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Project Idea: Explaining Radiation Anomalies with Machine Learning

Abstract:

In the aftermath of the 2011 Fukushima accident, the ability to detect for anomalies in radiation levels received renewed interest. Background radiation is present everywhere, and is known to fluctuate quite significantly with respect to weather conditions, time of day, seasonal variations, and environmental factors. A spike in radiation levels may not be caused by the accidental release of dangerous radioactive isotopes due to a nuclear power plant lost of containment accident or a vehicle carrying medical radioactive isotopes spilling its contents in an accident. The spike may be caused by precipitation or higher than normal humidity, which has been known to cause radiation levels to increase quite substantially above normal background levels due to the release of radioactive radon gas from the ground; caused by precipitation and high humidity. Another natural cause for increase radiation levels is the concentration of natural uranium and thorium in building materials such as granite, which have been known to increase background radiation levels as significant as precipitation and high humidity levels. These radioactive sources are relatively harmless unless a person is exposed to them for very prolonged periods of time in the timescale of decades. In the case of radon gas, the background radiation levels will go back to normal once the precipitation stops and the humidity level decreases.

At UIUC, the RDII research group in the nuclear engineering department is currently in the process of deploying a mobile sensor network comprised of smart phones paired with very small handheld radiation detectors to collect and stream radiation data to the cloud along location, velocity, and timestamp data. For this project, we will analyze this data with machine learning techniques in an attempt to learn if high radiation levels are caused by an environmental factor or actual radiation leak. This will involve using a library such as LB java to apply a set of machine learning techniques to the data. We also have to create several features related to weather and monument location. We have already started making these features. Many Ideas for the features came from the papers below.

Papers:

ClariSense+: An Enhanced Traffic Anomaly Explanation Service Using Social Network Feeds,

[http://www.sciencedirect.com/science/article/pii/S1574119216000444](https://webmail.illinois.edu/owa/redir.aspx?C=jROXlVsn5p2v1HgpUfWh0NIwEXeOSlcPmYzNFhc-4VEXEPgyFGjUCA..&URL=http%3a%2f%2fwww.sciencedirect.com%2fscience%2farticle%2fpii%2fS1574119216000444)

Machine Learning Techniques for Anomaly Detection: An Overview <https://pdfs.semanticscholar.org/0278/bbaf1db5df036f02393679d485260b1daeb7.pdf>