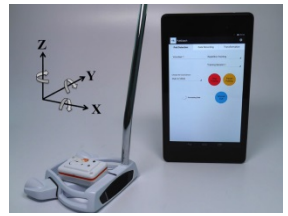
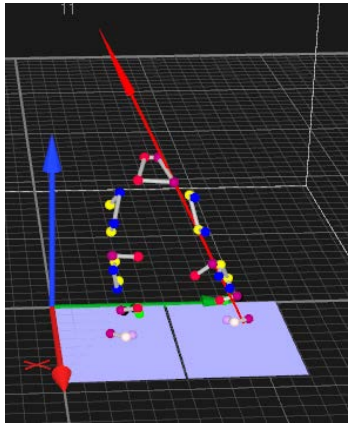
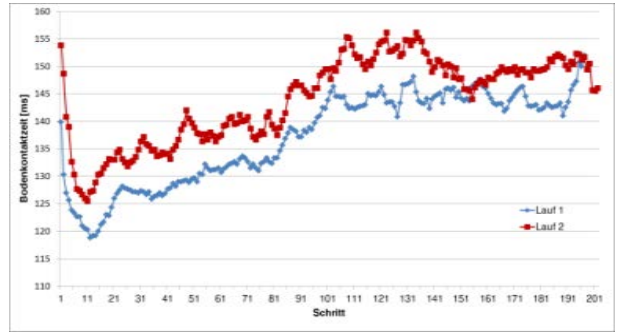
technische universität dortmund

Big Data in Sport and Movement Science – Challenges and Opportunities

Institut für Sport und Sportwissenschaft
TU Dortmund







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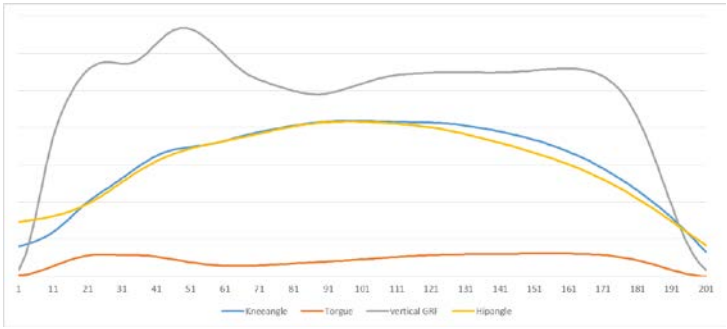
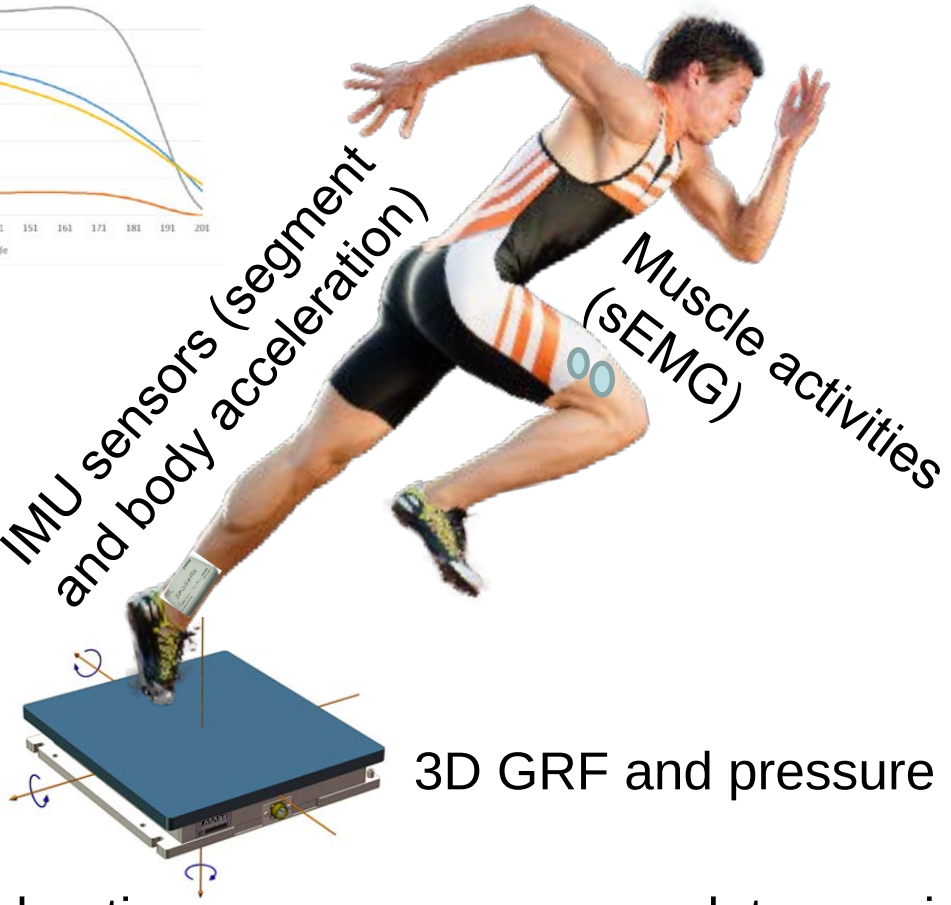
Performance related data acquisition



