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RESEARCH INTERESTS

My research interests revolve around theoretical questions in robust machine learning. There have been several important observations recently (Bubeck et. al., Degwekar et. al., Fawzi et. al., Schmidt et. al.) that suggests robust generalization is non-trivially harder than standard generalization. With several different approaches to explaining why SOTA neural architectures are susceptible to simple adversarial attacks, a significantly fine-grained analysis is needed to differentiate between levels and types of hard robust generalization. My goal is to contribute and extend works in this field and be part of an exciting conversation.

My first research project helped me see the impact of cutting edge randomized numerical linear algebra and hence I am also interested in exploiting structure in data to develop efficient algorithms (eg. sparsity, low rank).

EDUCATION & RESEARCH EXPERIENCE

Johns Hopkins University   JULY 2019 - PRESENT
Ph.D Student, Department of Computer Science
Advisors : Jeremias Sulam, Raman Arora

Cornell University   JULY 2017 - MAY 2019
Research Assistant, Department of Operations Research and Information Engineering
Advisors : Madeleine Udell, Drew Kouri (Sandia National Lab.)

Birla Institute of Technology and Science Pilani, Goa Campus   JULY 2013 - MAY 2018
Master of Science in MATHEMATICS,
Bachelor of Engineering in COMPUTER SCIENCE

PREPRINTS

- RANDOMIZED SKETCHING ALGORITHMS FOR LOW-MEMORY DYNAMIC OPTIMIZATION
  R. Muthukumar, D. Kouri and M.Udell
  Submitted (SIAM-OPT), July 2019

  - Leveraging recent randomized sketching algorithms to perform low memory PDE optimization

  - Provably convergent optimization algorithms based on Inexact Trust Region methods.
  (Paper available on request, currently under SANDIA internal review.)

SOFTWARE PROJECTS

- PRESOLVE ROUTINES FOR LP AND SDP
  Google Summer of Code 2016, Mentor - Dr. Madeleine Udell

  - Implemented fast Presolving algorithms discussed in scientific computing language - Julia

  - Benchmarking against existing solvers for speed and efficiency

TALKS AND CONFERENCES

SUMMER 2016 | Presolving Algorithms for Optimization @ JuliaCon 2016

SUMMER 2019 | Sketching Algorithms for Approximate Gradients @ JuliaCon 2019

REFERENCES

Madeleine Udell, Drew Kouri, Jeremias Sulam, Raman Arora