Abstract Submitted
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Machine Learning and Data Analytics for Reduction, Extraction, Enhancement, and Analysis in Plasma and Fusion Systems[1] CRAIG MICHOSKI, DAVID HATCH, TODD OLIVER, MILOS MILOSAVLJEVIC, SALOMON JANHUNEN, GABRIELE MERLO, MIKE KOTSCHENREUTHER, University of Texas at Austin — Advancements in machine learning (ML), artificial intelligence (AI), advanced data analytics (ADA), and uncertainty quantification (UQ) provide tools to evaluate classical plasma and fusion systems in new, and often conceptually revolutionary ways. As examples, uncertainty quantification (UQ) and Gaussian process regression are used to examine the advanced *analytics* of plasma profiles, revealing unexpected features (e.g. signed gradients) in diagnostic data. Next, multifidelity frameworks can be used to develop unbiased low variance *reduced* order estimators of expensive models (e.g. EDIPIC, GENE, XGC), that are propagated forward to minimize uncertainties in measurable quantities. In addition, deep learning networks are used to *extract* predictive models (e.g. parameterized equations representing derived plasma subsystems, such as, for example, the Dimits shift, or experimental diagnostics) from data, where new, hidden structures within the data can be extracted to develop more accurate, cheaper, and more stable modeling frameworks. Finally, theoretical (i.e. physical) models can be *enhanced* with data – e.g. experimental data used to extend MHD type models) ; or vice versa, enhancing experimental data acquisition with theory and models.

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