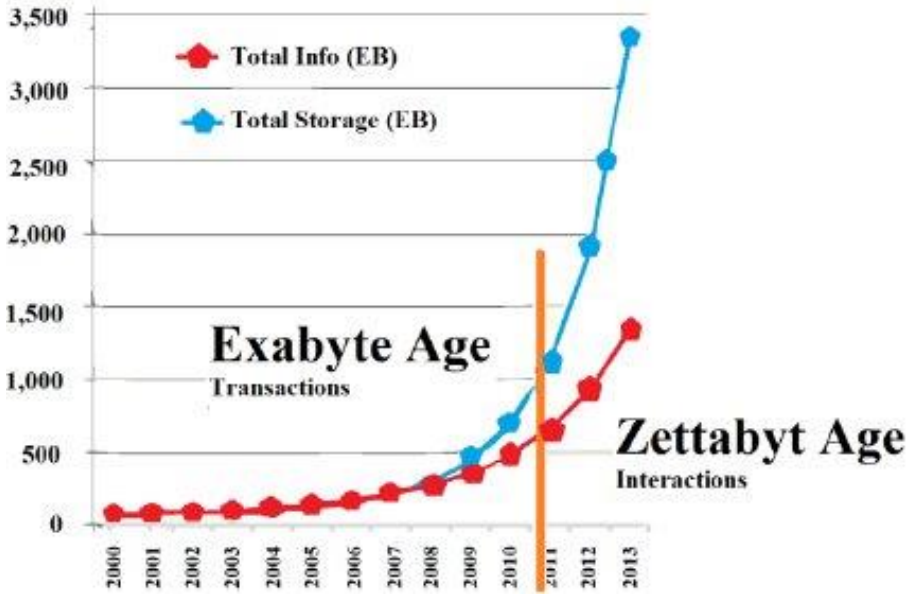
QUICK·STEP
PROJOB
PROJOB


IN
OUT

Rise of data availability

- Power
- GPS
- HR
- …



Missing Competencies?

- Sensors
- Modelling & Simulation
- Data processing using a programming language
- Visualisation of complex data

Sensors

What can be measured?

Electronics, Mechanics, Data transmission

Information Theory

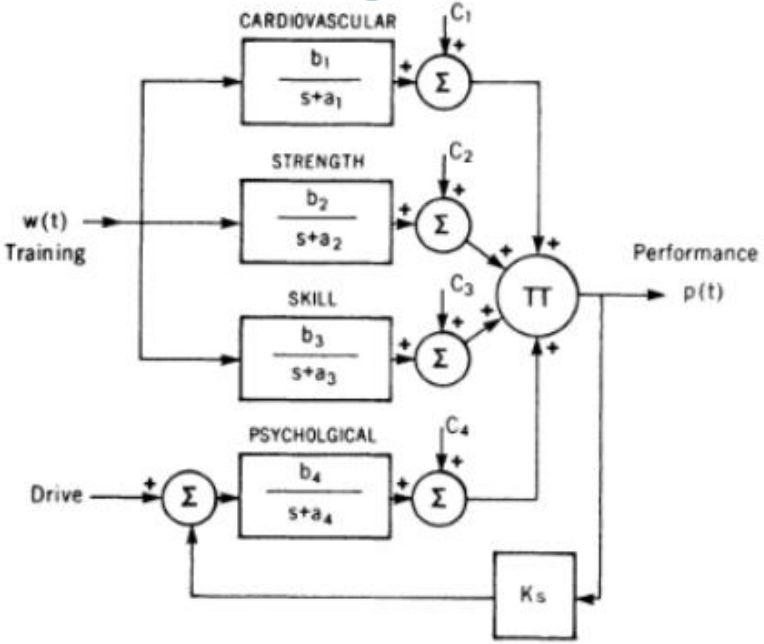
Storage formats

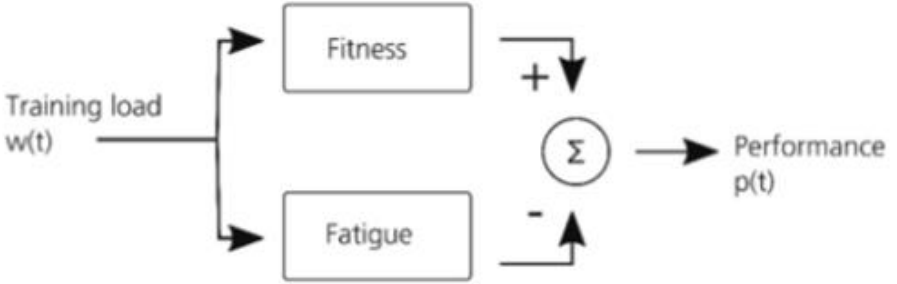
Examples – What could possibly go wrong?

