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Monitoring and Predicting Air Quality in Ulaanbaatar, Mongolia Using IoT IoT

John C. Burke
Minnesota State University, Mankato, john.burke@mnsu.edu

Michael Hart
Minnesota State University, Mankato, michael.hart-2@mnsu.edu

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John C. Burke
Minnesota State University, Mankato
john.burke@mnsu.edu

Michael J. Hart
Minnesota State University, Mankato
michael.hart-2@mnsu.edu

Abstract

Air quality is a concern for people living all over the world. Pollutants in the air we breathe causes quality of life issues for everyone, particularly for those who are at risk, such as the very young, the elderly and those with lung disease. At very high levels, even healthy people suffer adverse effects. Ulaanbaatar, Mongolia is a city of a million and a half people, in Central Asia, surrounded by high hills. In the winter temperatures average below 0 degrees C from November to March, and most of the city is heated by coal. Beginning in 2015, the U.S. State Department has been monitoring the air quality at the US Embassy in Mongolia, and that data is available online through the Internet of Things, (IoT). Using this data we are seeking to use Extreme Value Analysis to predict future maximum levels of pollutants during the year, so that organizations within the country can plan appropriately.

One of the benefits of continuous monitoring using IoT, is that data that in the past was difficult or extremely costly to get is becoming much more available. Because of this, one type of analysis that is becoming more common is Extreme Value Analysis, where statistics such as the maximums or minimums of samples are studied, as opposed to the more common analysis of mean averages. While a mean is often a very important measure of a population, it may not be the most interesting statistic. For example, when building a bridge over a river, the expected water level of the river is important, but far more important would be the expected highest water level over the next ten years, especially during periods of flooding. Likewise, when measuring levels of air pollution, the average level of pollution is important, but knowing when the highest and lowest levels of pollution during the day might be critical, especially for people in sensitive groups. The data that is available indicates strong seasonality, making the dataset an excellent teaching tool for educators wanting to demonstrate statistical techniques necessary for handling such data, while the specific technique, Extreme Value Analysis, is quite appropriate to the study of pollution and other environmental issues.

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