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# Machine Learning Investigations for the Detection of 5G RFI in Microwave Radiometry

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Satellite observations of the atmosphere by passive microwave sounders are crucial for weather forecasts. They provide the highest-impact input data for weather forecasts because microwave wavelengths can penetrate through clouds. That enables microwave sounders to uniquely provide 3D measurements of atmospheric temperature and humidity in all weather conditions, day or night, and over every part of the globe.

Most of the specific microwave frequencies used by operational sounders are "protected" by international and national regulations. However, intentional and unintentional signals within or in adjacent bands can cause Radio Frequency Interference (RFI) and impact significantly the sounding observations and weather forecasts in turn [1].

Recently, the development of 5G wireless technology and the deployment of the 5G network in bands adjacent to or on top of sounding frequencies threatens the future of weather forecasting. Future microwave sounders will require RFI detection capabilities, however this is not a solution, detecting 5G RFI is expected to be challenging due to the nature of the 5G signals themselves. And, mitigation (subtraction of RFI, leaving a usable observation) is not practical. Therefore, detection (and discarding of contaminated data) is the goal.

We will describe investigations into 5G RFI detection algorithms using machine learning (ML). A large set of simulated 5G signals are generated and a portion are used to train ML algorithms. The performance of these algorithms is then tested using the remainder of the simulated signals. The challenges posed by the nature of 5G signals will be described, and the detection performance will be characterized and evaluated. The suitability of ML algorithms for use by satellite sounders will be examined from the point of view of computational complexity, on-board resource availability, and data downlink capacity, as well as considering the dynamic nature of 5G systems and signals, and alternatives to ML approaches.

## References

[1] Radio-Frequency Interference (RFI) Workshop, Final report, European Centre for Medium-Range Weather Forecasts, Reading, UK, 13-14 September 2018.