2018 Research Interest/Project Ideas

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Derivative based models in Machine Learning and Optimization

Optimization problems abound in industry, and gradient-based algorithms such as Back-propagation are well-known in Machine Learning. In many of these scenarios, second order derivative information can lead to robust and faster convergence to the optimum solution. However, second order methods have been considered too expensive. In recent work we have generalized the first order gradient algorithm (used in Back-propagation) to compute second and higher order derivatives, in the form of Hessian-vector computations, and higher derivative tensor-vector computations. These algorithms are obtained by the "Reverse Mode" algorithms in Automatic Differentiation, and have provably lower time complexity. Our code is called ReverseAD and is available on Github.

Applications are in solving optimization problems in industry, Uncertainty Quantification, Quantum computations (Density Functional Theory), etc.