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Conference Abstract

Optimizing performance in cycling through machine learning

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Abstract: In professional sports, optimal performance requires a balance between training and subsequent recovery. To follow-up on this balance, it is important to monitor training load, symptoms of fatigue and predict changes in performance. At present, performance is mostly monitored and predicted based on white-box mathematical models, which were historically based on rigorously configured test protocols and taken under controlled settings with a moderate number of athletes. While these models have clear scientific evidence and provide great value, they are often too coarse grained to assess and predict subtle changes in performance. Moreover, in monitoring performance through e.g., lactate tests, the disruption of the athlete's training schedule can also not be neglected.

On the other hand, a lot of individual data is available from wearable sensors during training and in everyday life: physiological metrics such as heart rate and heart rate variability, performance metrics such as power and contextual metrics such as altitude. Recent advances in machine learning allow building a more personalized model for an individual athlete: the plethora of data that is available allows building a much more fine-grained and individualized model for monitoring and predicting performance. However, machine learning is facing its own challenges: it is essentially a black-box model and the data that is used is often noisy, as it is collected under non-controlled circumstances.

In this talk, we will explain how we will balance such white-box and black-box approaches. We present advanced machine learning models for approximating the performance measures based on this huge amount of individual data. More specifically, we will present specific machine learning modules for advanced performance monitoring such as estimating individualized fitness-fatigue levels, LT1/2 threshold prediction and automatic training anomaly detection.

Keywords: Performance; wearable sensors; machine learning