

PiAI Seminar Series: Physics informed AI in Plasma Science
9:30-10:30, 08 February 2021 (CET)
17:30-18:30, 08 February 2021 (JST)
Web Seminar

Data Learning: Integrating Data Assimilation and Machine Learning in real world applications

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Data Assimilation (DA) is the approximation of the true state of some physical system by combining observations with a dynamic model. DA incorporates observational data into a prediction model to improve forecasted results. These models have increased in sophistication to better fit application requirements and circumvent implementation issues. Nevertheless, these approaches are incapable of fully overcoming their unrealistic assumptions. Machine Learning (ML) shows great capability in approximating nonlinear systems, and extracting high-dimensional features. ML algorithms are capable of assisting or replacing traditional forecasting methods. However, the data used during training in any ML algorithm include numerical, approximation and round off errors, which are trained into the forecasting model. Integration of ML with DA increases the reliability of prediction by including information with a physical meaning. This work provides an introduction to Data Learning, a field that integrates Data Assimilation and Machine Learning to overcome limitations in applying these fields to real-world data. The fundamental equations of DA and ML are presented and developed to show how they can be combined into Data Learning. We present a number of Data Learning methods and results for some test cases, though the equations are general and can easily be applied elsewhere.