A Machine Learning Approach for the Determination of Upper Hybrid Resonance Frequencies Observed by Arase

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Electron number density is a key parameter for discussions of plasma wave generation/propagation, and wave-particle interaction in the inner magnetosphere. The High Frequency Analyzer (HFA) is a subsystem of Plasma Wave Experiment (PWE) aboard Arase [Kasahara et al. (2018), Kumamoto et al. (2018), Miyoshi et al. (2018)]. The HFA measures electric field spectra in a frequency range from 10 kHz to 10 MHz, which covers a typical frequency range of Upper Hybrid Resonance (UHR) frequency in the inner magnetosphere. Kumamoto et al. (2018) proposed the semiautomatic method for the identification of UHR frequency by computer and a human operator. However, it takes a enormous effort of a human operator.

We propose an automatic determination system of UHR frequency by machine learning. Machine learning is a technique in the field of artificial intelligence to give computers the ability to learn with data. In this study, we defined the task of UHR frequency determination as supervised regression that a computer estimates UHR frequencies using the dataset composed of electric field dynamic spectra with correct UHR frequency labels. We adopted the random forest regressor [Breiman (2001)] as a machine learning algorithm. Our method calculates the maximum and standard deviation of observed spectrum intensities for each frequency as a feature vector of machine learning inputs. In this study, we introduce our machine learning approach and initial results for determining UHR frequency from electric field spectra observed by PWE/HFA.