Generalized Derivatives: Automatic Evaluation and Implications for Algorithms

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A variety of generalizations of the concept of the derivative to classes of nondifferentiable functions have been proposed. Likewise, algorithms for nondifferentiable equation solving and optimization assume the ability to evaluate some class of generalized derivative at points visited by the algorithm. However, not all generalized derivatives are equal in the sense that the particular generalized derivative employed can have a large influence on the performance of algorithms. This leads to the notion of computationally relevant generalized derivatives.

Until recently, it has not been possible to evaluate generalized derivatives without a manual analysis of specific cases. Furthermore, in settings such as implicit functions and parametric ordinary differential equations, results enabling the evaluation of concrete, computationally relevant generalized derivatives have not been available. This talk will discuss a number of new theoretical results and algorithms that lead to automatic methods for the evaluation of computationally relevant generalized derivatives in several settings.

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