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Machine Learning techniques to explore scalar-fermion couplings

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The couplings of the 125 GeV Higgs are being measured with higher precision as the Run 3 stage of LHC continues. Models with multiple Higgs doublets allow potential deviations from the SM predictions. For more than two doublets, there are five possible types of models that avoid flavor changing neutral couplings at tree level by the addition of a symmetry. We consider a softly broken $\mathbb{Z}_2 \times \mathbb{Z}_2$ three-Higgs doublet model with explicit CP violation in the scalar sector, exploring all five possible types of coupling choices and all five mass orderings of the neutral scalar bosons. The phenomenological study is performed using a Machine Learning black box optimization algorithm that efficiently searches for the possibility of large pseudoscalar Yukawa couplings. We identify the model choices that allow a purely pseudoscalar coupling in light of all recent experimental limits, including direct searches for CP-violation, thus motivating increased effort into improving the experimental precision. An article with these results has been sent for publication.

Field of Research/Work

Particles and Fields

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