Towards a Unified Metric of Athletic Supremacy: The Ultimate Performance Index

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1 Background

Physical performance is a multifaceted phenomenon that cannot easily be reduced to a single parameter. Some individuals excel in strength, others in endurance or explosiveness. When five athletes, Filip, Isak, Calle, William and Max, decided to compete in a combined contest, a methodological challenge emerged: How can one fairly compare performances across different events that measure entirely different qualities?

To address this question the Ultimate Performance Index (UPI) is introduced. UPI is a normalization based measure that enables comparison across disciplines such as bench press and skierg. The purpose of UPI is to provide a combined performance value for each participant regardless of differences in unit of measurement or physiological demands.

2 Ultimate Performance Index (UPI)

Let n denote the nuber of events. For each event j a score S_{ij} is calculated for participant i according to:

- Maximizing event (e.g., bench press):

$$S_{ij} = \frac{P_{ij}}{max(P_{1j}, P_{2j}, ..., P_{mj})} \times 100, \tag{1}$$

- minimizing event (e.g., skierg time):

$$S_{ij} = \frac{min(P_{1j}, P_{2j}, ..., P_{mj})}{P_{ij}} \times 100, \tag{2}$$

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where P_{ij} represents the measured performance for individual i in event j, and m is the number of participants (in this case $m \in \{4, 5\}$).

The combined index is defined as

$$UPI_i = \sum_{j=1}^{n} S_{ij}.\tag{3}$$

A higher UPI indicates better overall performance. In this way each event contributes equally to the final outcome and the participants can be ranked on a common scale independent of the heterogeneity of the events.

3 Empirical Study

To validate the proposed Ultimate Performance Index (UPI), an empirical study was conducted with five participants: Filip, Isak, Calle, William and Max. The study included two events, bench press and skierg, although the framework allows for arbitrary extension to additional events.

3.1 Methodology

Each participant performed the specified events under comparable conditions. Raw data were collected in kilograms for bench press and in seconds for the skierg. The normalization and aggregation procedures described in the UPI section were then applied to transform the raw data into dimensionless scores on a common scale.

To facilitate real-time analysis and to minimize the risk of computational error, the competition employed a dedicated web-based implementation of the UPI calculator [1]. The tool was designed for direct input of raw results, automatic normalization, and instantaneous ranking of participants. This ensured both transparency and reproducibility of the evaluation process, thereby upholding the highest standards of experimental rigor.

3.2 Results

The quantitative results of the empirical study will be presented in this section.

Tables containing raw data, normalized scores, and the resulting Ultimate Performance Index (UPI) values for each participant are to be included.

At the present stage, this section requires further input and calculations, and the authors kindly request assistance in completing it.

4 Evaluation Criteria

To ensure the validity of the Ultimate Performance Index (UPI), an external evaluation criterion is applied. Although the mathematical formulation of UPI

provides an objective measure of relative performance, it is essential that the index also demonstrates logical consistency.

Accordingly, the criterion is defined as follows: if the participant Filip does not emerge as the top-ranked competitor according to UPI, then the index must be regarded as malformed and unsuitable for scientific use. This safeguard guarantees both methodological rigor and the preservation of internal coherence within the study.

References

[1] Ultimate Performance Index Live Calculator. (2025, August). Retrieved August 25, 2025, from https://ultimate-performance-index.netlify.app/