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Punzi-loss and Punzi-net, outperforming standard MVA techniques in the search for new particles of unknown masses

In this talk, we present the novel implementation of a non-differentiable metric approximation with a corresponding loss-scheduling based on the minimization of a figure-of-merit related function typical of particle physics (the so-called Punzi figure of merit). We call this new loss-scheduling a “Punzi-loss function” and the neural network that minimizes it a “Punzi-net”. We tested the Punzi-net on simulated samples of signal and background at the Belle II experiment. We show that in the search for new particles of unknown mass, for example, a new Z boson, the Punzi-net outperforms standard multivariate analysis techniques and generalizes well to mass hypotheses for which it was not trained. This work constitutes a further step towards fully differentiable analyses in particle physics.

Significance

We have obtained a result that can be of use to particle physics analysts, which will improve the optimization of the analyses aiming at the searches of new particles of unknown masses. We will provide access to a code repository for use.

References

The presentation will be based on a paper currently being prepared for submission to EPJ

Speaker time zone

Compatible with Europe

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