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Using Machine Learning techniques in phenomenological studies in flavour physics

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In the recent years, a series of measurements in the observables $R_{K^{(*)}}$ and $R_{D^{(*)}}$ concerning the semileptonic decays of the B mesons have shown hints of violations of Lepton Flavour Universality (LFU). An updated model-independent analysis of New Physics violating LFU, by using the Standard Model Effective Field Theory (SMEFT) Lagrangian with semileptonic dimension six operators at $\Lambda = 1\,\mathrm{TeV}$ is presented. We perform a global fit, in order to assess the impact of the New Physics in a broad range of observables including B-physics, electroweak precision test, Higgs physics and nuclear β decays. We discuss the relevance of the mixing in the first generation for the observables with heavier lepton flavours. We use for the first time in this context a Montecarlo analysis of the likelihood function to extract the confidence intervals and correlations between observables. Our results show that a suitable strategy is to use a Gradient Boosting predictor as a proxy of the real likelihood function, and to analyze the SHAP values as a measure of the impact of each parameter of SMEFT Lagrangian in the fit.

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