

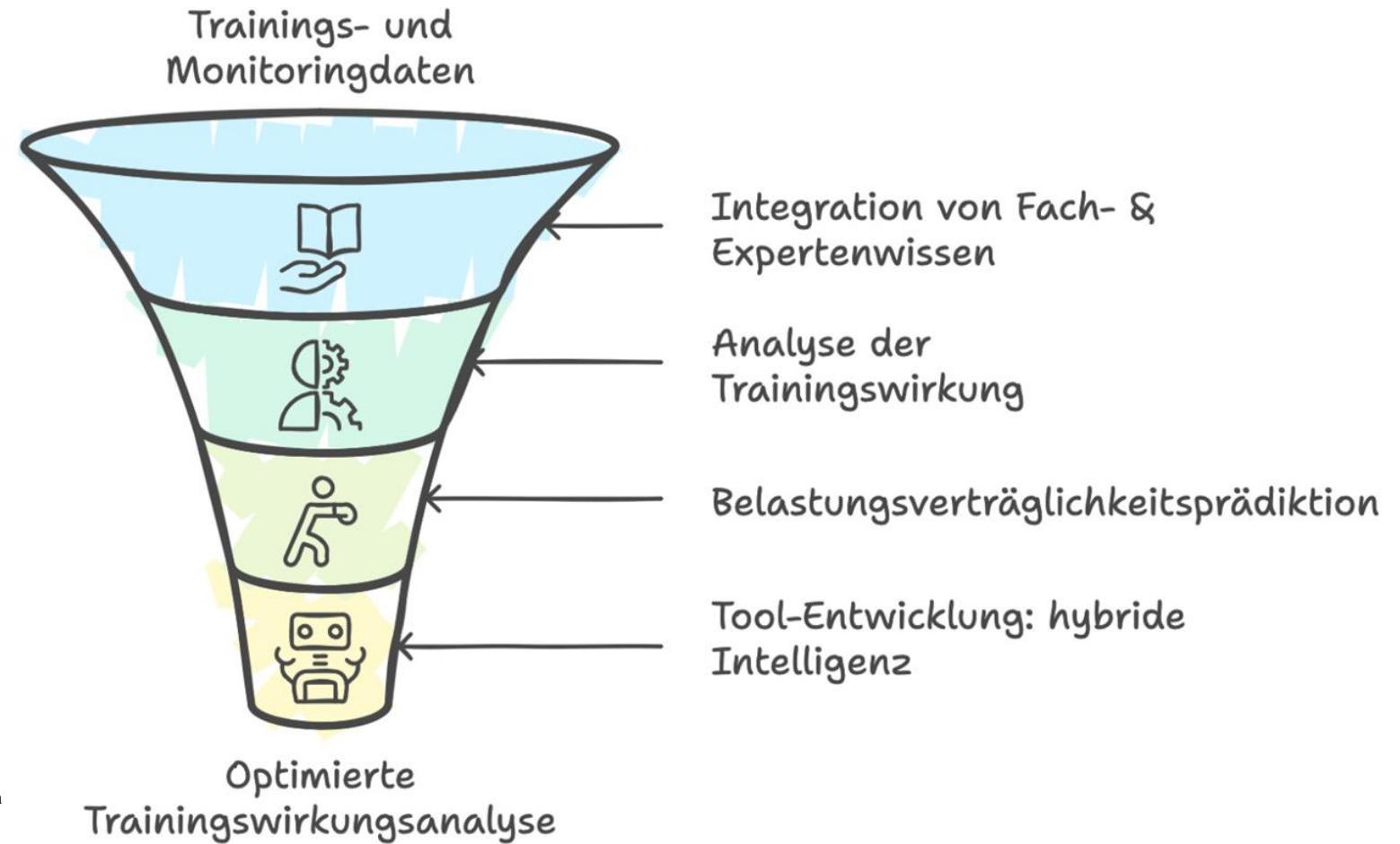
Artificial Intelligence – Anwendung in der Trainings-Wirkungs-Analyse

Workshop

Ludwig Rappelt, M.Sc.
Rudersymposium 2025
25.01.2025
15.00 – 16.00 Uhr
Raum Zellerfeld

tRAIN - Trainingswirkungsanalysen im Rad- & Rudersport durch Artifical Intelligence basierte Modellierung

Prof. Dr. Alexander Asteroth¹, Vincent Scharf¹, Prof. Dr. Lars Donath², Prof. Dr. Peter Ehnold³, Ludwig Rappelt², Clemens Hesse⁴, Dr. Kay Winkert⁵, & Prof. Dr. Steffen Held^{2,3}



¹Fachbereich Informatik, Hochschule für Bonn-Rhein-Sieg, Sankt Augustin

²Abteilung für Trainingswissenschaftliche Interventionsforschung, Deutsche Sporthochschule Köln

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ATHLETICA

Powered by: **HIT SCIENCE**

Paul Laursen, PhD.

Martin Buchheit, PhD.

Andrea Zignoli, PhD.

AIEndurance

AI-Powered Training. Individual To You.

A scientific, data-driven training plan that actually improves your performance - we have the data to back it up. Whether you're a runner, cyclist, or triathlete, AI coaching is your edge.

Performance-Driven Continuously Customizable Recommended Targets and Workouts

Xert

Xert's ADAPTIVE Training Advisor

Performance-Driven Continuously Customizable Recommended Targets and Workouts

Supra-Threshold using Target MPA - 3.0

OBC/CCD Green/Red Workout 75 min.

commercially available AI-based approaches

Enhancing Performance with Data-Driven Insights



Revolution in Training

AI-powered platforms offer personalized training based on real-time performance metrics.



Data-Driven Decisions

Analyzing data from wearables and historical performance to optimize outcomes.



Growing Adoption

An increasing number of athletes rely on AI tools for strategic training plans.



Customized Training Plans

Tailored programs based on heart rate, power, and historical data.



Dynamic Adaptation

Programs adjust in real time to athlete progress and goals.



Seamless Integration

Works with leading wearables like **Garmin** and **Strava**. ?!



Periodized Training

Incorporates evidence-based periodization for peak performance.



Goal-Oriented Plans

Focus on individual goals like marathons or triathlons.



AI & Coach Synergy

Enables collaboration with human coaches for hybrid training. ?!



Breakthrough Metrics

Introduces unique metrics like XSS and Focus Duration for deep performance insights. ?!



Real-Time Feedback

Provides dynamic adjustments based on fatigue and performance metrics.



Cycling-Centric Features

Ideal for cyclists with advanced analytics tailored to cycling power. ?!



!!!

Lack of Team Training Features

Rowing heavily relies on synchronized teamwork, which current AI platforms don't address.



!!!

Limited Rowing-Specific Metrics

Continuous power measurement and unique rowing dynamics are not well-supported.



!!!

Rigid Training Structures

Preset programs (e.g., HIIT 30/30) lack flexibility for rowing's specific demands.

