Acid rain

Acid rain effects on water bodies can have deleterious consequences on aquatic as well as human life. The toxic chemicals constituted in the atmosphere right above the water surfaces when combined with rain, will cause them to increase the concentrations of these water, lower their pH and elevate the levels of hydrogen ions,making them unusually acidic.

The main gas constituents for this are emissions of gaseous sulphur dioxide and nitrogen oxide due to human activities. Apart from natural causes such as volcanic eruptions, human activities such as electricity generation, fossil fuel combustion and so on, causes the percent of these gases in the atmosphere to increase at an exponential rate. 70 Tg(S) per year in the form of SO2 is released by industries. When nitrogen oxide is oxidized nitric acid is formed. Thus continous monitoring of the gaseous substances are vital for a sophisticated water quality management system.

The various attributes that contribute to acid rains are as follows :



According to Air Quality Index - India, the breakpoints and the thresholds of health are given.



The pollutants are categorized according to six classes - Good, Satisfactory, Moderately Polluted, Poor, Very Poor, and Severe. According to the end use purpose and uses, the severity thresholds are adjusted at first. The ambient concentrations are dynamically and continuously monitored by our sensors. These measurements are regularly checked. The diverse measurements from all the sensors are combined,preprocessed, estimated and compared with the existing thresholds. When there is an abnormal deviation, an alert is formed and sent to the central fusion center (CFC) after it has been verified for its veracity.

Three algorithms are needed for the effective local fusion for the ambient parameters. One is to handle the diverse measurements from all the sensors. These may vary according to the location, the type of industries, the climatic conditions right above the water surfaces. Thus a local fusion is done. From this fused data, an estimation process takes place and thus compared with the thresholds. Repeated comparison leads to near-accurate results. Depending on the severity, this is sent to the CFC to be fused with other water and soil parameters.

Raw Data is taken in and features are given as output. A low-level fusion takes place at first and later a medium-level fusion occurs. Clearly an optimized algorithm that works with multilevel fusion is needed.

The raw data that pours in here is almost same and stagnant most of the times and not changes frequently or sharply. Since similar and also redundant values are presented, clustering algorithms can be deployed. Since NN algorithm shows a poor performance, K - Means can be used. With the desired clusters and input data, each measurement can be assigned to a cluster with the least variance.

Having defined the first algorithm, for the estimation technique, Multiple Hypothesis test can be done to find the event probabilities based on hypotheses given. This maintains new hypotheses in every iteration. But this is suitable for heavily cluttered environments. Since the ambience monitoring doesn't deal with much dynamic data, JPDA must suffice. Different hypotheses such as one for the rainy seasons, other seasons or human life and aquatic life can be maintained,given the probabilities of the estimated constituents of acid rain are given.

The data is discrete but a range of these values can be maintained. From these ranges and the severity involved the centroids of the clusters can be given.