**Central Fusion Module**

This part of the architecture focuses upon data fusion techniques used to combine data from related information from associated databases to achieve improved decision making and threshold setting.

This module is an implementation of data fusion techniques that processes features from Local Fusion Centers (LFC's) placed all over the system to decision level features in a Central Fusion Center (CFC). Each LFC provides an estimation of the object state based on their local views and this information is the input to the CFC which in turn gives a fused global view. As stated in Dasarathy's Classification of Fusion Techniques, this module is a Feature-In-Decision-Out System. This particular module obtains a set of features from the LFC's gathered information databases concerning water, soil and temperature attributes. After the raw data from the sensors are cleaned, preprocessed and streamed according to a local fusion algorithm, the final features of the LFC's are sent to the CFC (only if the results are abnormal?) for the fusion of these individual features and high-end decision making based on an optimized central fusion algorithm.

Having found the most perfect or adaptable algorithm to fuse, the module will be able to result in providing near-to-accurate decisions and thresholds about the percent toxic releases of industrial wastes into the water bodies.

Yet another challenge to this module is the dynamic nature of the data and features streaming in.

Of all the currently-used data fusion algorithms, the list has been to narrowed down to a few which would suffice this system's conditions - fusion of multifaceted attributes and features (from water,soil and temperature), dynamic nature of the system, veracity of the features produced at the LFC's, the algorithms' scope and current status of the same in this particular domain.

1)Bayesian Blah Blah Blah!!!!

2) Dempster - Shafer Inference

It is a mathematical theory which generalizes the Bayesian methods. This provides solutions for the limitations found in the Bayesian Theory. This takes care of incomplete knowledge as to the probabilities of the estimated tuples, updating the beliefs accordingly, and allows us to represent uncertainity explicitly.

A complete set of exhaustive and mutually exclusive states or classes are taken according to the situation assessment. A particular data tuple can belong to only one state at a time. This set is called as a frame of discernment, because its elements are employed to discern the current state of the system.

Another set of hypotheses is maintained. Based on the evidence X, a probability for each hypothesis is assigned. The mass function of a hypothesis is larger than or equal to zero for all the hypotheses, wherein the collective sum adds up to one. It provides a formalism to account for incomplete beliefs, doubt levels and plausibility in a hypothesis. The confidence interval defines the true belief in a hypothesis H.

Advantages

1. Prior or priori probabilities are not required in advance as they are assigned at the instant of arrival. This plays a major role when computing dynamic streaming in of data.

2. can be used for context-aware environments

3. calibrated according to the recent measurements of the sensors (provided ground-truth is available)

4. used to assess the validity of a given set of hypotheses

Since high-level fusion (or decision fusion) and multiple level fusion are both involved, the features are obtained from different levels of abstraction and combined with measurements to obtain a more accurate decision. Bayesian's methods are typically employed at this level.

The input features will be in form of symbolic information and the fusion process has to account for the uncertainities and constraints.

Abductive Reasoning is a technique or rather a reasoning pattern that is deployed after Bayesian Inference or Dempster-Stafer Inference is used. It assumes the hypothesis to be true and valid and explains or reasons out the observed events more accurately. This provides Probabilistic Reasoning.