

PiAI Seminar Series: Physics informed AI in Plasma Science
10:00-11:00, 5 June 2023 (CEST)
11:00-12:00, 5 June 2023 (EEST)
17:00-18:00, 5 June 2023 (JST)
Web Seminar

Application of Bayesian optimization for accelerating model validation

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Magnetic confinement fusion research is characterized by expensive experiments, limited and noisy diagnostic information, and computationally costly physics models with uncertain, phenomenological input parameters. In such an environment, scientists conduct hypothesis testing based on limited information, and quantification of uncertainties would be central to assess the degree of belief on the inferred conclusions. Bayesian inference (BI) algorithms provide a principled approach to quantify the uncertainty for the state of the investigated system or hypothesis validity, given the available information [von Toussaint, Rev. Mod. Phys. 2011]. When operating with computationally costly models or limited experimental resources, data-efficiency is key to maximizing the information gain for each sample. Such efficiency can be achieved by combining Bayesian optimization (BO) with the overall BI task. This presentation discusses BI and BO work performed within or in close connection to the EUROfusion Advanced Computing Hub, hosted by the University of Helsinki (ACH 5). The primary example application is focused around simulations of runaway electrons in tokamak disruptions [Järvinen, J. Plasma Phys., 2022].