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Learning Enhanced Detection of Radionuclide Anomalies

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Atmospheric concentrations of radionuclides measured at International Monitoring System (IMS) stations can vary by an order of magnitude or more between neighboring stations and from one collection to the next due to changes in weather, emission rates of background sources and other local factors. Large spatiotemporal changes make it difficult to categorize elevated collections as anomalies of interest or something benign. Simple univariate quantile scores are easy to calculate from time series of individual radionuclides at single IMS stations, but they do not account for correlated anomalies across different collections or different isotopes within a collection. In this presentation, we demonstrate the advantages of using machine learning algorithms routinely used to detect fraudulent activity in the financial industry for identifying radionuclide anomalies. Unsupervised machine learning anomaly detection algorithms, such as isolation forests and local outlier factors, can provide quantitative scores that consider a multitude of information. These algorithms run quickly, are easy to train, and, with relatively little effort, could be automated to process streaming IMS data. We also demonstrate supervised machine learning approaches, such as Bayesian ridge regression, to improve radionuclide anomaly detection through the incorporation of simulated signals from one or more atmospheric transport models.

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Promotional text

This contribution shows how the detection of anomalies of atmospheric radioactivity can be enhanced and streamlined using machine learning algorithms designed for automated fraud detection in the financial industry.

Oral preference format

in-person

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