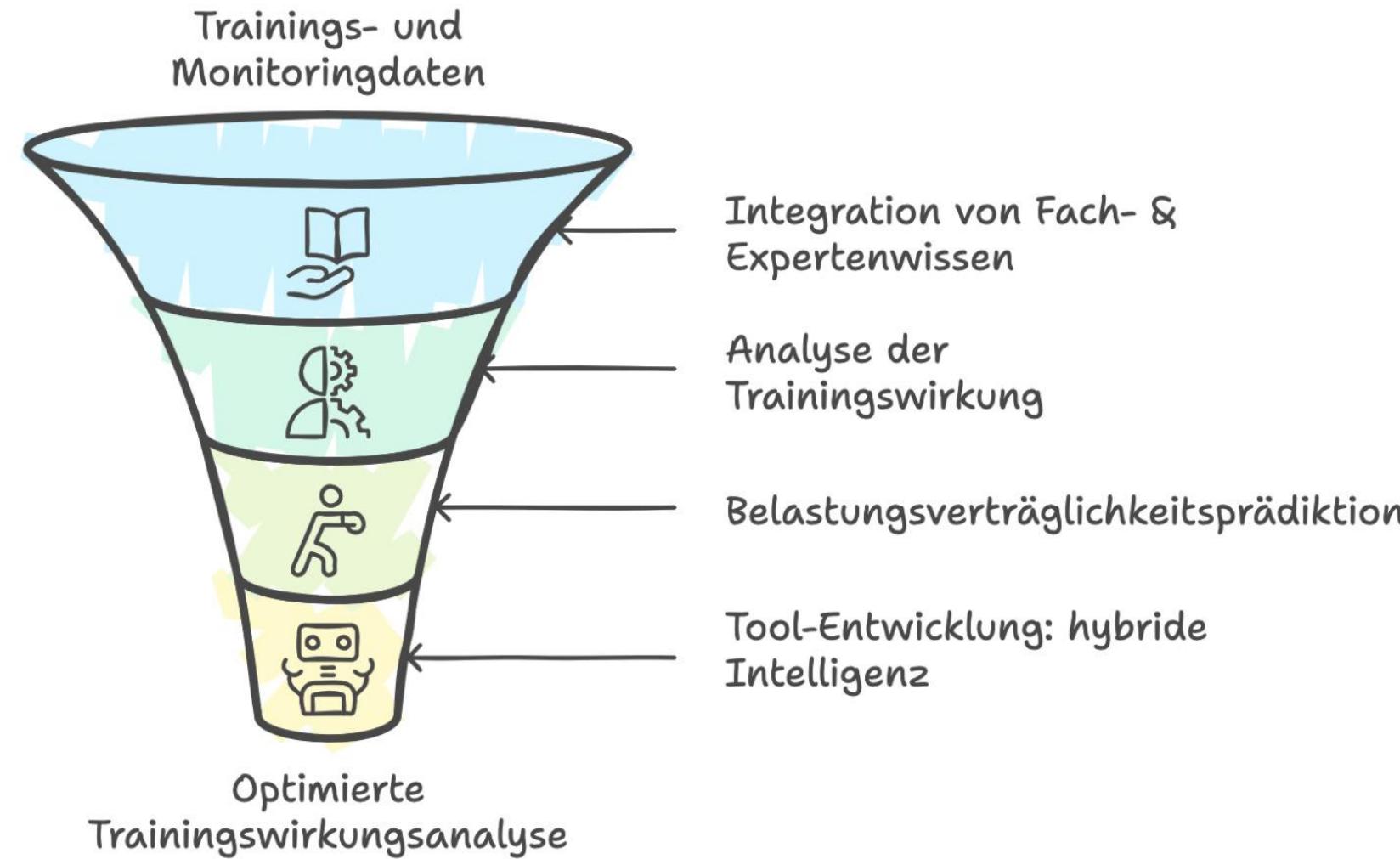


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Minimal Hybrid Intelligence

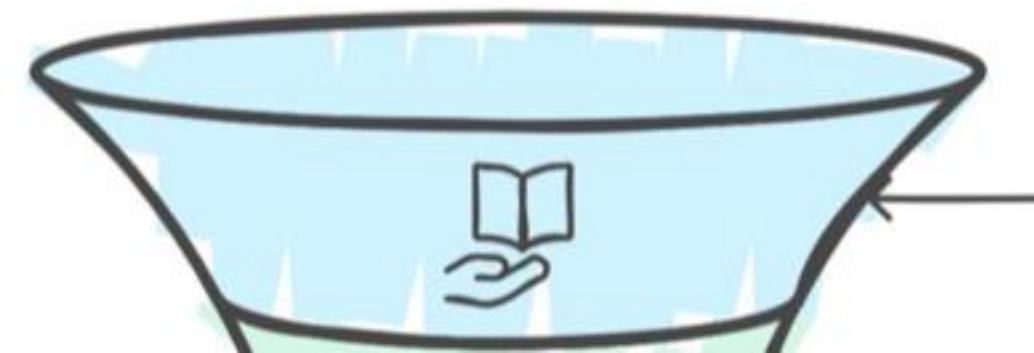
Platforms lack integration of prior rowing knowledge or adaptive coach-athlete models.

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Arbeitspaket 1: Domänenwissen

Grundlagen für KI-gestützte Trainingsanalysen



Erfassung von Wissen
Systematische Analyse
wissenschaftlicher Literatur und
praktischer Erfahrungen.

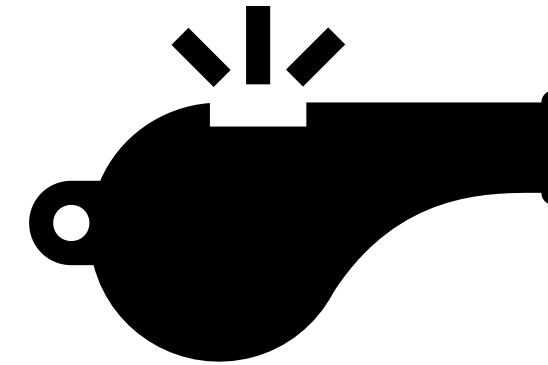


Verknüpfung von Theorie und Praxis
Integration von Publikations- und Praxiswissen für fundierte Modelle.

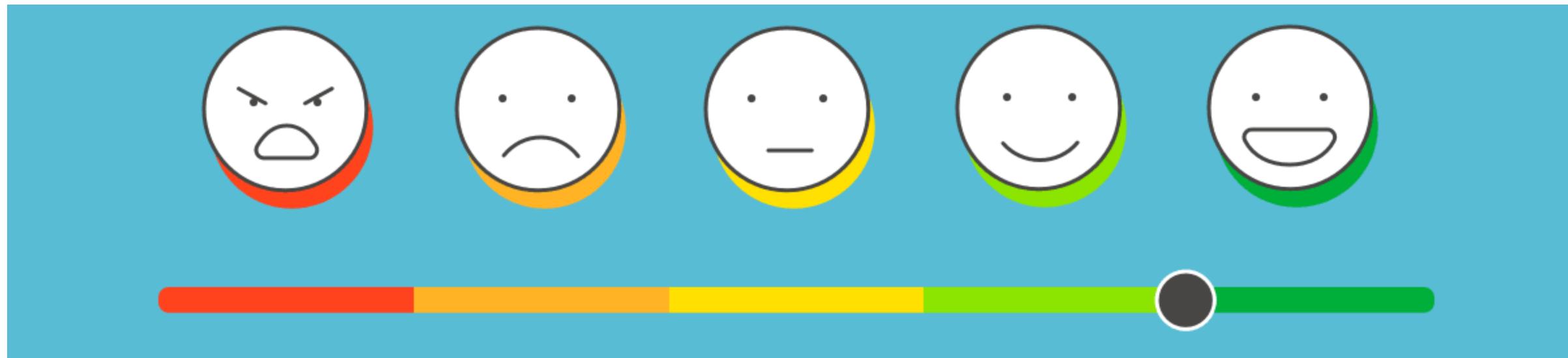


Basis für KI-Modelle
Schaffung einer fundierten Wissensbasis für nachfolgende Analysen.