- Use 1s Max power

- “We set sensor to sample at 1 Hz”

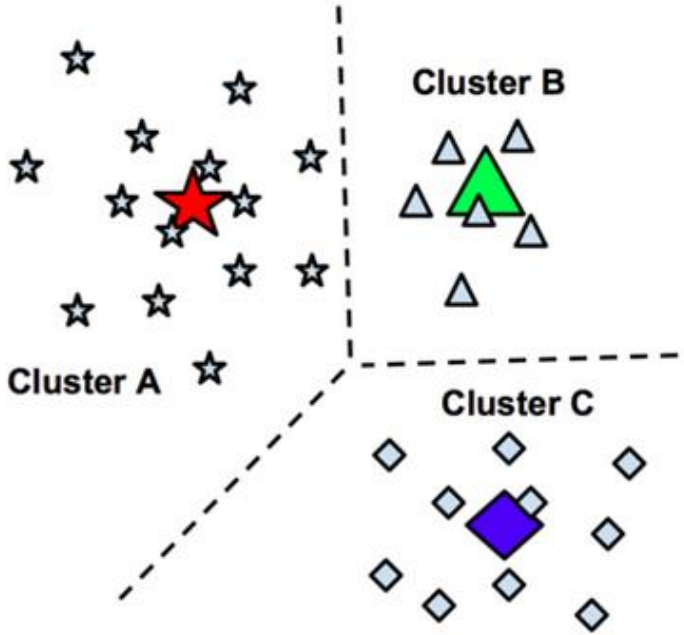
Modelling & Simulation

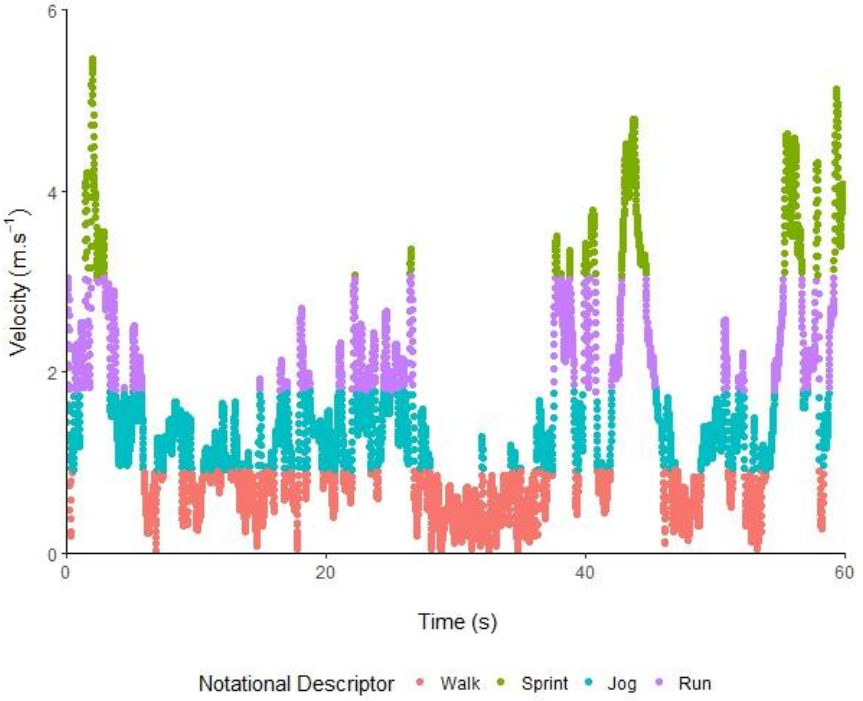




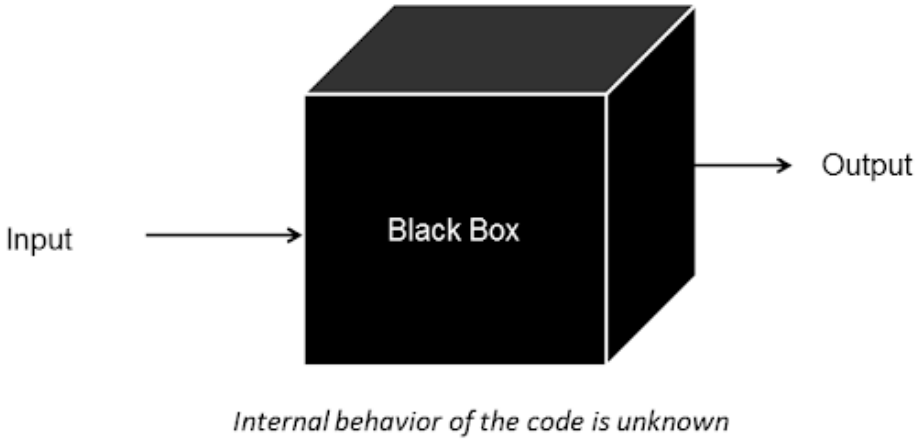
$$\hat{p}(n) = p^* + \underbrace{k_1 \cdot \sum_{t=1}^{n-1} w(t) \cdot e^{\frac{-(n-t)}{\tau_1}}}_{fitness} - \underbrace{k_2 \cdot \sum_{t=1}^{n-1} w(t) \cdot e^{\frac{-(n-t)}{\tau_2}}}_{fatigue}$$

Modelling & Simulation





Problems



Internal behavior of the code is unknown

- Over-fitting
- Validation


Real world data
iris &
mtcars

Programming

ETL – Extract, Transform, Load

CRUD – Create, Read, Update, Delete

- Python
- R
- Java

```
df_print: paged
---

# Loading the data
```{r}
require(readxl)
raw_data <- read_excel("~/Dropbox/[redacted].xlsx")

# someone has really messy data ...
raw_data$hms<- round(raw_data$hms)
```

New names:
* `` -> ...1
* W -> W...3
* W -> W...4
* W -> W...5
* W -> W...6
* … and 35 more problems

Conventional linear 1/time model
Create model
```{r}
hypm <- lm(raw_data$W ~ {1 / raw_data$hms})
hypm <- setNames(coef(hypm), c("CP", "W'"))
print(hypm)
```

Plot model
Conventional plot
```{r}
plot(raw_data$hms, raw_data$W, ylim = c(hypm["CP"]-100, max= max(raw_data$W)),
