C A L L   F O R   P A P E R S

Applications to Geosciences

Existing (statistical) methods of data processing are not always applicable to geosciences. Standard data processing techniques are usually based on the assumption that we know the probability distribution for all measurement errors. In many applications, we can determine these distributions if we gather enough statistics.

In geophysical, geodesical, etc, measurements, every location that we measure is unique. It is difficult to collect statistics about many similar situations, and therefore, for geophysical measurement techniques, the probabilities of different errors are often not known. The only thing that we usually know about each error is its upper bound Δ. As a result, when the measured value of the quantity of interest is $\tilde{x}$, then the only information that we have about the actual value x of this quantity is that it belongs to an *interval* $[\tilde{x} - \Delta, \tilde{x} + \Delta]$.

The problem is: given the intervals $[\tilde{x}_i - \Delta_i, \tilde{x}_i + \Delta_i]$, $1 \leq i \leq n$, of possible values of *inputs* x_i for a data processing algorithm, to determine the interval of possible values of the result $y = f(x_1, \ldots, x_n)$ of applying the data processing algorithm f. These types of problems are solved by *interval computations*.

What has been done. There have been several applications of interval methods to geosciences:

- In the 70s, Gerhard Heindl (Germany) used these methods to get reliable geodesic estimations (i.e., estimations that do not depend on assumptions about error probabilities).

- In the 80s, there was some progress in geophysical applications, starting from the Ph.D. dissertation of Mark Baker from the Geology Department of the University of Texas at El Paso (UTEP). Several talks on geophysical applications were presented at the International Workshop on Applications of Interval Computations (El Paso, February 1995), and a survey on geophysical applications of intervals is currently being considered for the journal *Reliable Computing*.

What needs to be done. We believe that it is very unfortunate that few geophysicists are aware of interval techniques, and, as a result, the majority of geophysical papers do not produce guaranteed data processing results.

One way to help this situation is to promote interval methods by putting together a special issue of the journal in which both results and problems will be provided.

What papers we seek. Papers submitted for the issue can come from both academic community and practical researchers.

What we expect. We do not expect a wonder, but we do expect a big boost.

Editors of the special issue:

- Dan Cooke, from NASA PACEES (Pan-American Center for Environmental and Earth Sciences), and the UTEP Computer Science Department, a specialist in practical applications of data processing to environment-related geophysical problems;

- Diane Doser (Geology Department, UTEP), one of the pioneers of using interval methods in geology;

- Gerhard Heindl (University of Wuppertal, Germany), a pioneer of geodesic applications of intervals;

- Vladik Kreinovich (Computer Science Department, UTEP).

When. Please send the title and, ideally, the abstract of the paper to Vladik Kreinovich at vladik@cs.utep.edu by April 1, 1996. The papers (ideally, in LaTeX) are due (by email) by June 1, 1996. If you have problems with email, the address for hardcopies is:

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