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EIH modeling classification ECSS

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Introduction: Exercise-Induced Hypoxaemia (EIH) phenomenon is present in some endurance-trained athletes. Its consequences on adaptations to exercise during acute and chronic exposure to altitude have been recently published [1], suggesting that responses to altitude training could be linked to it. Determined at sea level, considering the drop of oxygen saturation during a maximal exercise ([2]-[4]), EIH is not always detected in athletes before altitude training. Thus, the aim of this study was to determine EIH without a direct indicator of the phenomenon. As Artificial Intelligence (AI) and computational approaches are powerful and seems promising for sport sciences development [5] we used those approaches in this work.

Methods: To investigate this phenomenon, we used 127 endurance trained athlete's data measured during previous stress test including anthropological variables (age, height, weight and sex), physiological variables (heart rate, gas exchanges, start and end saturation) and training information (years of training, training volume and sport). Three data sets were created using those data: the first with raw (measured) values, the second using relatives (to the maximal measured) values and the last one using data resulting from a principal component analysis. Those data were then analyzed following two approaches, the first one is descriptive and the second predictive. The descriptive analysis is based on multiple clustering methods: k-means, hierarchical, DBSCAN and OPTICS. For the predictive part we build classifications models using a newest version of the Gradient Boosted Machine (GBM): Light Gradient Boosted Machine (LGBM) [6], whose parameters were tuned using the optuna framework.

Results: The descriptive analysis was not powerful enough to create clusters that were reflecting the status of the subjects (EIH or not and it's intensity). On the other hand, the predictive analysis that aimed to classify EIH or non-EIH athletes had a correct prediction in about 71% of the time (27 out of 38 in the test data set, with Kappa = 0.41). Furthermore, we were able to determine the most important factors used to discriminate EIH athletes: height, mean carbon dioxide consumption, weight and maximal carbon dioxide consumption. Those results show that Machine Learning (ML) method can be more powerful and allow new approaches.

Conclusion: Our study demonstrates that AI and especially ML could be applied to detect EIH afterwards. This possibility could be a supplemental tool for coaches and scientists and could allow to re-investigate data about altitude

training in order to better understand the inter-individual responses and individualize the monitoring of training sessions.

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