



# Shengjun(Daniel) Zhang

RESEARCH ASSISTANT · CONTROL · OPTIMIZATION · STATISTICAL LEARNING

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🎓 Shengjun(Daniel) Zhang

*"There is nothing more practical than a good theory."*

## Education

### UNT (University of North Texas)

PH.D. MAJOR IN ELECTRICAL ENGINEERING

- Minor in Business Management

*Denton, Texas, U.S.A*

*Jan. 2018 - present*

### NYU (New York University)

M.S. IN ELECTRICAL ENGINEERING

- Robotic Control

*New York, New York, U.S.A*

*Jan. 2015 - Jan. 2017*

### CAU (China Agricultural University)

B.S. IN AUTOMATION OF HONORS PROGRAM WITH *Cum Laude*

- Control Theory

*Beijing, China*

*Sep. 2010 - Jul. 2014*

## Research Interests

### Artificial Intelligence

Statistical Learning, Machine Learning, Reinforcement Learning

### Optimization

Convex Optimization, Non-convex Optimization, Distributed Optimization

### Power System

DERs with Transactive Approaches

## Professional Experience

### University of North Texas.

RESEARCH/TEACHING ASSISTANT

- Cyber-Physical Energy System Laboratory, Department of Electrical Engineering.
- Supervisor: Dr. Colleen Bailey & Dr. Tao Yang.

*Denton, Texas, U.S.A*

*Jan. 2018 - present*

### Huazhong University of Science and Technology.

VISITING RESEARCHER

- Key Laboratory of Image Processing and Intelligent Control of Education Ministry, School of Artificial Intelligence and Automation.
- Supervisor: Dr. Ye Yuan.

*Wuhan, China*

*May 2018 - Jul. 2018*

### Zhejiang University.

VISITING RESEARCHER

- Group of Networked Sensing and Control, College of Control Science and Engineering.
- Supervisor: Dr. Junfeng Wu.

*Hangzhou, China*

*Jul. 2018 - Jul. 2018*

### New York University.

RESEARCH ASSISTANT

- Control/Robotics Research Laboratory, Tandon School of Engineering.
- Supervisor: Dr. Farshad Khorrami.

*New York, New York, U.S.A*

*Jan. 2016 - Jul. 2016*

## Research & Projects

## Sparse PCA via Zeroth-order Optimization Approach

RESEARCH DISSERTATION

UNT

Sep.2019 - Present

- Applying zeroth-order optimization techniques to Sparse PCA problem.
- Develop new zeroth-order optimization algorithm to solve Sparse PCA problem.
- Compare proposed zeroth-order algorithm with existing zeroth-order algorithms and first-order algorithms.
- Develop stochastic zeroth-order algorithm for Sparse PCA problem.

## Obstacle Avoidance and Navigation Utilizing Proximal Policy Optimization

RESEARCH PROJECT

UNT

Oct. 2019 - Apr. 2020

- Utilizing PPO, a reinforcement learning approach, to guide a TurtleBot to avoid obstacles.
- Compared PPO approach with DDPG and DQN in simulation on ROS platform.
- This work has been accepted by 2020 SPIE Artificial Intelligence and Machine Learning for Multi-Domain Operations Applications II.

## Robust Optimization with Event Triggered Communication.

RESEARCH PROJECT

UNT

Feb. 2019

- Minimize a global cost function formed by a sum of local convex cost functions in a distributed way.
- Develop a robust algorithm over an undirected and connected network.
- The proposed algorithm is arbitrarily initialized unlike the existing algorithms.

## Analyzing Distributed Optimization Algorithms via IQC.

RESEARCH PROJECT

UNT

Nov. 2018

- Investigate the convergence rate of distributed push-pull based optimization algorithms in directed graph networks.
- Present a unified framework based on integral quadratic constraints (IQCs) from robust control theory.
- Formulate convergence analysis problems into a semidefinite program (SDP).
- This work has been accepted by the 15<sup>th</sup> IEEE International Conference, and is in **Best Student Paper Shorten List**.

