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DeepXS: Fast approximation of MSSM electroweak cross sections at NLO

The recent years have shown an exciting development in the scientific commmunity due to the interplay between new methods from data science and artificial intelligence, increasing computational resources and physics. The fundamental object of our theories of nature is the Lagrangian whose form is determined by the symmetries found already. A famous and well-motivated extension of the SM Lagrangian is given by an additional space-time symmetry, supersymmetry. However, this extension is not only one additional theory but instead is a manifold of infinitely many theories in a parameter space with 19 effective dimensions. The quest to judge whether our models for nature are still possibly true descriptions requires the careful statistical analysis of the sea of data that is provided by experiments, e.g. at the Large Hadron Collider, in the face of the standard model of particle physics. This inspection demands a fast and accurate evaluation of cross sections at least at the next-to-leading order. However, the currently available codes take several minutes to evaluate the cross section of one parameter point. With the help of deep neural networks, expert knowledge, stacking and active learning we create a tool, DeepXS, that is seven orders of magnitude faster and only needs microseconds to calculate the cross section of supersymmetric electroweak pairs produced at the LHC with errors that are lower than the scale and PDF uncertainty. In this talk we will present how we created the AIs in DeepXS, demonstrate its performance and discuss subtleties of its validity.

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