„Bitte bewerten Sie inwiefern Sie den folgenden Aussagen zustimmen oder widersprechen:“

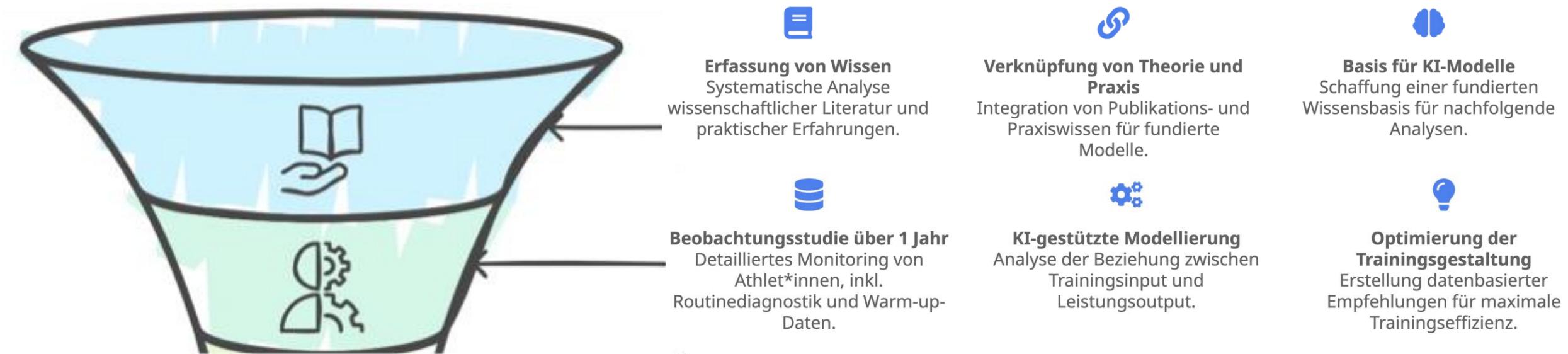


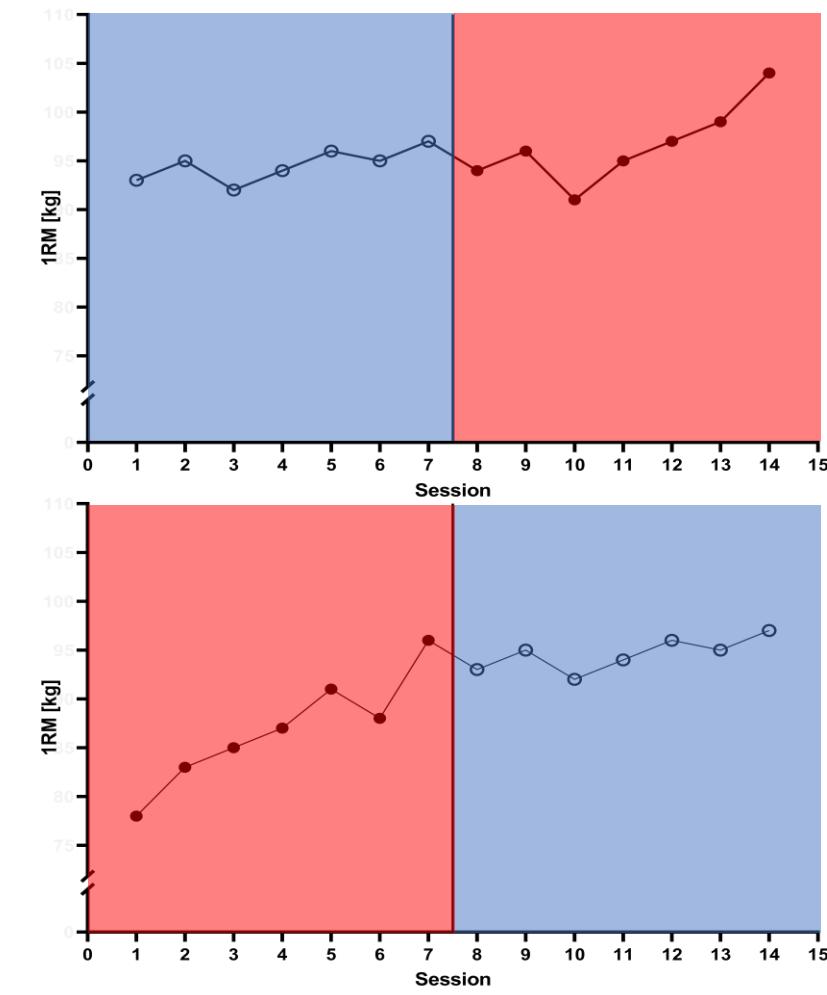
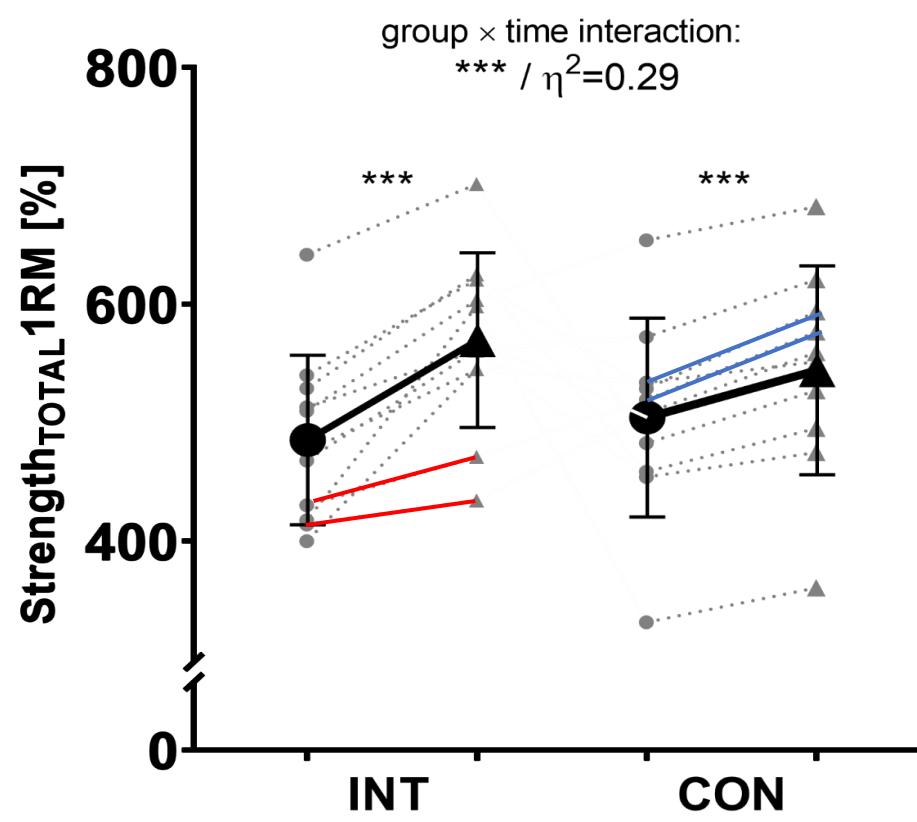
“Für wie wichtig halten Sie die folgenden Faktoren eines Trainingsplans in Bezug auf das Anpassungspotential der Athleten?”

