

# HAOXUAN (STEVE) CHEN

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## EDUCATION

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### California Institute of Technology

October 2018 - Present

Senior Undergraduate (Information and Data Sciences & Mathematics)

Overall GPA: 4.3/4.3

- **Major/Department advisor:** Prof. Yisong Yue & Prof. Dinakar Ramakrishnan
- **Research advisor:** Prof. Andrew M. Stuart
- **Selected coursework:** numerical linear algebra and numerical PDE, real and complex analysis, functional analysis, optimization, probability and stochastic processes, multiscale modeling, statistical inference, machine learning (deep learning, reinforcement learning, learning theory), computer vision, signal processing, algorithms, combinatorics and discrete mathematics, abstract algebra, topology, differential geometry
- **Research statement:** My research focuses on the intersection of applied mathematics, data science, statistics and machine learning. I am interested in using ideas from statistics, optimization, mathematical analysis, and differential equations to develop robust and theoretically guaranteed machine learning models for discovering physical laws and solving engineering problems.

## RESEARCH EXPERIENCE

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### Uncertainty Quantification Group, Massachusetts Institute of Technology

*Class of '36 SURF Fellow*

June 2021 - Present

- Project: Learning High-Dimensional Non-Gaussian Graphical Models via Neighborhood Selection
- Mentor: Ricardo Baptista (Ph.D. Student), PI: Prof. Rebecca E. Morrison, Prof. Youssef M. Marzouk
- Developed a localized version of the SING (Sparsity Identification in NonGaussian distributions) algorithm via neighborhood selection methods. Tested the localized SING algorithm's performance on several high-dimensional distributions.

### Institute for Computational and Mathematical Engineering, Stanford University

*Visiting Researcher (Online)*

January 2021 - September 2021

- Project: Convergence Rate of Neural PDE Solvers
- Mentor: Yiping Lu (Ph.D. Student), PI: Prof. Jianfeng Lu, Prof. Lexing Ying
- Studied the statistical limits of Deep Ritz Method (DRM) and Physics Informed Neural Networks (PINN) for solving a class of high-dimensional PDEs. Established upper and lower bounds for the accuracies of both DRM and PINN.

### Department of Computing and Mathematical Sciences, California Institute of Technology

*SURF Fellow (Online)*

June 2020 - August 2020

- Project: Continuous Time Opinion Formation on a Graph
- Mentor: Dr. Bamdad Hosseini (Von Karman Instructor), PI: Prof. Andrew M. Stuart.
- Studied unsupervised and semi-supervised learning algorithms and spectral graph clustering. Applied these techniques to analyze how people's opinions vary under the influence of a communication network.

### Department of Mathematics, California Institute of Technology

*Morgan Ward SURF Fellow*

June 2019 - August 2019

- Project: Properties of Quaternionic Automorphic Forms.
- Mentor: Dr. Zavosh Amir-Khosravi (Olga Taussky John Todd Instructor).
- Developed an analogue of automorphic forms for quaternions. Explored a concept called " $n$ -Regularity", which corresponds to holomorphicity in the classical case.

## PUBLICATION

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1. Yiping Lu, Haoxuan Chen, Jianfeng Lu, Lexing Ying, Jose Blanchet. **Machine Learning For Elliptic PDEs: Fast Rate Generalization Bound, Neural Scaling Law and Minimax Optimality**, *International Conference on Learning Representations (ICLR)*, 2022  
(Short version presented at *NeurIPS 2021 Workshop on the Symbiosis of Deep Learning and Differential Equations (DLDE)* as a **Spotlight Talk**.)
2. Zongyi Li, Hongkai Zheng, Nikola Borislavov Kovachki, David Jin, Haoxuan Chen, Burigede Liu, Andrew Stuart, Kamyar Azizzadenesheli, Anima Anandkumar. **Physics-Informed Neural Operator for Learning Partial Differential Equations**, *Submitted, arXiv:2111.03794*

## TEACHING EXPERIENCE

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### California Institute of Technology

October 2019 - Present

Teaching Assistant

Math/Applied Math/Computer Science courses

- CS/CMS/CNS/EE/IDS 155: Machine Learning and Data Mining (Graduate level), Winter 2022.
- CS/CMS/IDS 139: Analysis and Design of Algorithms (Graduate level), Winter 2022.
- ACM/CMS 117: Probability Theory and Stochastic Processes (Graduate level), Fall 2021.
- ACM 11: Introduction to Matlab and Mathematica (Undergraduate level), Spring 2021.
- ACM/IDS 104: Applied Linear Algebra (Undergraduate level), Fall 2020.
- ACM 11: Introduction to Matlab and Mathematica (Undergraduate level), Spring 2020.
- Math 2: Differential Equations (Undergraduate level), Fall 2019.

## HONORS AND FELLOWSHIPS

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Class of '36 Summer Undergraduate Research Fellowship (SURF)	2021.6
Summer Undergraduate Research Fellowship (SURF)	2020.6
William Lowell Putnam Mathematical Competition, 114- <i>th</i> in overall ranking	2019.12
Morgan Ward Summer Undergraduate Research Fellowship (SURF)	2019.6
William Lowell Putnam Mathematical Competition, 120- <i>th</i> in overall ranking	2018.12
Harvard-MIT Math Tournament (HMMT), 20- <i>th</i> in individual ranking	2016.11
Princeton University Mathematics Competition (PUMaC), 7- <i>th</i> in individual ranking	2016.11
American Invitational Mathematics Exam (AIME 2), 13 out of 15 points, USAMO Qualifier	2016.3

## TECHNICAL SKILLS

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### Computer Languages

Python, MATLAB, Mathematica, Java, R

### Software & Tools

LaTeX, Microsoft Word, Excel, PowerPoint

### Languages

English, Mandarin, Japanese (Elementary), Spanish (Elementary)