

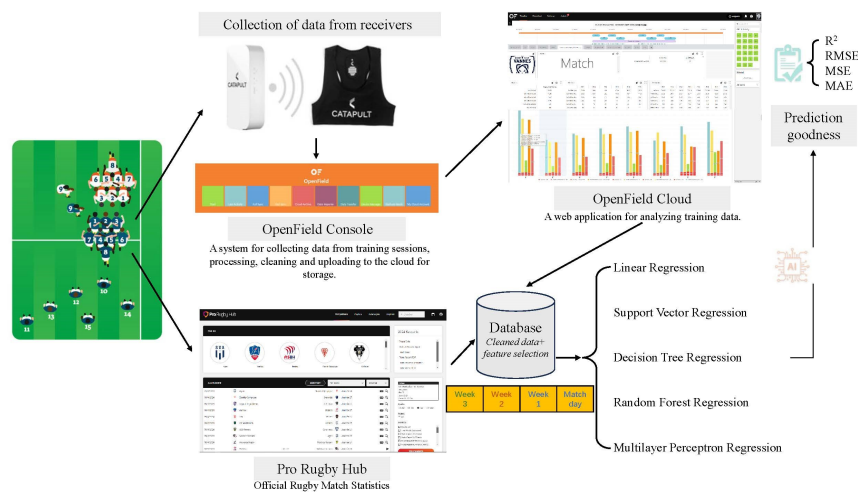
Machine learning in rugby union: Predicting key performance indicators for professional players in match play based on workload

Ren X.^{1,2}, Boisbluche S.³, Philippe K.⁴, Demy M.³, Äyrämö S.⁵, Ding S.¹, & Prioux J.²

East China Normal University¹, École Normale Supérieure de Rennes², Rugby Club Vannes³, University of Pau and Pays de l'Adour⁴, University of Jyväskylä⁵

xiangyu.ren@ens-rennes.fr

Rugby union is an intermittent high-intensity contact sport that involves a large number of training and match metrics. Time-motion analysis and video analysis have helped to better understand the interplay between these two factors. However, limited studies have investigated the effect of workload on key performance indicators (KPIs) during matches. In this study, sixty-three professional rugby union players were monitored over three seasons, and the data was filtered to meet three consecutive weeks of training during the season. Linear regression, support vector regression, decision tree regression, random forest regression (RFR), and multilayer perceptron regression machine learning (ML) methods were used to model the collected data. The superiority of the model was assessed by Pearson's correlation coefficient (R^2), Mean squared error (MSE), root mean square error (RMSE) and mean absolute error (MAE). Results showed that the RFR model produced the best performance ($R^2 = 0.61 \pm 0.09$, MSE = 0.03 ± 0.01 , RMSE = 0.17 ± 0.02 , MAE = 0.12 ± 0.02) among forwards and backs. Subsequently, using feature importance calculations and partial dependency plots, we found the RFR model demonstrated the highest accuracy among all models, which identified key workload metrics that significantly influenced performance, revealing specific thresholds for KPIs in both forwards and backs during matches. Thus, ML techniques can help coaches identify factors related to players' performance, thus driving them to properly manage their weekly workload.



Flowchart of the player key performance indicators performance prediction model.