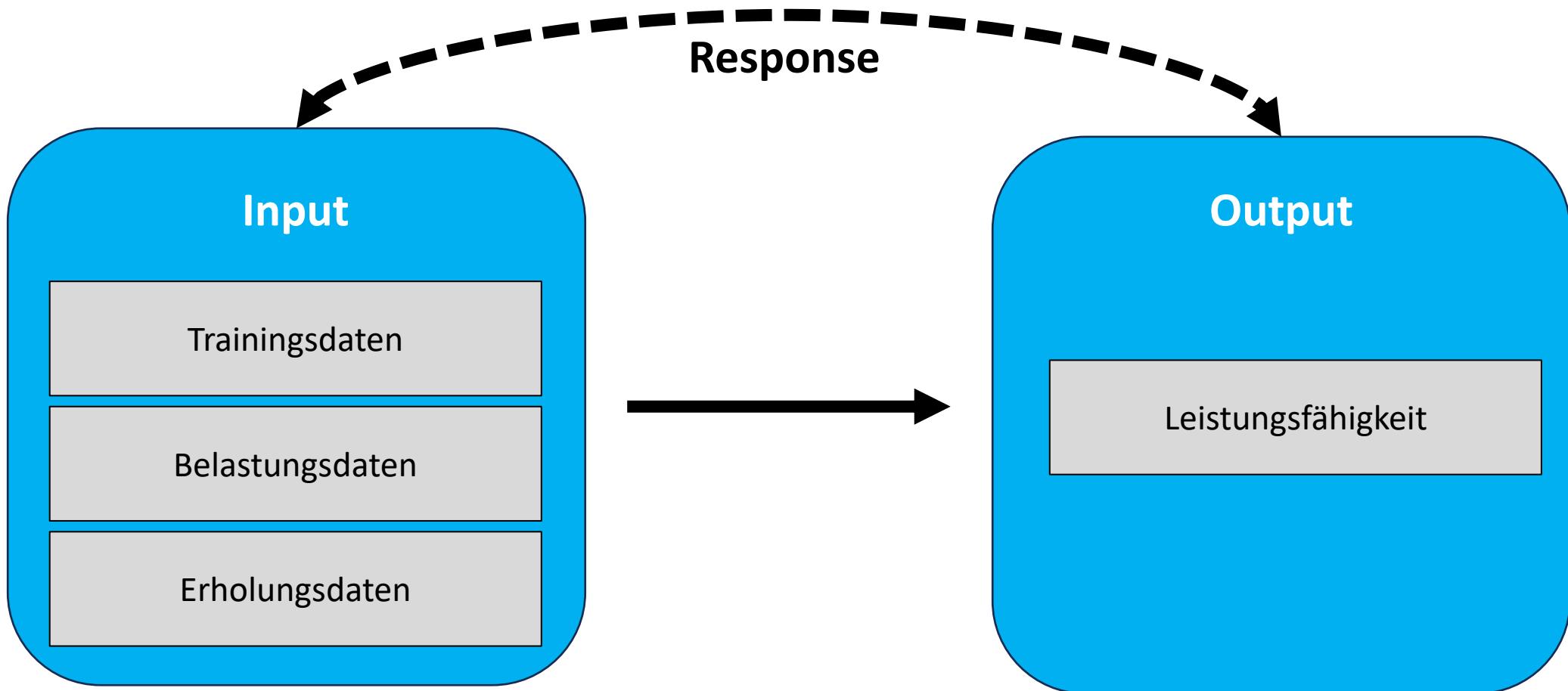


Arbeitspaket 2: Trainingswirkungsanalyse

Vorhersage der Leistungsanpassung

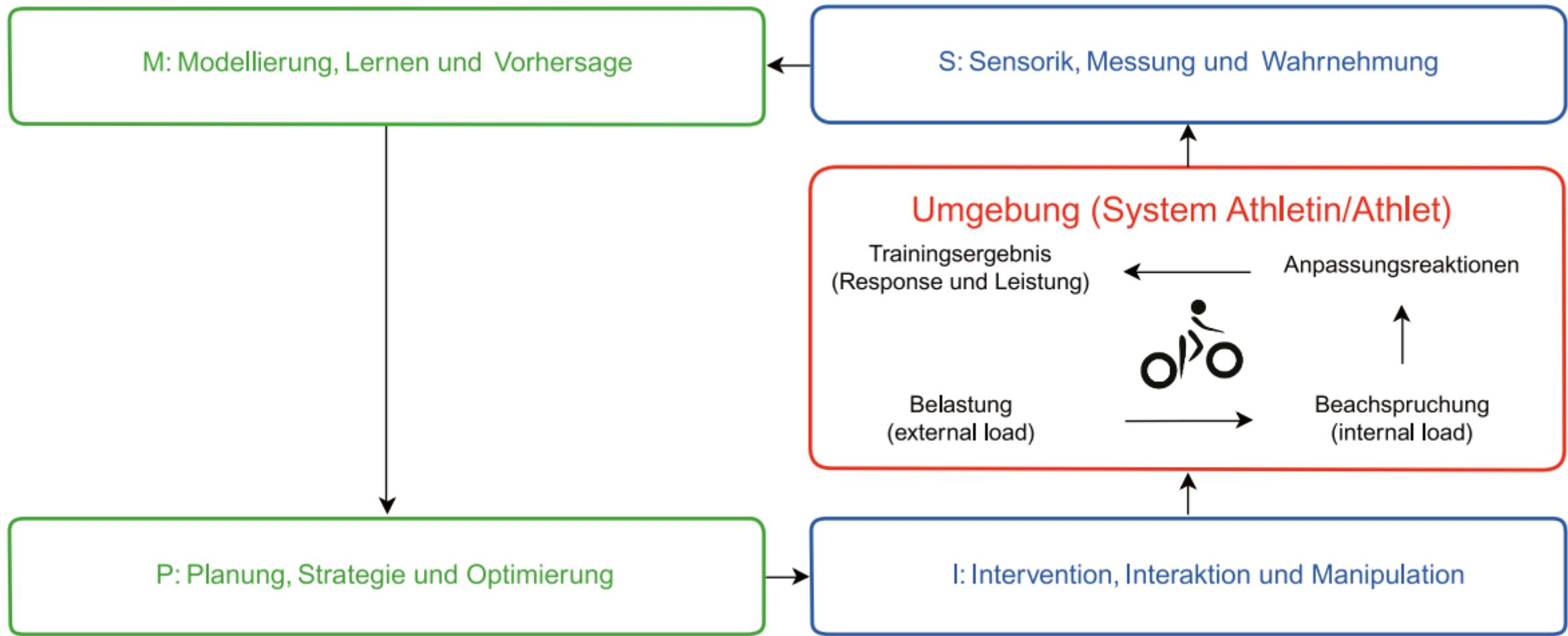






Arbeitspaket 2: Trainingswirkungsanalyse

Vorhersage der Trainingsanpassung: KI-gestützte Modellierung



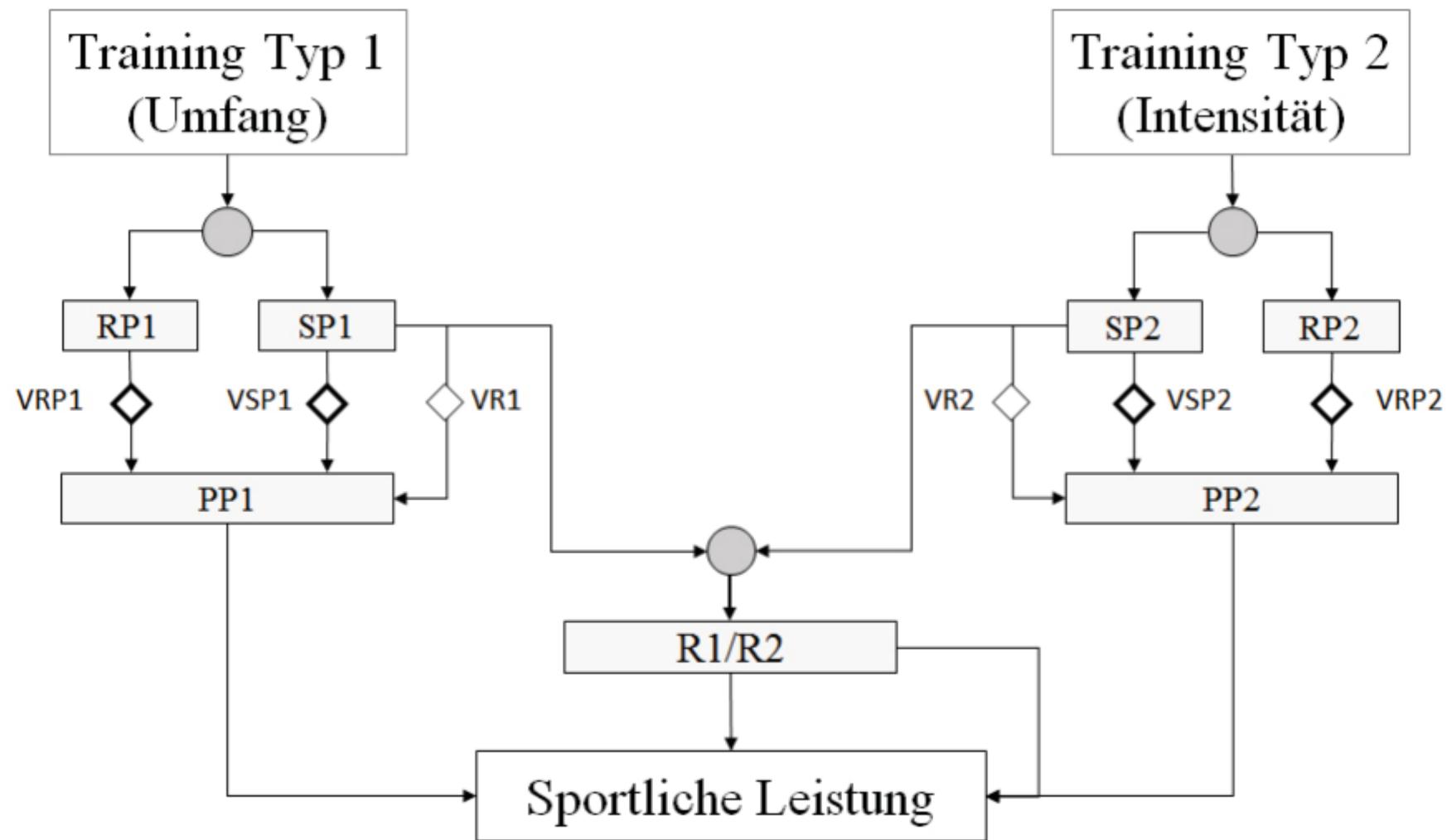
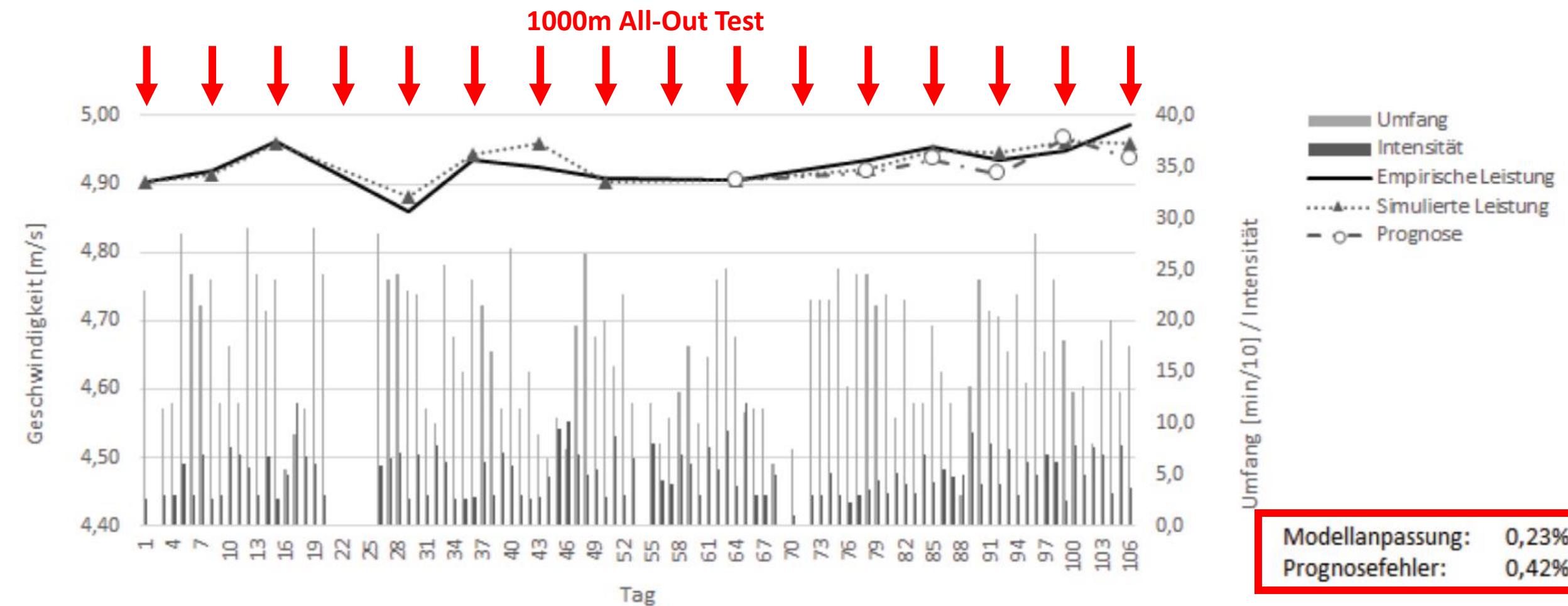


Abb. 1: Modellstruktur des Performance Potential Double Model (PerPot DoMo) (Erläuterungen im Text)

Arbeitspaket 2: Trainingswirkungsanalyse

Vorhersage der Trainingsanpassung: Detailliertes Monitoring



Arbeitspaket 2: Trainingswirkungsanalyse

Vorhersage der Trainingsanpassung: Detailliertes Monitoring

Diagnostik

Sprint-Test (vLamax)

Stufentest [P2, P4]

Rampentest [VO_2max]

„Training as testing“

Submaximaler Stufentest

HRex, HRR, HRV

Monitoring

Herzfrequenz (Zonen)