## Nonlinear System Identification via Sparse Bayesian Learning.

COURSE PROJECT

UNT

Oct. 2018 - Dec. 2018

- Reimplement *Sparse Bayesian Learning Algorithm*, proposed in *A Sparse Bayesian Approach to The Identification of Nonlinear State-space Systems*.
- Apply such an algorithm to identify a pendulum model.

## Applying Q-Learning to a $4 \times 4$ Tic-Tac-Toe.

COURSE PROJECT

UNT

Mar. 2018 - May 2018

- Implement *Q*-learning algorithm to a  $4 \times 4$  Tic-Tac-Toe game.

## UGV Integrated Mobile Platform.

RESEARCH PROJECT

NYU

Jan. 2016 - Jul. 2016

- Model the UGV integrated mobile platform and simulated it via V-rep.
- Implement SLAM and control algorithms on the integrated mobile platform.

## Honors & Awards

2020	<b>Third Place Graduate Student Poster Competition</b> , IEEE North Tech SAS	Denton, Texas, U.S.A
2019	<b>IEEE Outstanding Graduate Student</b> , IEEE local event	Denton, Texas, U.S.A
2019	<b>College of Engineering Dean Tuition Scholarship</b> , UNT	Denton, Texas, U.S.A
2019	<b>Toulouse Graduate School Scholarship</b> , UNT	Denton, Texas, U.S.A
2018	<b>College of Engineering Dean Tuition Scholarship</b> , UNT	Denton, Texas, U.S.A
2018	<b>Toulouse Graduate School Scholarship</b> , UNT	Denton, Texas, U.S.A
2012	<b>2<sup>nd</sup> prize</b> , Physics Experiment Competition of colleges	Beijing, China

## Certifications

2016	<b>Machine Learning</b> , Instructor: Andrew Ng, license: NNBCAXYFA2HK.	Stanford University on Coursera
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## Mentoring

- Project on load shedding in Smart Grid.
- First placement: engineer, Oncor Electric Delivery.

## Teaching Experiences

Spring '19 **EENG 2620 Signals and Systems**, Teaching Assistant

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Fall '18 **EENG 2620 Signals and Systems**, Teaching Assistant

UNT

Fall '18 **EENG 5940 Control and Optimization for Power Systems**, Teaching Assistant

UNT

## Professional Activities

**Member** IEEE HKN, IEEE Studnet Member, IEEE Young Professionals

**Journal Reviewer** IET Control Theory and Applications

Neurocomputing

Automatica

International Journal of Robust and Nonlinear Control

**Conference Reviewer** Advances in Neural Information Processing Systems (NeurIPS)

IEEE Conference on Decision and Control (CDC)

American Control Conference (ACC)

IEEE International Conference on Control and Automation (ICCA)

Chinese Control Conference (CCC)

## Publications

### JOURNAL ARTICLES [7]

A Primal-Dual SGD Algorithm for Distributed Nonconvex Optimization

Xinlei Yi, Shengjun Zhang, Tao Yang, Tianyou Chai, Karl H Johansson  
*SIAM Journal on Optimization* (Under Review). 

Under Review

Linear Convergence of First- and Zeroth-Order Primal-Dual Algorithms for Distributed Nonconvex Optimization

Xinlei Yi, Shengjun Zhang, Tao Yang, Tianyou Chai, Karl H Johansson  
*IEEE Transactions on Automatic Control* (Under Review). 

