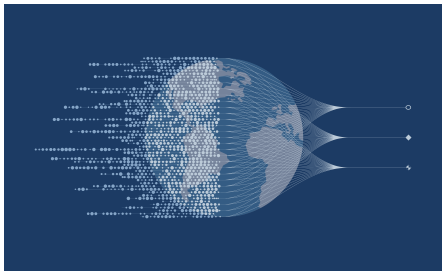

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Particulate Filters from the IMS Based on Machine Learning as a Means of Identifying Anomalies

The presence of radioactive particles and their nuclide mixture in the air is measured by gamma ray spectra through International Monitoring System radionuclide stations to help detect nuclear explosions. These gamma ray spectra are reported to the International Data Centre by each radionuclide station. We use supervised machine learning to show that the radionuclides present in each sample and detector characteristics are unique to each station. After collecting over 200 000 spectra and training to classify each spectra by its radionuclide station of origin, we achieved 95% balanced validation accuracy. We show how this ability stems from both the radionuclide mixture present on the filter and the electrical characteristics of the detection equipment. By indicating spectra which are unrepresentative of a certain station and flagging for possible data corruption, this capability has implications for anomaly detection within the overall International Monitoring System as a system and can therefore improve system operation. Additionally, we also achieved similar results with sequence models, which can adapt to different resolution of spectra. We also comment on the capabilities and benefits afforded by unsupervised learning for data quality analysis and other anomaly detection.

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