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AI-Enhanced Magnetic Field Measurements

The measurement of the muon anomalous magnetic moment depends on a precise measurement of the muon anomalous precession frequency and the magnetic field. For magnetic field measurement, as the field that muons experience cannot be directly measured, the multipole fitting interpolation method is generally employed. In recent years, integrating physical laws into machine learning has made progress in solving PDE equations. We use a physics informed machine learning method, combining Maxwell's equations with machine learning, to predict magnetic fields in non-directly measurable areas based on a few external field measurements, achieving precise results with simulation data. We have also constructed a Helmholtz coil device to verify the method and obtained some promising results. The method is expected to assist in magnetic field monitoring for the J - PARC muon g - 2 experiment, thereby enabling better control of the muon beam. Furthermore, we aim to refine the method through further research to achieve precise magnetic field measurement and prediction in the future.

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