     xlab = "Time (sec)", ylab = "Power (Watts)")
curve((hypm["W'"] / x) + hypm["CP"], add = TRUE, col = "red")
```

```
import pandas as pd
import math
import numpy as np
import sklearn
from scipy import optimize
from sklearn.linear_model import LinearRegression
from sklearn.neural_network import MLPRegressor

TSS=[]
aTSS=[]
losses = []

#dia,tss,Vo2
data=pd.read_csv('D:\pyDemos\Modelo_Responder\data_tss_id_53.csv')

p  = data['Vo2'] #cambiar por power/hrm
ofp = []
for i in range(len(ap)):
    ofp.append(np.mean(ap[i:(i+28)]))

TSS = data['tss']
bTSS=[]
for i in range(len(TSS)):
    aTSS = np.mean(TSS[i:(i+28)])
    bTSS.append(aTSS)

def pmc(k1,k2,inicial,T1,T2):
    for i in range(len(TSS)):
        fit = TSS[i] * 1-math.exp(-1/T1)
        fat = TSS[i] * 1-math.exp(-1/T2)
        pmcfun = k1 * fit - k2 * fat + inicial
        loss = abs(ap[i]-pmcfun)
        losses.append(loss)
    MAE = np.mean(losses)
    return MAE

#Constantes individuales
#     k1   k2  i T1 T2
ipr = [0.1,0.5,0,42,7]
pmc(0.1,0.5,0,42,7)
ipmc = optimize.minimize(pmc,ipr)
rna = MLPRegressor(solver='lbfgs',activation='relu',hidden_layer_sizes=[50],random_state=42)
a=rna.fit(bTSS,ofp)
```
```

