

PiAI Seminar Series: Physics informed AI in Plasma Science
10:00-11:00, 05 July 2021 (CET)
17:00-18:00, 05 July 2021 (JST)
Web Seminar

"ML of the nonlinear dynamics and chaos in a one-dimensional plasma diode system"

Hae June Lee

*Department of Electrical Engineering, Pusan National University, Pusan,
S. Korea*

Abstract

Deep learning is an emerging technology for optimization and prediction in computation-intensive and data-intensive engineering problems. Particularly, in the case of plasma systems, it is difficult to predict the results due to instabilities caused by nonlinear interaction. In this presentation, a deep learning technology is investigated to create a classification model and to analyze accuracy by applying AI to a non-predictable nonlinear plasma system, called the Pierce diode. With the variations of three input parameters, algorithms have been developed to automatically classify oscillation patterns by checking raw data of electric field intensity, the spectrum of Fourier transform, and the oscillation patterns in phase space. Training and test data are generated for the prediction of plasma state. The machine learning multinomial classifier that predicts the plasma state and the neural network system of deep learning was constructed to compare the self-oscillation and chaos. By verifying the prediction performance and accuracy of the proposed method, it was found that this study shows a high accuracy prediction result compared with the time-consuming direct simulation cases. Based on the analytical technique, it is proposed to build a prediction system for a complicated two-dimensional particle-in-cell (PIC) simulation as a final goal.