TRIAD:
Georgia Tech
TRIPODS Phase 1

Xiaoming Huo
Joint Statistics Meeting
Thursday, August 6, 2020

Transdisciplinary Research Institute
for Advancing Data Science
https://triad.gatech.edu
GT TRIAD: Group effort
TRIAD
Transdisciplinary Research Institute for Advancing Data Science

• Campus wide effort 38 faculty members

• Biology, Computational Science and Engineering, Computer Science, ECE, Interactive Computing, Industrial and Systems Engineering, Mathematics, Mechanical Engineering, Public Policy

• Mapping to strategic areas of interest to the city, state, and region

• TRIPODS+X:EDU Collaborative DS alliance w/ local colleges

• NSF South Big Data Hub partnership

• Research Centers in Analytics, Cyber Security, Health Systems, Internet of Things, Logistics and Supply Chains, Materials, Smart Cities

• Phase 2: STRIDES - Partnership with Duke and local colleges
TRIPODS Highlights

• **Workforce**
  - Partially supported 26 graduate research assistantship in the past 3 years; 7 female
  - 7 postdocs; 1 female (incoming)
  - **Rui Gao** (supported in 2018) - Assistant Professor, UT-Austin
  - **Andre Wibisono**, Yale CS

• **Research**
  - # of papers in annual reports to NSF: 16 (2018) and 21 (2019)
  - Interdisciplinary work
Recent work

1. *Convex Recovery of Marked Spatio-Temporal Point Processes*

   Anatoli Juditsky, Arkadi Nemirovski, Liyan Xie, Yao Xie
   March 26, 2020

2. *ℓ₁ Regularized pseudo Least Squares based PDE Identification: Recovery Theory*

   Yuchen He, Xiaoming Huo, Sung Ha Kang, Yajun Mei, Namjoon Suh
   February 19, 2020
Optimization & Inference – virtuous cycle

- CS: Fast computing
- CS: Data sampling
- M/S: RKHS
- M: Stochastic PDEs
- S: Uncertainty quantification
- S: Model selection
- M/S/CS: optimization

Different resolutions on forward and inverse problems

Noisy observations, Multi-level sampling and modeling

Models, methods, algorithms

Insights

Underlying dynamical systems
Optimal control, feedback
System properties: stability and UQ measures
Transient vs. long term dynamics

Foundations of data science

Updated databases
Open source software
Testable theories
Interdisciplinary training
Domain contributions
Contributions at the foundations

 Supported through industrial consortium Seismic Lab for Imaging and Modeling (Herrmann, CSE)

Rachel Walker
Central Washington
REU Ga Tech

(a)  
(b)  
(c)
Invited Speakers - Workshop in October 2018: Theoretical Foundation of Deep Learning

G. Lan, GaTech
L. Song, GaTech
S. Vempala GaTech
D-X Zhou, CUHK
S. Bubeck, EPFL
L. Carin, Duke
A. Basu, JHU
A. Klivans, UT Austin
J Schmidt-Hieber, U. Twente
P-L Loh, Columbia
A. Anandkumar, Caltech
T. Ma
Stanford
J. Klusowski
Rutgers
J.D. Lee
Princeton
D. Needell,
UCLA
H. Sedghi
Google Brain
R.Y. Liu
Rutgers
J. Klusowski
Rutgers
J. Fan
Princeton
O. Shamir,
Weizmann Inst,
R. Willet
U Chicago
A. Montanari
Stanford
ACO+X: Excellence at Ga Tech

**Algorithms, Combinatorics, Optimization (ACO):** PhD program focuses on foundations in algorithms, discrete math, and optimization founded in 1991. Pioneer in interdisciplinary programs. (co-PI: Prasad Tetali, the current Program director.)

**Objective:** Rigorous, competitive interdisciplinary program. Spans—computing, engineering, and sciences. Excellent placement in Academia + BIG. Top ranked in 2019 US News and World Report.

**Expansion:** Extend to ACO+X: Certificates in Data Science (choice of 4 out of 10 courses, including high-dimensional probability/statistics, ML Theory, Deep Learning) and bring in Duke as the first partner in expanding to other universities.

**Distance learning:** Ga Tech pioneered online MS programs.
Workshop and Summer School 2019

• 1st annual Data Science for Social Good (April 1-2)
  • 65 participants – 36 female, 27 African heritage, 8 LatinX
    9 Lecturers: Rediet Abebe (Harvard), Sean Barnes (UMD), Kira Goldner (UW), Sanmi Koyejo (UIUC), Destenie Nock (UMass), Jennifer Lewis Priestly (Kennesaw), Kaitlin Rizk (Accenture), Alba Rojas-Cordova (SMU).

• Foundations of Data Science (Aug.5-9)
  • 40 advanced grad students, post-docs
    4 Lecturers: A. Nemirovski (GaTech), V. Koltchinskii (Math), Polo Chao (CS), Mark Davenport (ECE).

    4 Speakers: Huan Yan (Wells Fargo), Feng Qiu (Argonne Nat’l Lab), Yao Xie, Xiaoming Huo (GT)
GT Industrial / City Collaborations

Data-driven policing

Police zone-redesign using mixed integer programing with statistical prediction

- City of South Fulton (implemented Jan.’ 20)
- City of Atlanta (implemented Mar. 18, 2019)

Macy’s

- Real-time electronic transaction anomaly detection from one-class, limited data using robust adversarial learning
- Real-time online order fulfilment using meta heuristic
Data science building
Phase II Effort

STRIDES: Southeastern Transdisciplinary Research Institute for Data Engineering and Science