GPS-Daten

RPE

Feeling-Scale

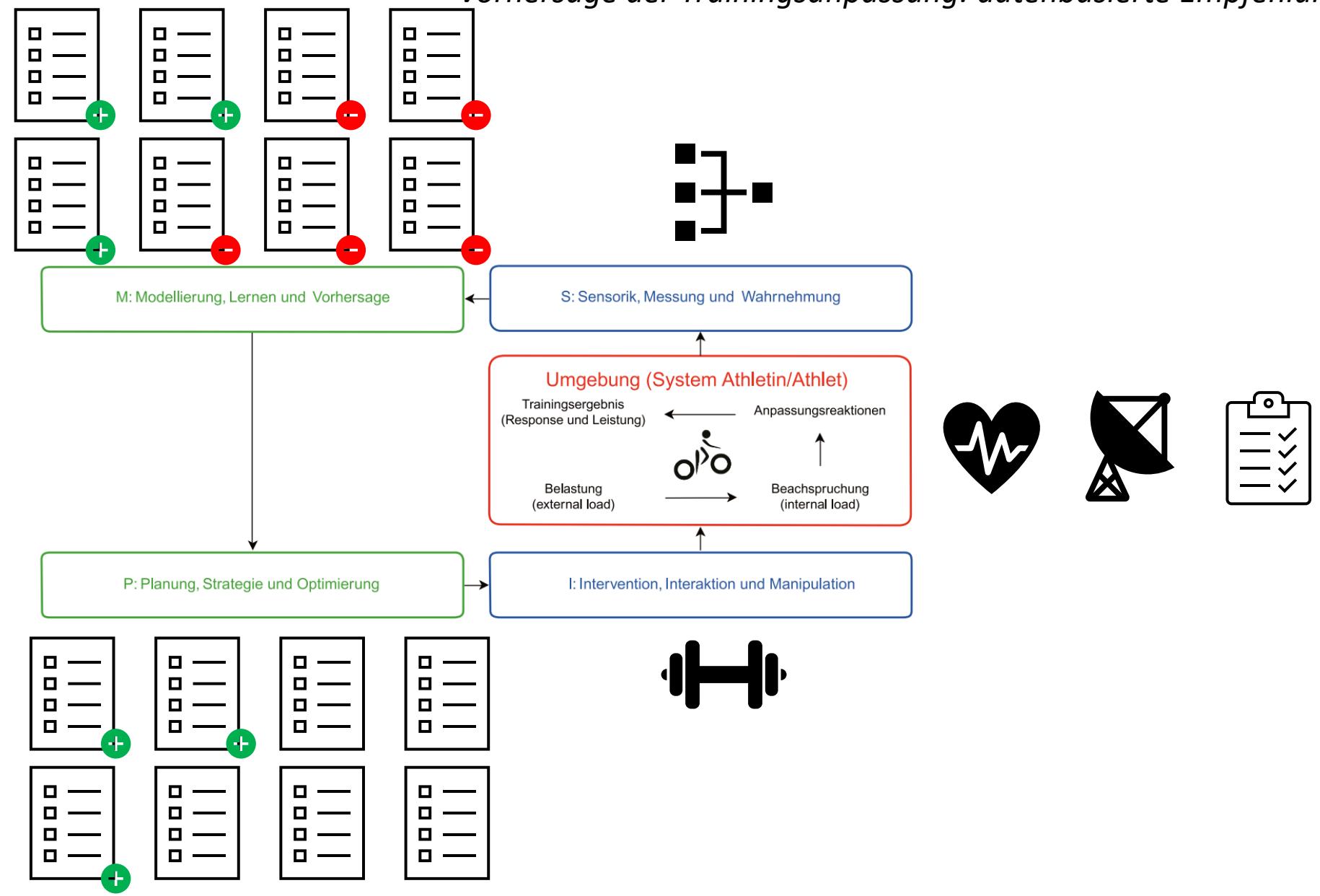
VBT

KEB

Off-Training

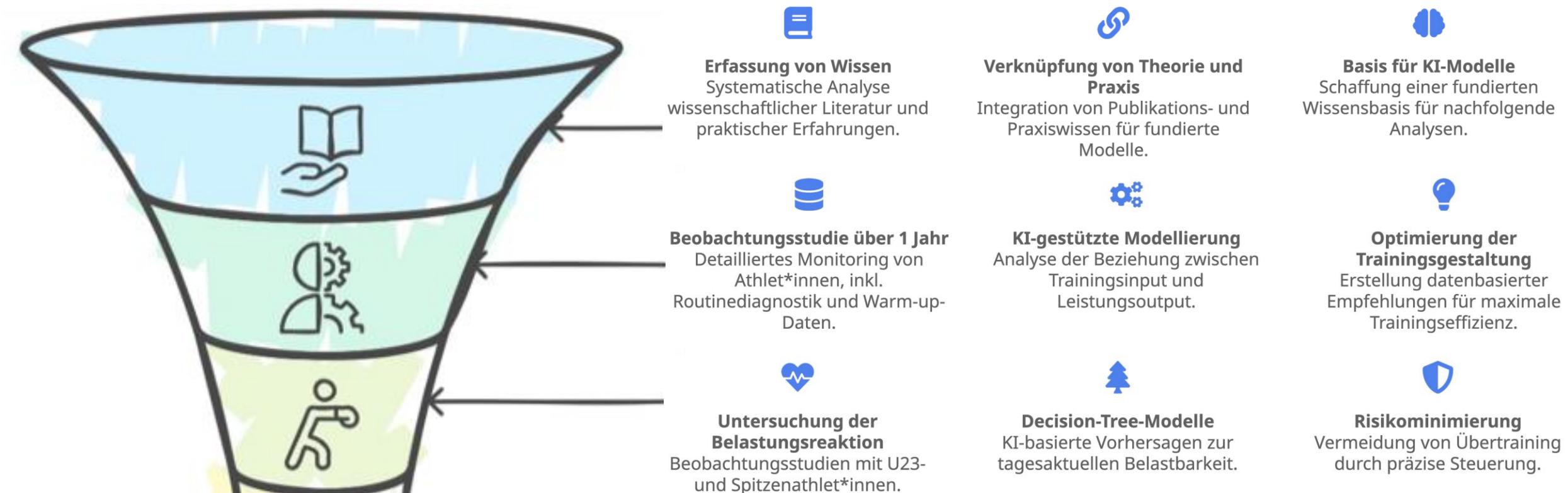
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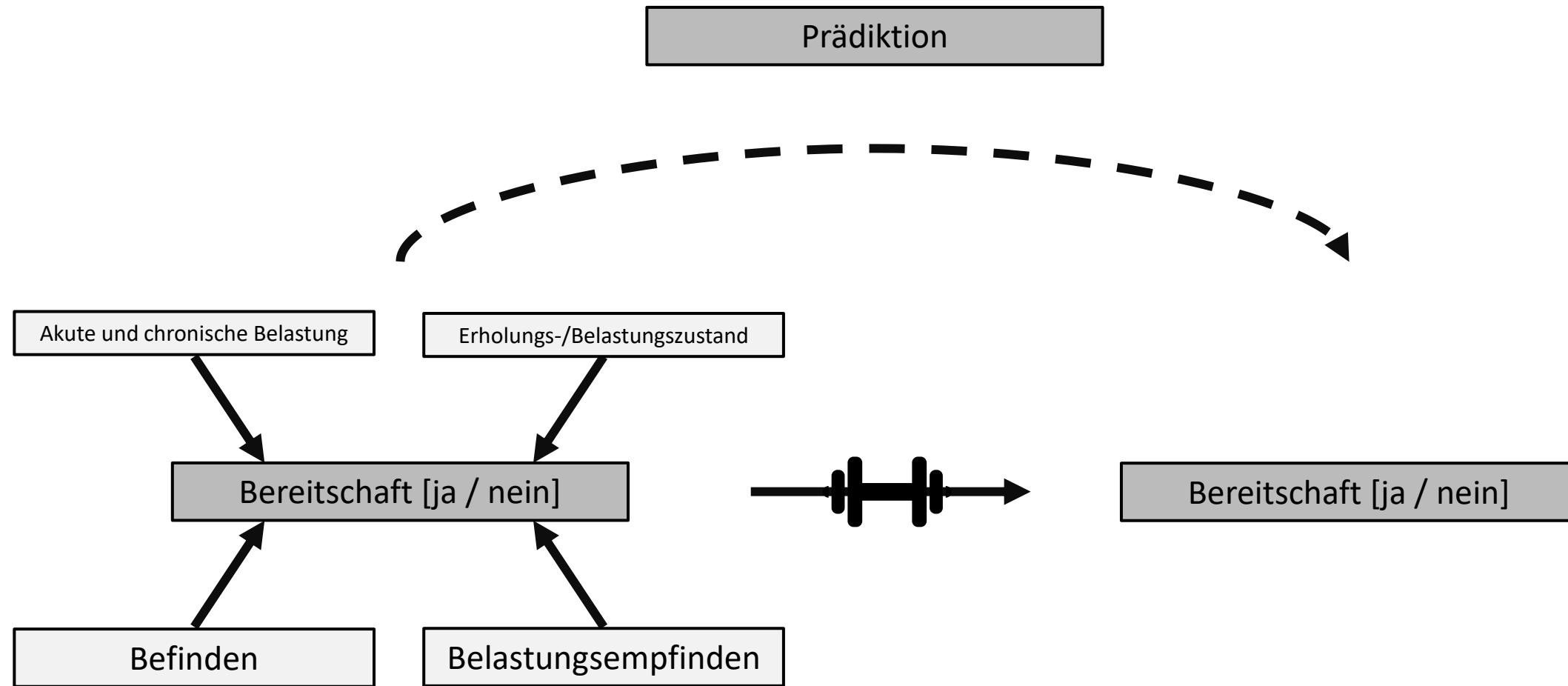
Vorhersage der Trainingsanpassung: datenbasierte Empfehlungen



