Interval Methods for Data Fitting under Inaccuracy and Uncertainty

Sergey P. Shary

Institute of Computational Technologies SB RAS,
Novosibirsk State University, Russia

How to estimate parameters from measurements subject to errors and uncertainty?

The measurement errors are often supposed to be random quantities that can be adequately described by the probability theory. Such data fitting problems are the subject of consideration in classical regression analysis. In particular, when we know that the measurement errors are normally distributed with zero mean, then the Maximum Likelihood Method leads to the popular least squares estimates.

In many situations, however, we do not know the shape of the error distribution and its parameters. It may even happen that the probability theory cannot be adequately applied to the data fitting problem, since the sample is too small and/or statistical stability is violated. Instead, we only know that the measurement errors are located on a certain interval. Then, for the solution of the data fitting problem, we can exploit new approaches based on the methods of interval analysis and adjacent disciplines.

In our lectures, we give an overview of the subject, beginning with the pioneering work by Leonid Kantorovich [1] up to the latest most significant results in this area. We analyze specificity and drawbacks of the interval approaches to data fitting under essential interval uncertainty in data and discuss their implementation, especially in the part related to numerical optimization.

References

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