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The DL Advocate: Playing the devil's advocate with hidden systematic uncertainties

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We propose a new method based on machine learning to play the devil's advocate and investigate the impact of unknown systematic effects in a quantitative way. This method proceeds by reversing the measurement process and using the physics results to interpret systematic effects under the Standard Model hypothesis.
We explore this idea with two alternative approaches, one relies on a combination of gradient descent and optimisation techniques, the other employs reinforcement learning.
We illustrate the potentiality of the presented method by considering two examples, firstly the case of a branching fraction measurement of the decay of a b-hadron, secondly the determination of the $P_5^{\prime}$ angular observable in $B^0 \to K^{*0}\mu^+\mu^-$ decays.
We find that for the former, the size of a hypothetical hidden systematic uncertainty strongly depends on the kinematic overlap between the signal and control channels, while the latter is very robust against possible mismodellings of the efficiency.

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