Under Review

Sublinear and Linear Convergence of ADMM for Distributed Nonconvex Optimization

Xinlei Yi, Shengjun Zhang, Tao Yang, Tianyou Chai, Karl H Johansson  
*IEEE Transactions on Control of Network Systems* (Under Review)

Under Review

Variance Aware Reward Smoothing for Deep Reinforcement Learning

Yunlong Dong, Shengjun Zhang, Xing Liu, Yu Zhang, Ye Yuan  
*IEEE Transactions on Automatic Control* (In Submission)

In Submission

Distributed Zeroth-order Stochastic Coordinate Methods

Shengjun Zhang, Dong Xie, Lisha Yao, Colleen P. Bailey, Shengli Fu  
*IEEE Transactions on Signal Processing* (In Submission)

In Submission

Event-triggered Based Distributed Optimization Algorithms (in Chinese)

Tao Yang, Xinlei Yi, Shengjun Zhang, Ruijuan Chen, Yuzhe Li  
*ACTA AUTOMATICA SINICA* (2021)

2021

A Magnetic Nanoparticle Based Nucleic Acid Isolation And Purification Instrument for DNA Extraction of Escherichia coli O157: H7

Yahui Chen, Jianhan Lin, Qin Jiang, Qi Chen, Shengjun Zhang, Li Li  
*Journal of nanoscience and nanotechnology* 16.3 (2016) pp. 2296–2300. 

2016

### CONFERENCE PROCEEDINGS [9]

## A Primal-Dual Algorithm for Distributed Sparse Principal Component Analysis

Shengjun Zhang, Colleen P. Bailey

ICASSP 2021 - 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)

Toronto, ON, Canada

Under Review

## Zeroth-order Algorithms for Distributed Stochastic Nonconvex Optimization

Xinlei Yi, Shengjun Zhang, Tao Yang, Tianyou Chai, Karl H Johansson

In 38th International Conference on Machine Learning (ICML)

Virtual

In Submission

## Convergence Analysis of Distributed Zeroth-order Stochastic Coordinate Methods Under Polyak-Łojasiewicz Condition

Shengjun Zhang, Dong Xie, Lisha Yao, Colleen P. Bailey, Shengli Fu

60th IEEE Conference on Decision and Control (CDC)

Austin, TX, United States

In Submission

## Exponential Convergence for Distributed Smooth Optimization Under the Restricted Secant Inequality Condition

Xinlei Yi, Shengjun Zhang, Tao Yang, Tianyou Chai, Karl H Johansson

21st IFAC World Congress

Berlin, Germany

2020

## Linear Convergence for Distributed Optimization Without Strong Convexity

Xinlei Yi, Shengjun Zhang, Tao Yang, Tianyou Chai, Karl H Johansson

59th IEEE Conference on Decision and Control (CDC)

Jeju Island, Republic of Korea

2020

## Obstacle Avoidance and Navigation Utilizing Proximal Policy Optimization

Daniel Zhang, Colleen P. Bailey

SPIE Artificial Intelligence and Machine Learning for Multi-Domain Operations Applications II

California, United States

2020

## Optimal Control Under Communication Constraints for Multi-agent Unmanned Vehicles

Daniel Zhang, Colleen P. Bailey

SPIE Artificial Intelligence and Machine Learning in Defense Applications II

Edinburgh, United Kingdom

2020

## Event-Triggered Control for Consensus of Multi-Agent Systems with Nonlinear Output and Directed Topologies

Xinlei Yi, Shengjun Zhang, Tao Yang, Junfeng Wu, Karl Henrik Johansson

38th Chinese Control Conference (CCC)

Guangzhou, China

2019

## Computational Convergence Analysis of Distributed Optimization Algorithms for Directed Graphs

Shengjun Zhang, Xinlei Yi, Jemin George, Tao Yang

15th IEEE International Conference on Control and Automation (ICCA) **Best Student Paper Shorten List**

Edinburgh, Scotland

2019

## PREPRINT [2]

### Distributed Proportional-Integral Optimization Algorithms with Event-triggered Communication

Wen Du, Xinlei Yi, Shengjun Zhang, Jemin George, Tao Yang

2019

### Distributed Economic Dispatch over Networks with Markovian Communication Losses

Junfeng Wu, Shengjun Zhang, Tao Yang, Ling Shi, Hong Wang

2018