3D kinematics (segment positions & joint angles, e.g.)

IMU sensors (segment and body acceleration)

Muscle activities (sEMG)



3D GRF and pressure distribution

<u>Movement (phase) duration</u>

ms to minutes

<u>data acquisition rates</u>

depending on device and movement duration:
100 to 2000 samples/s

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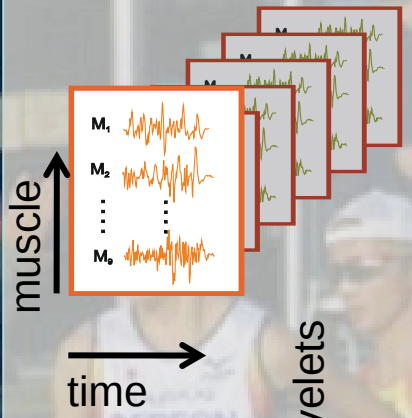
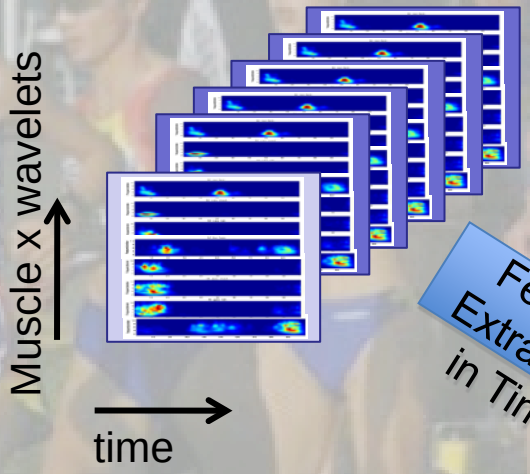
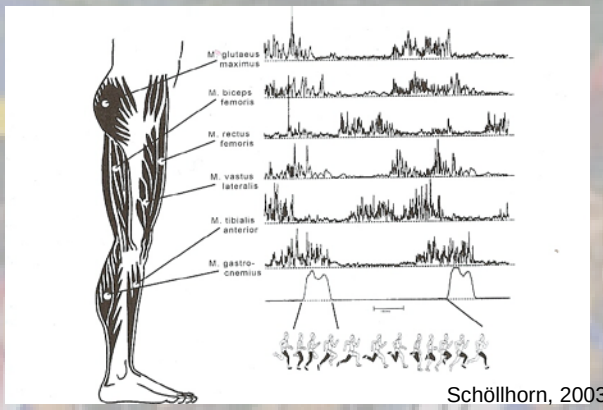
Muscle activy synergies during running at different speed and slope (Jaitner et al. 2010)



Wavelet transformation (van Tscharner, 2000)

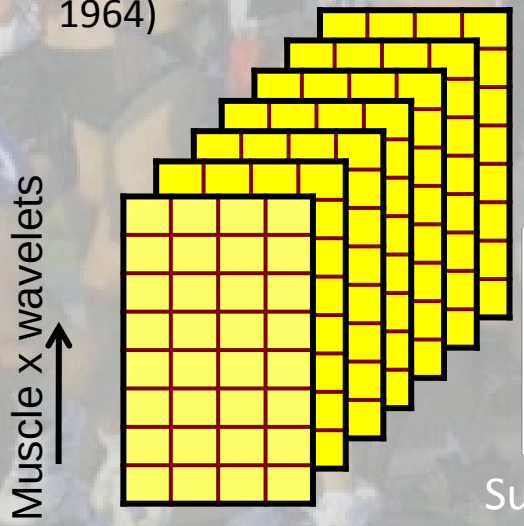


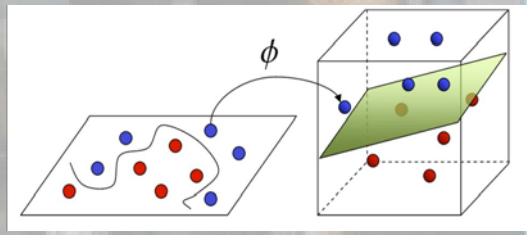


Schöllhorn, 2003

Dimension reduction Multidimensional scaling (Cox & Cox, 1994; Kruskal, 1964)

via Feature Extraction in Time





Support Vector Machine

378 trials (≈ 8 subjects x 5 conditions x 10 steps)

