Detection of Radio Frequency Interference in Microwave Radiometry using a Supervised Classification Method

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Over the past decade, an increasing amount of RFI contamination has been observed in passive microwave remote sensing measurements due to human-made RFI signals, which leads to erroneous retrieval of critical geophysical parameters. To overcome this problem, several detection and mitigation algorithms have been proposed and implemented with limited success in cases of weak and noise-like interference.

In this study, detection of Radio Frequency Interference (RFI) in microwave radiometry using a supervised classification method, specifically support vector machine (SVM), is proposed. Implementation of this method requires exploiting distinct features of RFI contamination extracted from the retrieved data to get the optimal classification margin that maximizes the separation between RFI-free and the RFI-contaminated measurements. A dataset where the class labels of RFI-free and the RFI-contaminated data are manually determined is used to train the method, and the class label of radiometer measurements will be decided based on the classification margin determined by the training data.

We have implemented this method on simulated data where RFI-free radiometer measurements are modeled as Gaussian noise, and RFI-contamination is simulated by injecting a pulsed sinusoidal signal with variable power and duty cycle. The initial analyses show performance improvements in comparison with traditional RFI detection methods such as time-domain pulse blanking and kurtosis detection, especially for low interference to noise ratio cases.

Herein, first, we will be presenting the results of our simulation studies. Then, implementation of the proposed algorithm on the geolocated measurements from NASA's Soil Moisture Active Passive (SMAP) radiometer will be discussed. A high dimensional feature space is extracted using SMAP's Level 1A data, and the RFI detection efficiency of the SVM method utilizing this space is evaluated against SMAP's own algorithms.