Arbeitspaket 3: Belastungsverträglichkeit

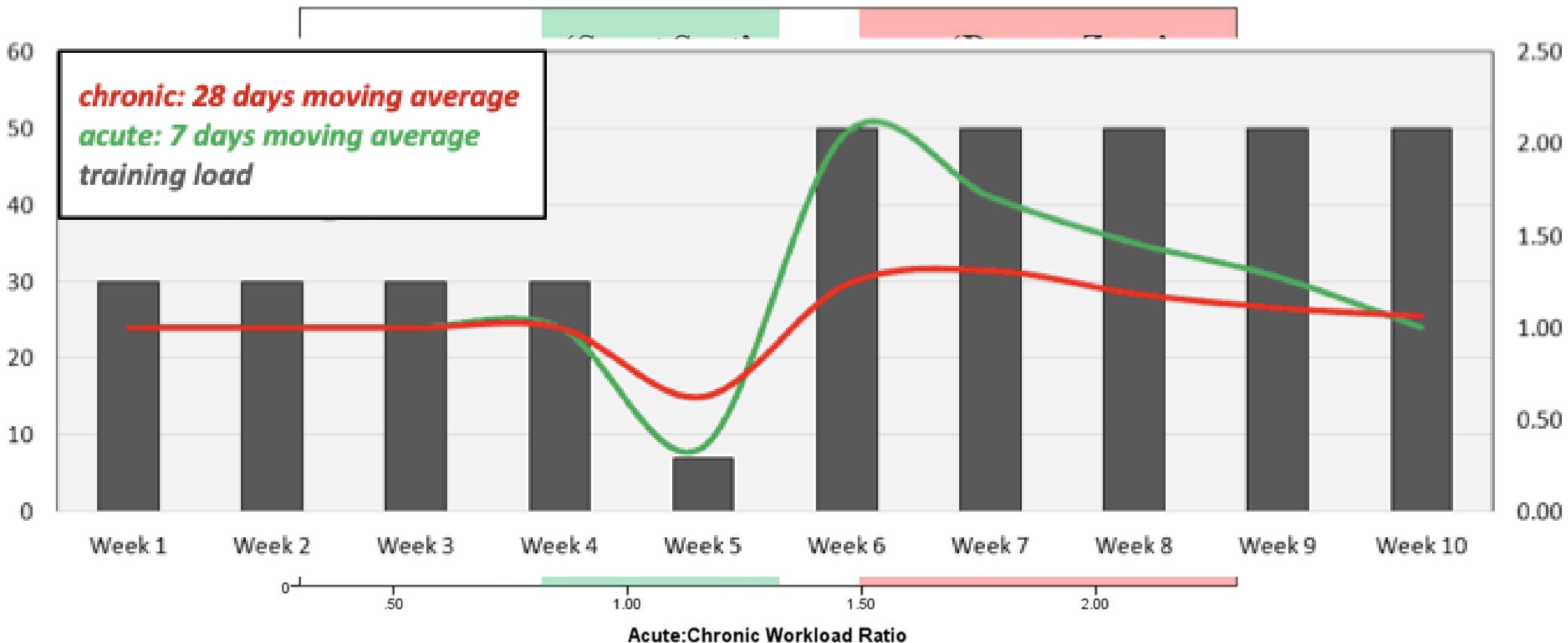
KI-Modelle zur Analyse der Trainingsbereitschaft





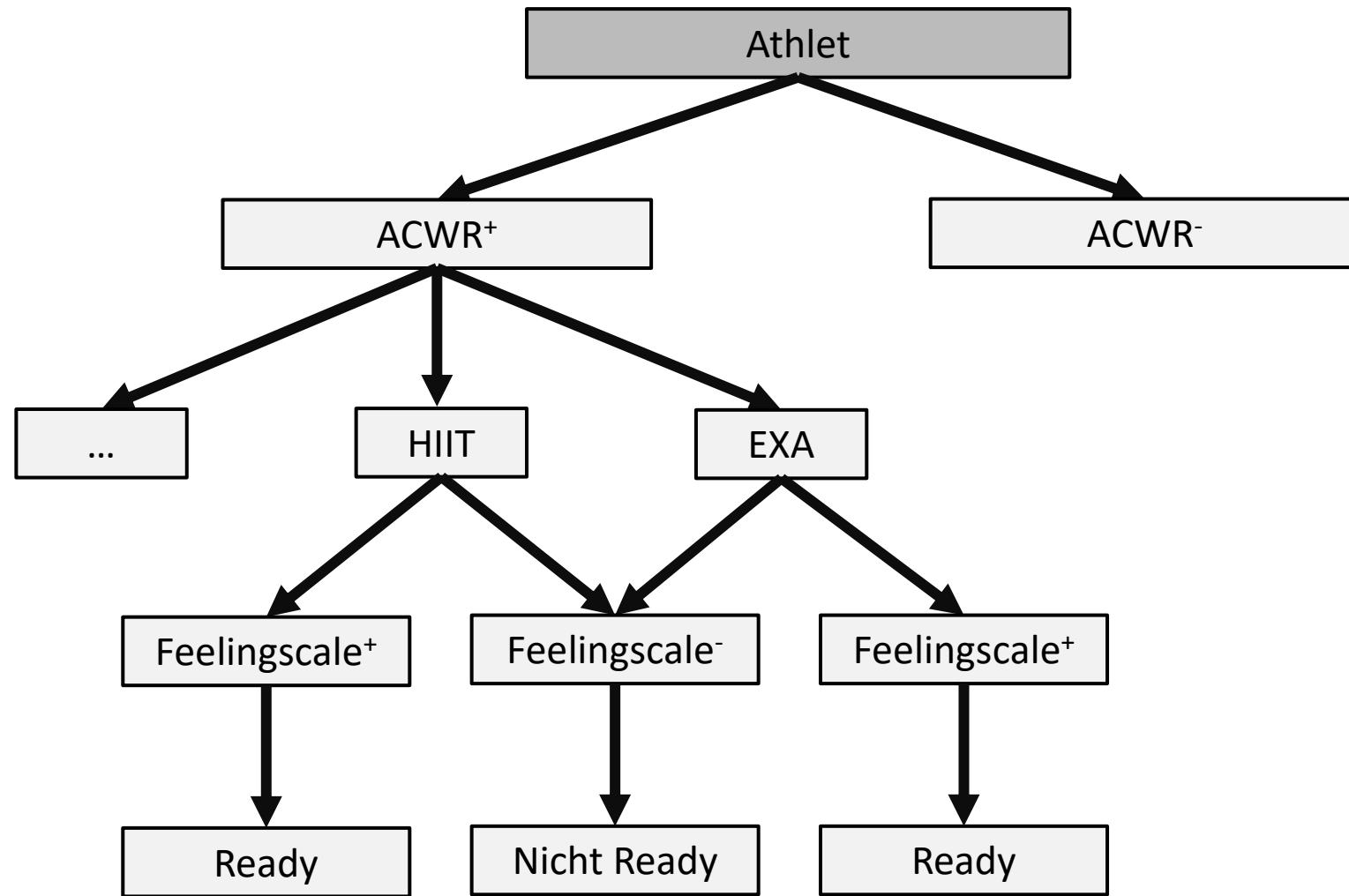
Arbeitspaket 3: Belastungsverträglichkeit

