

Center for Applied Mathematical Sciences Distinguished Lecturer, Fall 2015



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Algorithms for Overcoming the Curse of Dimensionality for Certain Hamilton-Jacobi Equations Arising in Control Theory and Elsewhere

This work is joint with Jerome Darbon.

Abstract: It is well known that time dependent Hamilton-Jacobi-Isaacs partial differential equations (HJ PDE) play an important role in analyzing continuous dynamic games and control theory problems. An important tool for such problems when they involve geometric motion is the level set method. The cost of these algorithms, and, in fact, all PDE numerical approximations is exponential in the space dimensions and time.

In this work we propose and test methods for solving a large class of HJ PDE without the use of grids or numerical approximations. For this wide class, which includes many linear control problems, we can obtain methods which are rapidly convergent, low memory, easily parallelizable and apparently very low complexity in dimension. We can evaluate the solution in many dimensions at between $10^{(-4)}$ to $10^{(-8)}$ seconds per evaluation on a laptop.

In addition, as a step needed in our procedure, we have developed a new and equally fast and efficient method to find the closest point x_{opt} lying in the union of compact convex sets in R^n , (n large) to any point x exterior to this set.

The term "curse of dimensionality" was coined by Richard Bellman in 1957 when he considered problems in dynamic optimization.

Monday, October 12, 2015

Reception: 3:00
Kaprielian Hall 410

Lecture: 3:30-4:30
Kaprielian Hall 414



USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences

Osher's research interests include scientific computing, applied PDE, shock capturing methods, and image processing techniques.

Osher's many honors and awards include membership of the National Academy of Sciences, Fellow of the American Academy of Arts and Sciences, Fellow of SIAM, Fellow of the AMS, honorary degrees from Hong Kong and ENS in Paris, the ICIAM Pioneer Prize and the SIAM Kleinman Prize. Most recently Osher received the Carl Friedrich Gauss Prize whose citation credited "his far ranging inventions that have changed our conception of physical, perceptual and mathematical concepts, giving us new tools to apprehend the world".