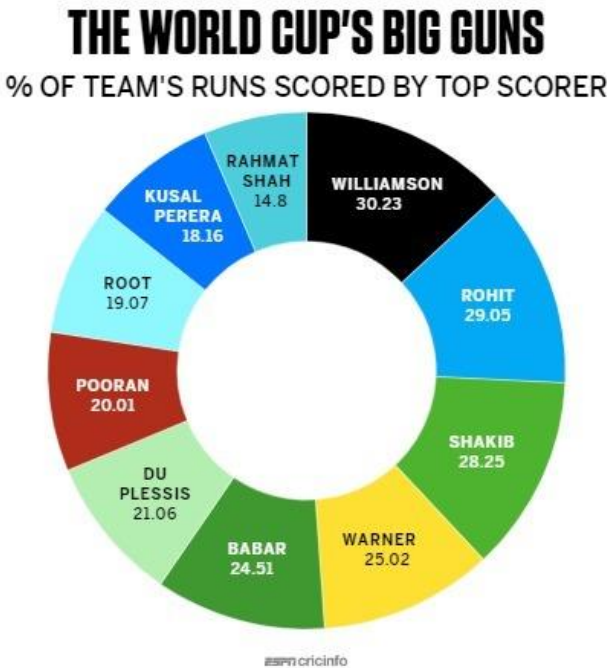
Visualisation

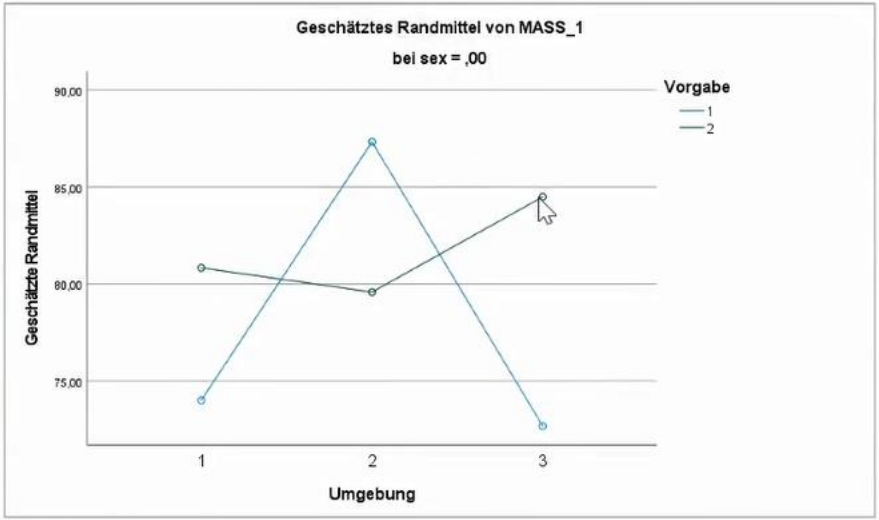
More than just creating a standard Excel chart

General Concepts

(Adequate) Tools

„Which visualisation for which data?“





https://www.espncricinfo.com/story/_/id/27143430/kane-williamson-hand-steadies-new-zealand-ship

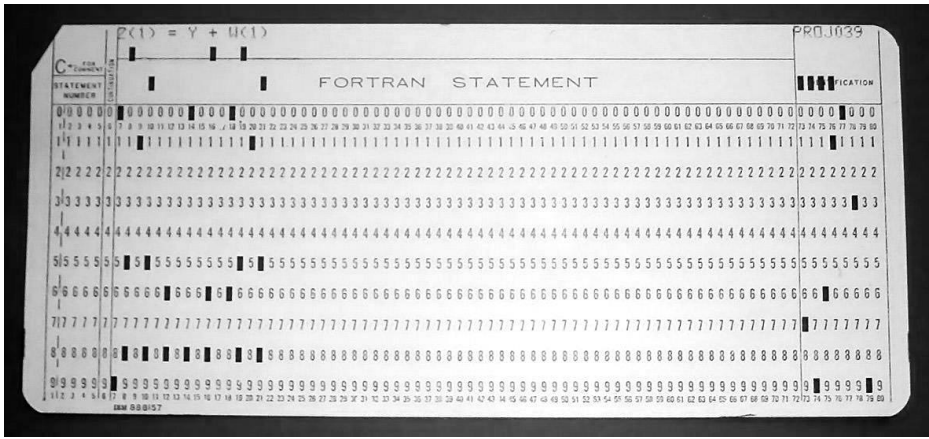
Hindering Factors

Examples based on anecdotal evidence

„Not necessary“

Teaching what we have learned

Autodidactic teachers / lecturers



Necessary Level?

Methods

„Text mining“ of published Curricula

Focus on (public) universities

Listed competencies & courses

Competencies in Austria

4 universities (sport science)

„Profile of Graduate“: 1 /4

Courses: 1 /4

Dobiasch, M., & Oppl, S. (2020). Modellabstraktionen und deren Wirkung im Sport – Ein Ausbildungsproblem? Wirtschaftsinformatik & Management, 12(5), 362--368. https://doi.org/10.1365/s35764-020-00282-y


Austria is a too small country
ORF
REUTERS
Eisbär

International

Shanghai Ranking, Top 3:

- University of Copenhagen
- Norwegian School of Sport Sciences
- Deakin University

Undergraduate Programs

At best: „Introduction to Statistics“


WON'T SOMEBODY PLEASE
THINK OF THE CHILDREN

Competencies in Sports Education

Austria

School (K12)

