Abstract Submitted
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Evolution patterns and parameter regimes in edge localized modes on the National Spherical Torus Experiment[1] DAVID R. SMITH, R.J. FONCK, G.R. MCKEE, Univ of Wisconsin, Madison, A. DIALLO, S.M. KAYE, B.P. LEBLANC, PPPL — We implement unsupervised machine learning techniques to identify characteristic evolution patterns and associated parameter regimes in edge localized mode (ELM) events observed on the National Spherical Torus Experiment. Multi-channel, localized measurements spanning the pedestal region capture the complex evolution patterns of ELM events on Alfven timescales. Some ELM events are active for less than 100 micro-s, but others persist for up to 1 ms. Also, some ELM events exhibit a single dominant perturbation, but others are oscillatory. Clustering calculations with time-series similarity metrics indicate the ELM database contains at least two and possibly three groups of ELMs with similar evolution patterns. The identified ELM groups trigger similar stored energy loss, but the groups occupy distinct parameter regimes for ELM-relevant quantities like plasma current, triangularity, and pedestal height. Notably, the pedestal electron pressure gradient is not an effective parameter for distinguishing the ELM groups, but the ELM groups segregate in terms of electron density gradient and electron temperature gradient. The ELM evolution patterns and corresponding parameter regimes can shape the formulation or validation of nonlinear ELM models. Finally, the techniques and results demonstrate an application of unsupervised machine learning at a data-rich fusion facility.

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