Condition	Individuals	Speed/Decline
Level running at 4, 5 and 6m/s	100%	78,6%
Running at 5m/s [+5°/±0°/-2°]	97,7%	88,2%
Slope running [+5°/-2°]	99,3%	82,1%
All trials	92,9%	

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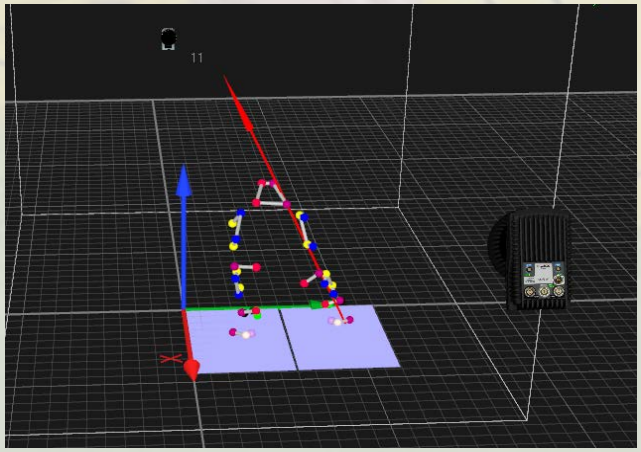
Injury prediction and prevention in teamsports (e.g. football)

Biomechanical Screening

65 Youth Elite Soccer Players

25 Youth Elite Handball Players

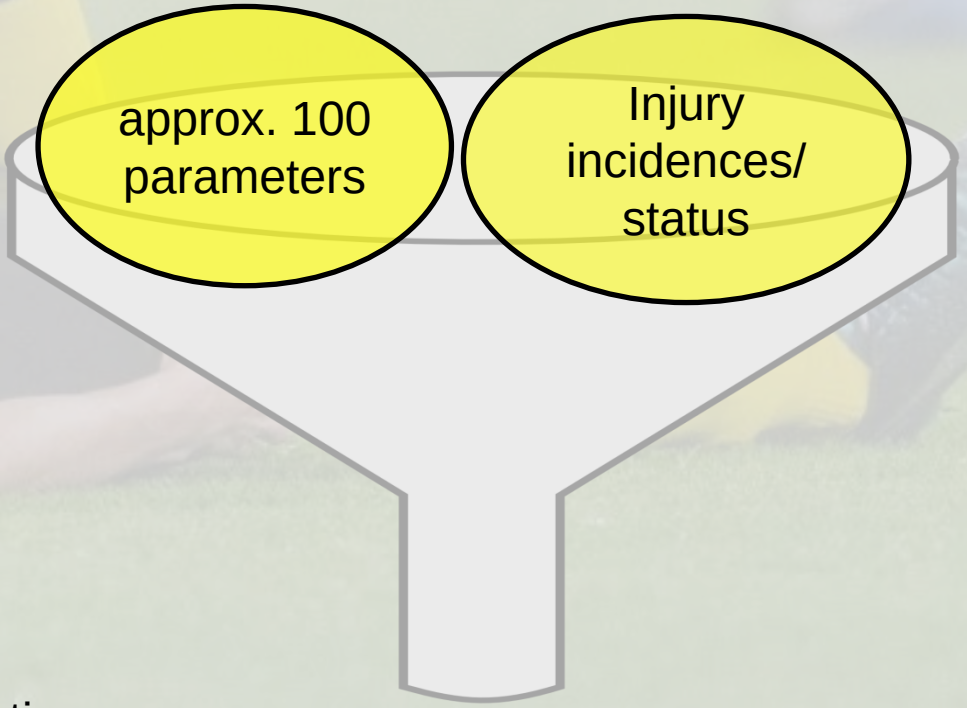
12 month injury documentation
(FIFA consensus)



movement patterns
(e.g. GRF in running)