KI-Modelle zur Analyse der Trainingsbereitschaft: ACWR & TRIMP



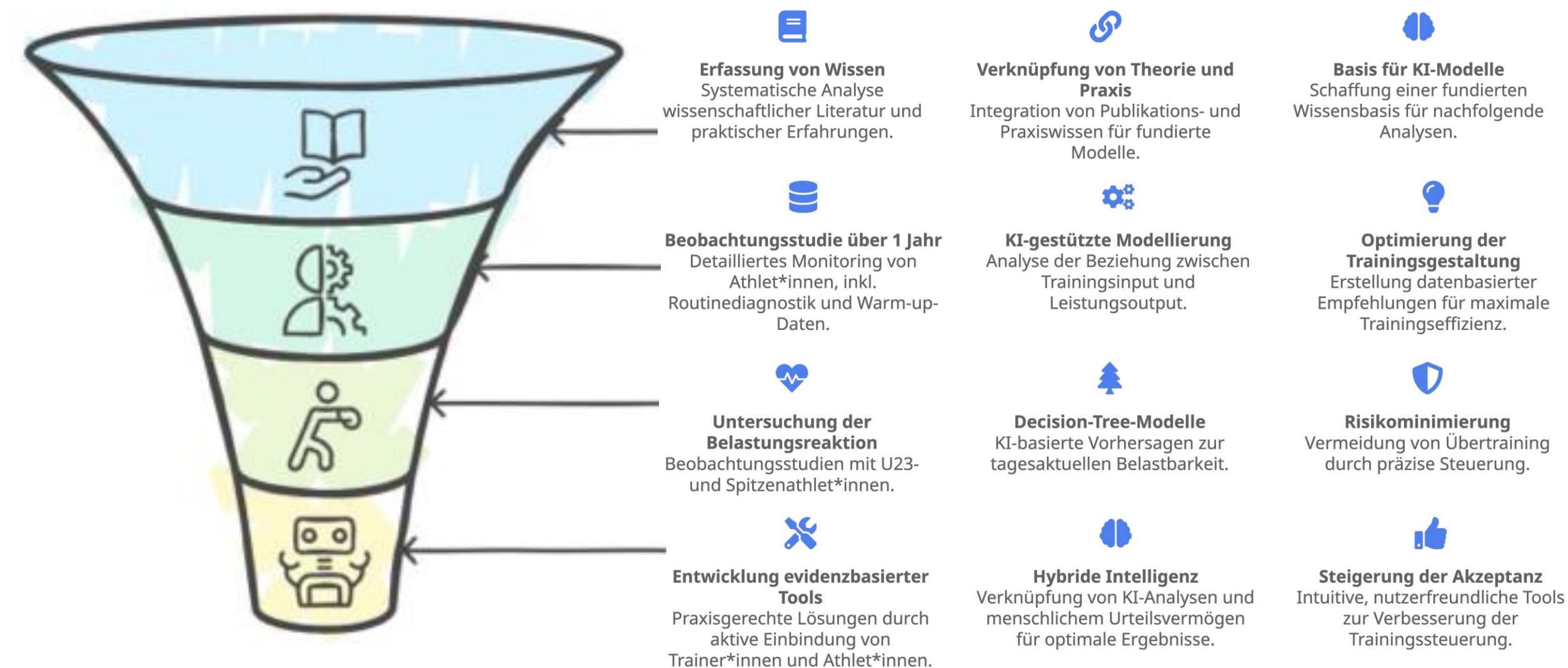
Arbeitspaket 3: Belastungsverträglichkeit

KI-Modelle zur Analyse der Trainingsbereitschaft: Decision Tree



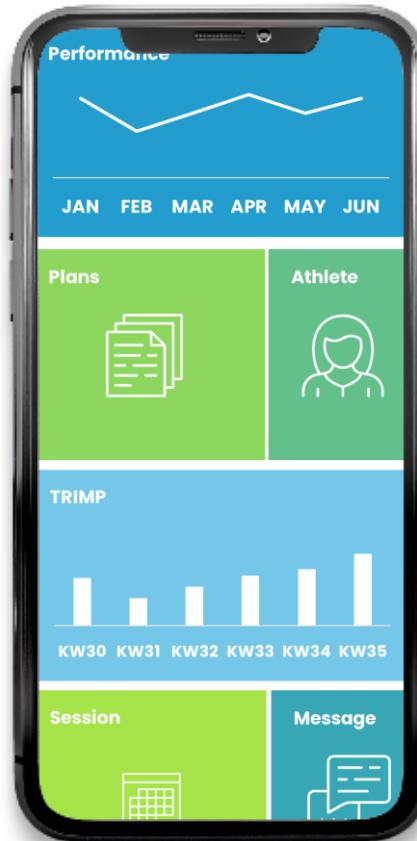
Arbeitspaket 4: Hybride Intelligenz & Tool-Entwicklung

Kombination von KI und menschlichem Wissen



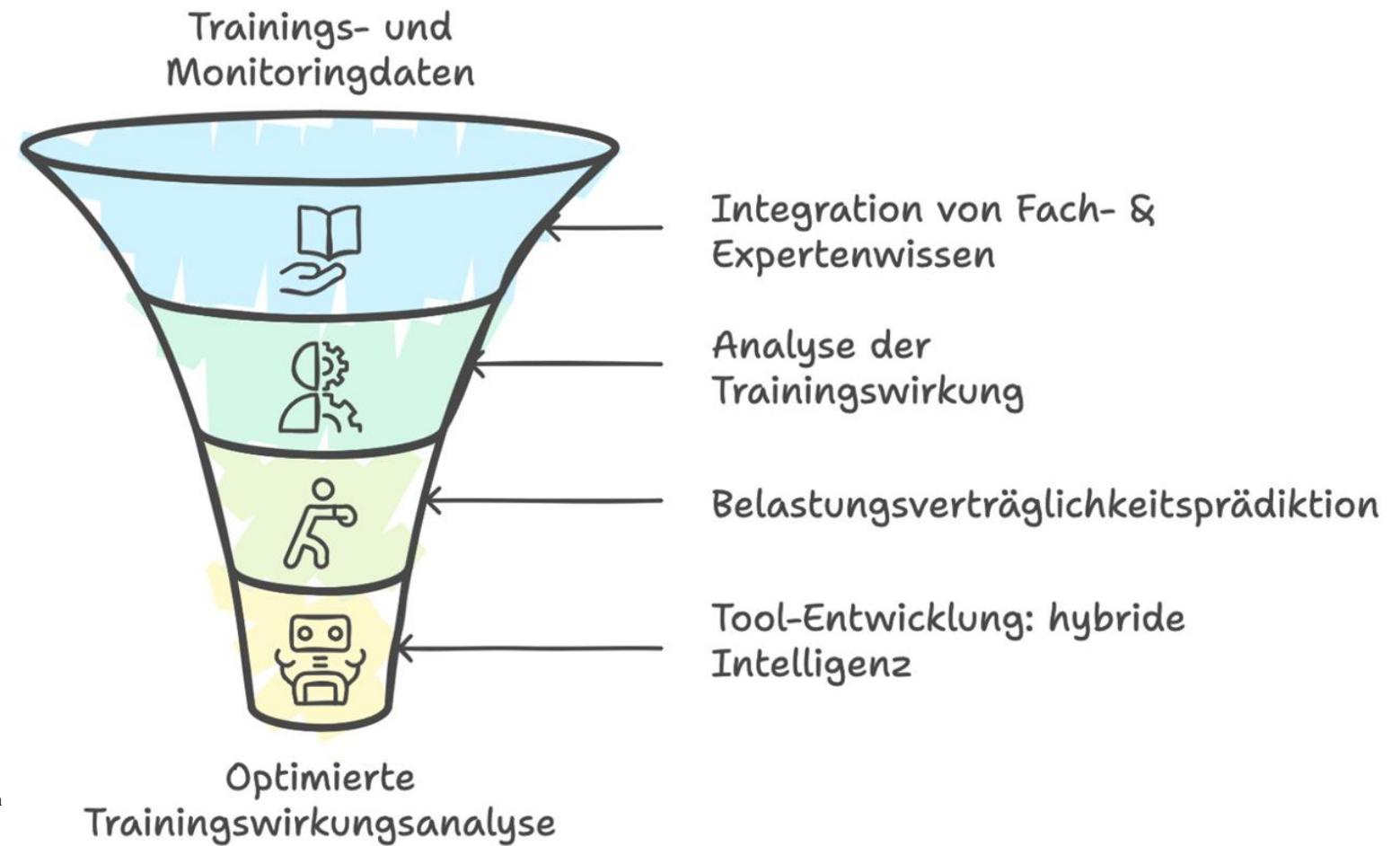
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