„Teaching standard“

4 clusters of universities / institutions

Bachelor + Master, general + specific

Dobiasch, Fellner & Oppl, Digitale Kompetenzen in den Curricula und im Bildungsstandard für „Bewegung und Sport“ in Österreich [submitted]

Findings (Students)

No links to digital competencies

References to documenting

→ Analogue

Heartrate

Dobiasch, Fellner & Oppl, Digitale Kompetenzen in den Curricula und im Bildungsstandard für „Bewegung und Sport“ in Österreich [submitted]

Findings (University)

4x: Bachelor & Master ➔ 16 documents

Differences between clusters

Data-security & privacy, content law: 1

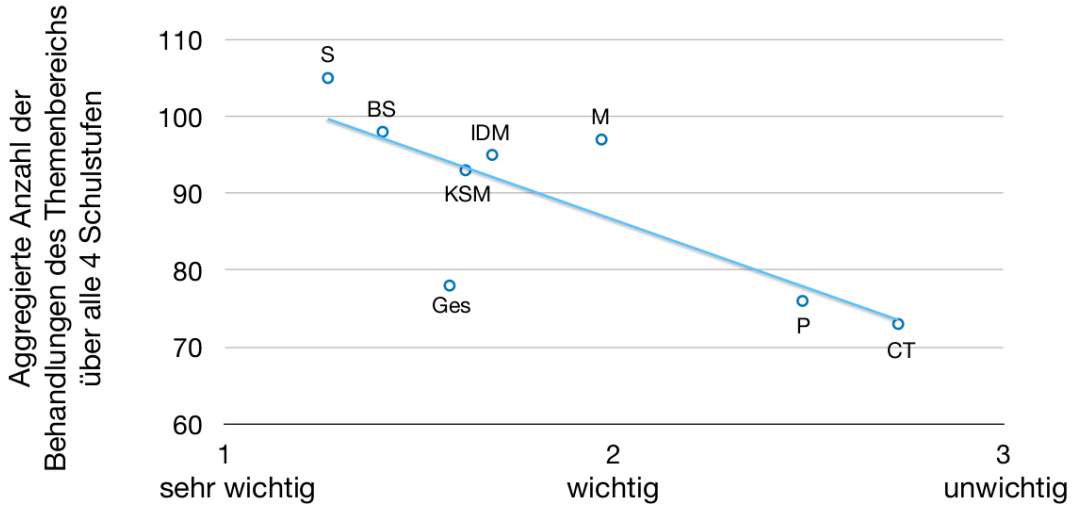
Technology: 16 (max: 3)

Modelling & Simulation: 2

Digital Media: 15 (max: 6)

Video: 0

Going even further



Zur inhaltlichen Schwerpunktsetzung im Rahmen der verbindlichen Übung „Digitale Grundbildung“ an österreichischen Mittelschulen (Oppl/Fuchs/Dobiasch, 2021) [ahead of publication]

Limitations

Translations

Access to documents

Theory vs practice

Alignment with competence models

Solutions?

- Specialisation courses
- Integrative teaching
- Interdisciplinary projects

Specialisation Courses

„graduate certificates“

Example: ”Graduate Certificate in Data Analytics for Sport Performance” (Victoria University)

Problems:

- Not mandatory
- Varying quality
- Limited time
- Cost

Integrative Teaching

Integration into existing courses

ATSTEM

- Integrated STEM curriculum
- E.g. assessing skills in „Geography“

Train the trainer / teacher

Multiplicators

Interdisciplinary Projects

Problem concerns many disciplines

codeAbility

„Digitally Supported Programming Education at Austrian Universities“

codeAbility [austria]

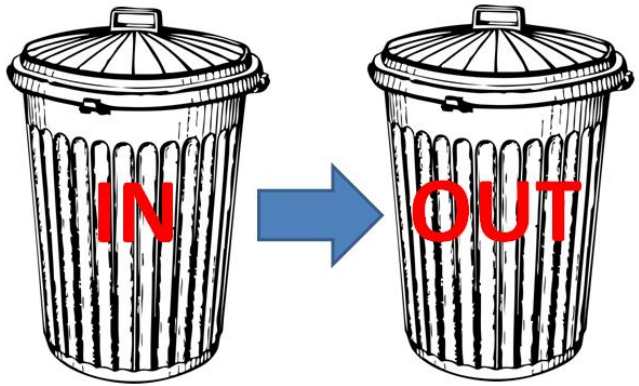
Active engagement necessary

Wrap-Up

„Digital competencies“ necessary

Gap: Low implementation in „policies“

Future: Broader investigation of needs



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