Radiochemistry and AI: Development of a Targeted Emergency Response and Recovery System Using ML Algorithms for Use After a Nuclear Event

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In 2011, the Fukushima Daiichi nuclear disaster released a considerable amount of radioactive materials into the environment. In the time after the disaster, the government had a deficit of data about what radioactive materials were released, preventing them from activating data driven response until months after the disaster. The research objective was to create a system to conduct real time threat analysis for predictive targeted rapid emergency response through artificial intelligence (AI). The system created follows a four steps process: image classification with artificial neural networks (ANN), the analytical capability of semiconductor detectors, airborne particulate sampling, and machine learning algorithms for data analysis. Lichen and filamentous algae were identified as accurate bioindicators. The ANN was then trained to classify images as having presence of the both bioindicators, the species, bioindicator/ft2, and GPS coordinates. Filamentous algae was incubated under artificial conditions using river water. UAVs were flown to analyze the counts/sec in the air and capture airborne particulates for sampling. Pulse height histograms were analyzed through three machine learning algorithms for threat analysis. The system outputs a composite threat score, radionuclides, radionuclide concentration, probabilistic effect on the environment, the predictive response recommended, and overlays it on the 3D modeled environment. All data generated is incorporated into a platform in which public health officials can use in order to direct responders to separate areas and plan the response pathways that will minimize nuclear damage, proving to work in a fast paced manner for governmental intervention in the event of a nuclear disruption, streamlining the entire process.

Awards Won:

Second Award of $2,000

University of Arizona: Tuition Scholarship Award