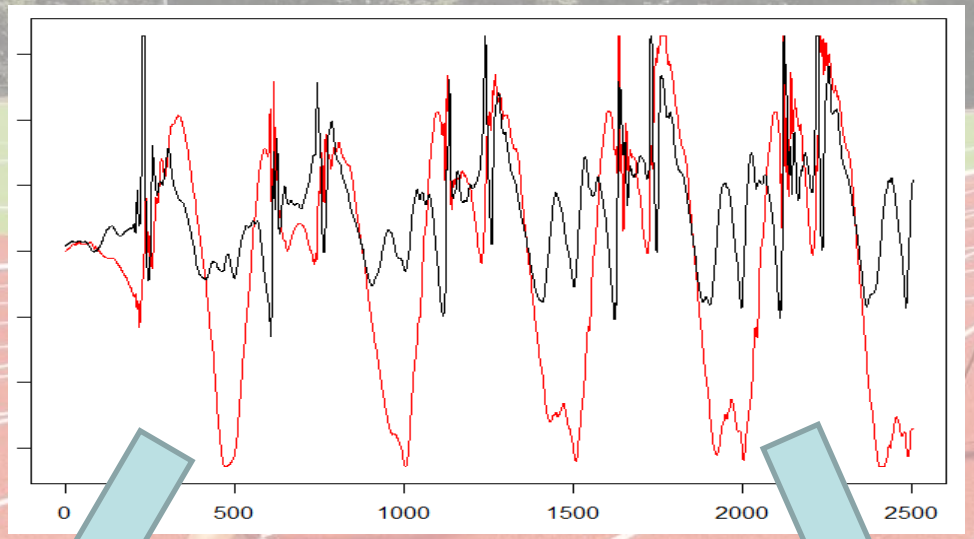
interaction

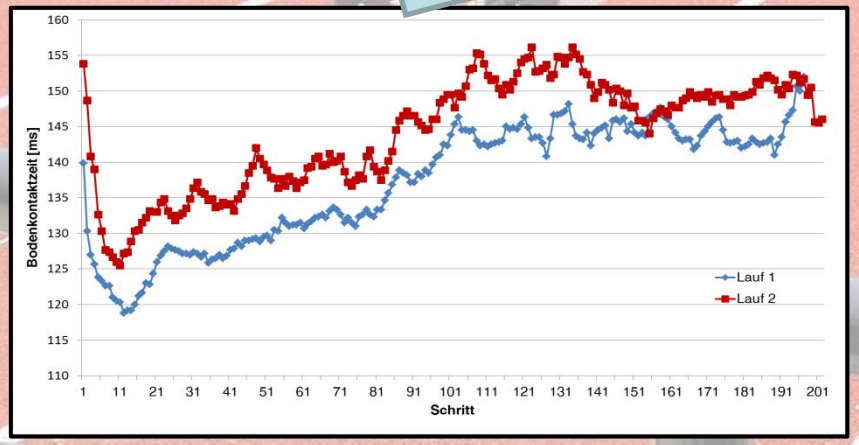
prediction

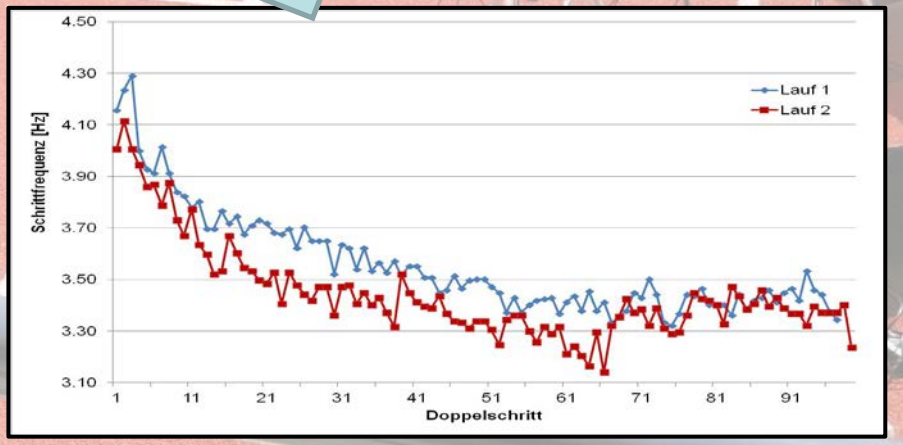


injury specific risk factors
Interaction of risk factors

Performance analysis of jumping and sprinting







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Further research questions

- movement pattern adaption following motor learning or training
- gait pattern variability and adaption following short time interventions (e.g. balancing, wobbling)
- identification of pathologic gait/running pattern (that result from injuries or may cause overuse injuries)
- motor control strategies and muscle activation variability in gross motor movement

Big Data in Sport and Movement Science:
Interdisciplinary Opportunity and Challenge