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Enforcing Self-Consistent Kinematic Constraints in Neutrino Energy Estimators

Machine learning algorithms have long been utilized across many experimental collaborations within the neutrino physics community in applications to ascertain the singular kinematic quantity of initial neutrino energy for use in neutrino oscillation analyses. However, most of these algorithms do not incorporate a coherent physical picture of initial neutrino kinematics, opting to introduce loss functions involving knowledge of only $|p_\nu|$. Here, we argue for the introduction of composite loss functions utilizing the full kinematic description of the neutrino, $p_\nu \equiv (E, p_x, p_y, p_z)$, compiling all relevant energy and angle information consistently. The use of such a fully defined variable can be seen as a usage of Physics Informed Machine Learning.

Working Group

WG 2: Neutrino Scattering Physics

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