

Sketching for Efficient Computation of Numerical Linear Algebra

Overview

This is a course aimed at introducing various dimensionality reduction techniques, such as sampling and sketching, to speed up commonly occurring optimization problems, in particular those occurring in numerical linear algebra.

The course will cover the following topics in a single module. Least squares regression, low rank approximation, and many variants of these problems, such as solving these problems in distributed environments. We will show a number of sketching and sampling techniques. This course highlights the recent advances in algorithms for numerical linear algebra that have come from the technique of linear sketching, whereby given a matrix, one compresses it to a much smaller matrix by multiplying it by a (usually) random matrix with certain properties. Much of the expensive computation can then be performed on the smaller matrix, thereby accelerating the solution for the original problem. This technique has led to the fastest known algorithms for fundamental problems in this area, and we will consider least squares as well as robust regression problems, low rank approximation, and many variants of these problems, such as those in distributed environments.

This is a theoretical course (with lectures), and it is assumed that participants will have background in Linear Algebra and Probability and are familiar with mathematical proofs. To help revise background, the first three days of the course will be devoted to a review of standard concepts of Linear Algebra and an introduction to data streaming and dimensionality reduction.

Module	Sketching for Numerical Linear Algebra : February 24- March 4, 2017 Number of participants for the course will be limited to twenty.
You Should Attend If...	<ul style="list-style-type: none">▪ you are a computer scientist, or work with Big data and are interested in designing and learning about the state of the art in dimensionality reduction and efficient computation of numerical linear algebra.▪ you work in Big data and use regression and other standard tools for data analysis.▪ you are a student or faculty from academic institution interested in learning about state of the art research in the area of streaming, sketching.
Fees	The participation fees for taking the course is as follows: Participants from abroad : NIL Industry/ Research Organizations: NIL Academic Institutions: NIL A copy of the instructional material will be provided. The participants will be provided with accommodation on payment basis.

The Faculty



Dr. David Woodruff is a research staff member at IBM Almaden Research Center, San Jose, California, USA. His research interests are in sketching, data streaming algorithms and lower bounds, communication complexity, numerical linear algebra, machine learning and sparse recovery.



Dr. Nandini Nilakantan is an Associate Professor of Mathematics at the Indian Institute of Technology, Kanpur. Her research interests lie in algebraic topology, in particular combinatorial topology and homotopy theory.



Dr. Sumit Ganguly is Professor of Computer Science and Engineering at the Indian Institute of Technology, Kanpur. His research interests lie in data streaming algorithms, numerical linear algebra and dimensionality reduction.

Course Co-ordinator

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