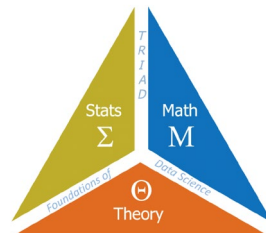


TRIAD: Georgia Tech TRIPODS Phase 1

**Georgia
Tech** 
CREATING THE NEXT

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

Optimization Statistics Applied mathematics Students

2. ℓ_1 Regularized pseudo Least Squares based PDE Identification: Recovery Theory

Yuchen He, Xiaoming Huo, Sung Ha Kang, Yajun Mei, Namjoon Suh

February 19, 2020

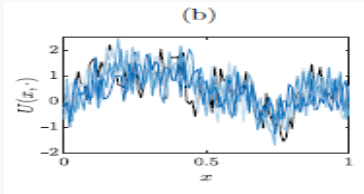
Optimization & Inference – virtuous cycle

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

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



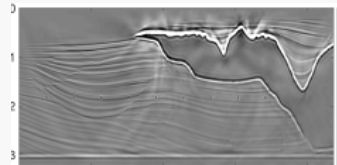
Rachel Walker
 Central Washington
 REU Ga Tech

Different resolutions
 on forward and inverse
 problems

Noisy observations,
 Multi-level sampling
 and modeling

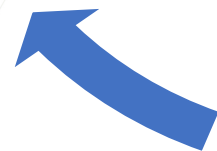
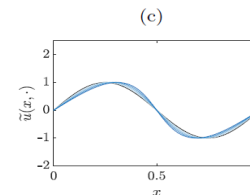
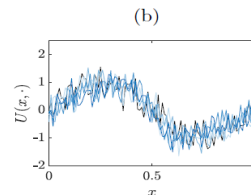
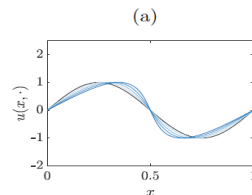
Reporting and
 evaluation

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)

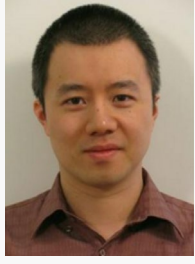
PDE-driven
 systems



Invited Speakers - Workshop in October 2018: Theoretical Foundation of Deep Learning



G. Lan, Ga Tech



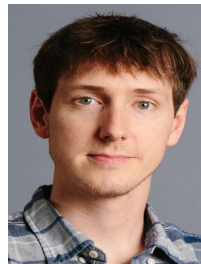
L. Song, GaTech



S. Vempala GaTech



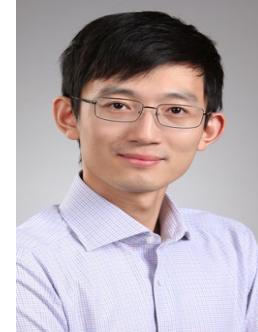
D.-X. Zhou, CUHK



S. Bubeck, EPFL



A. Anandkumar,
Caltech



T. Ma
Stanford



J.D. Lee
Princeton



L. Carin, Duke



A. Basu, JHU



A. Klivans,
UT Austin



J. Schmidt-Hieber,
U. Twente



P.-L. Loh, Columbia



D. Needell,
UCLA



H. Sedghi
Google Brain



R.Y. Liu
Rutgers



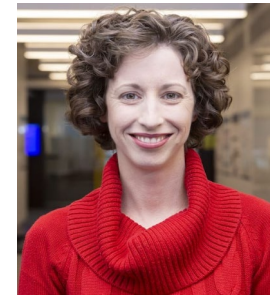
J. Klusowski
Rutgers



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)



Data Science Bootcamp

Summer 2018

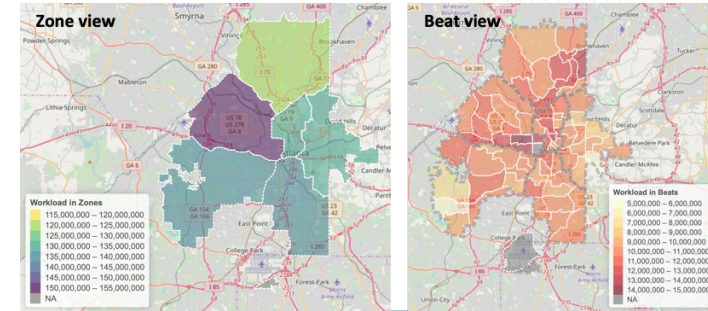


GT Industrial / City Collaborations

Data-driven policing

Police zone-redesign using mixed integer programming with statistical prediction

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



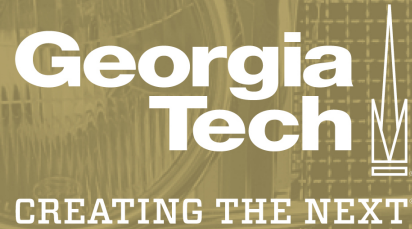
Macy's

- Real-time electronic transaction anomaly detection from one-class, limited data using robust adversarial learning
- Real-time online order fulfillment using meta heuristic

Data science building



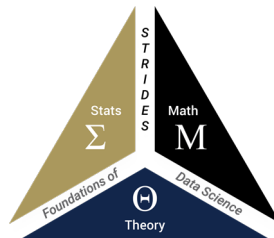
Phase II Effort



STRIDES:
Southeastern
Transdisciplinary
Research Institute
for Data
Engineering and
Science



Duke
UNIVERSITY



Southeastern Transdisciplinary
Research Institute for Data
Engineering and Science