Abstract Submitted
for the GEC19 Meeting of
The American Physical Society

Machine Learning for Low Temperature Plasma Diagnostics BHASKAR CHAUDHURY, NIRBHAY RAM, AGAM SHAH, DA-IICT, Gandhinagar, India, 382007, HIMANSHU TYAGI, MANAS BHUYAN, KAUSHAL PANDYA, MAINAK BANDYOPADHYAY, ITER-India, IPR, Gandhinagar, India, 382428 — Langmuir Probe based measurements of the current (I) at various applied voltages (V) is probably the simplest way to diagnose low temperature plasmas. The standard (classical) approach requires analysis of different regions of the I-V curve for the determination of plasma parameters (electron density, temperature etc.). However, the classical approach can be error prone if there is a significant noise (due to collisions, RF noise, magnetic field etc.) in the Langmuir probe data resulting in inaccurate plasma characterization. To address this issue, we have developed a Machine Learning (ML) based algorithm to interpret the Langmuir probe based I-V data obtained from ROBIN (inductively coupled single RF driver based negative ion source) experiments, wherein we have explored Convolutional Neural Networks (CNNs) for determining the plasma parameters. Our analysis indicates that the classical approach is reasonably effective in measurement of plasma parameters, however this method is practically not accurate enough for experimental data with significant noise component and ML based method offers much better accuracy in such cases. The primary reason is that CNN based algorithm adaptively exploits the pattern in the I-V data unlike the classical model which uses fixed rules for the interpretation of the data. By performing extensive statistical analysis of the results, we have studied network's robustness, accuracy and computational demands compared with the classical approach.

Bhaskar Chaudhury
DA-IICT, Gandhinagar, India, 382007

Date submitted: 01 Jun 2019 Electronic form version 1.4