Yue 'Scott' Guan

Curriculum Vitae

Ph.D. Student in Dynamics and Control Systems Lab
School of Aerospace Engineering
Georgia Institute of Technology
Atlanta, GA, United States, 30332

Email: yguan44@gatech.edu
Cell: +1 (470)-399-0447
LinkedIn Google Scholar

EDUCATION

Georgia Institute of Technology — Atlanta, GA

- Ph.D in Aerospace Engineering, GPA 3.94/4.00 — *Aug. 2020 – Present*
  Advised by Dr. Panagiotis Tsiotras
  Research field: Reinforcement Learning, Game Theory, Optimal Control, Deep Learning
- M.S. in Computer Science, GPA 4.00/4.00 — *Aug. 2019 – Present*
- M.S. in Aerospace Engineering, GPA 3.90/4.00 — *Aug. 2018 – May 2020*
- B.S. in Aerospace Engineering, Minor in Mathematics, GPA 3.99/4.00 — *Aug. 2014 – May 2018*

RESEARCH EXPERIENCE

Dynamics and Control Systems Lab — Atlanta, GA
Graduate Research Assistant — August 2018 – Present

- Hierarchical Decision-Making in Competitive Environments
  - Proposed a hierarchical algorithm for decision-making in stochastic games leveraging the option framework, which achieved a 5x speedup (30x under parallelization) compared to the non-hierarchical approach while maintaining 90% of performance.
  - Developed certificates for options that guaranteed ϵ-suboptimality in games.
  - Implemented the algorithms and the game environments using **Python, Numpy, Scipy, Matplotlib**.
  - Currently implementing the algorithm in a **ROS** + **Unity** high-fidelity simulation environment. Will conduct field tests with Husky unmanned ground vehicles (UGVs) in Spring 2023.
- Learning in Games with Policy Approximation
  - Proposed and implemented a multi-agent learning algorithm with entropy-regularized policy approximation which outperformed other learning algorithms with a 10x speedup.
  - Established theoretical guarantees regarding the convergence to a Nash equilibrium.
  - Currently extending the algorithm to high-dimensional space leveraging deep neural networks (**PyTorch**).
- Large-Population Game Theory
  - Utilized mean field approximation to model the behavior of a large population of intelligent agents.
  - Addressed the feedback regularity issues in finite mean field games through entropy regularization.
  - Established convergence to an ϵ-Nash equilibrium and performance guarantees for a finite population.
  - Currently working on an extension to large population team games using mean-field sharing.
- Bounded Rationality in Multi-Agent Environments
  - Deployed cognitive hierarchy theory to model bounded-rational behaviors in pursuit-evasion games.
  - Developed Bayesian inference algorithms to estimate opponent's rationality level.
  - Utilized Markov Chain Approximation Method to discretize stochastic systems with convergence guarantees.
  - Implemented the algorithms and analyzed performance data using **MATLAB**.
- Resource Allocation in Adversarial Environments
  - Leveraged reachable set theory to address resource allocation problems with traversibility constraints.
  - Established theoretical guarantees regarding system performance with presence of adversaries.
  - Developed efficient algorithms for finding optimal allocation strategies using **Gurobi, CDDLib, SymPy, Shapely.**

PUBLICATIONS

Referred Conference/Journal Articles

1. "Learning Nash Equilibria in Zero-Sum Stochastic Games via Entropy-Regularized Policy Approximation" | **Y. Guan***, Q. Zhang*, P. Tsiotras | International Joint Conference on Artificial Intelligence (IJCAI), pp. 2462-2468, 2021.
2. "Hierarchical Decompositions of Stochastic Pursuit-Evasion Games" | **Y. Guan**, M. Afshari, Q. Zhang, P. Tsiotras | Conference on Decision and Control (CDC), IEEE, 2022 (to appear).
3. "Shaping Large Population Agent Behaviors through Entropy-Regularized Mean-Field Games" | **Y. Guan**, M. Zhou, A. Paknyat, P. Tsiotras | American Control Conference (ACC), pp. 4429-4435, IEEE, 2022.
4. "Dynamic Defender-Attacker Blotto Game" | D. Shishika*, **Y. Guan***, M. Dorothy, V. Kumar | American Control Conference (ACC), pp. 4422-4428, IEEE, 2022.
5. "Joint Access Selection and Bandwidth Allocation Methods: Evolutionary Game" | M. Zhou, **Y. Guan**, K. Niu, M. Hayajneh, C. Abdallah | International Wireless Communications and Mobile Computing (IWCMC), pp. 1320-1325, 2021.
6. "Bounded-Rational Pursuit-Evasion Games" | **Y. Guan**, D. Maity, C. Kroninger, P. Tsiotras | American Control Conference (ACC), pp. 3216-3221, IEEE, 2021.
7. "On a Hilbert-type Integral Inequality with Non-Homogeneous Kernel of Mixed Hyperbolic Functions" | M. You, **Y. Guan** | Journal of Mathematical Inequalities, 2019.
8. "Monte-Carlo Value Analysis of High-Throughput Satellites: Value Levers, Tradeoffs, and Implications for Operators and Investors" | F. Geng, D. Gomez, **Y. Guan**, J. Saleh | Plos One, 2019.
9. "Review of High Throughput Satellites: Market Disruptions, Affordability-Throughput Map, and the Cost per Bit/Second Decision Tree" | **Y. Guan**, F. Geng, J. Saleh | IEEE Aerospace and Electronic Systems Magazine, 2019.

Non-refereed Open Archives

1. "Chasing Convex Bodies Generated by an Adversary" | **Y. Guan*,** L. Pan*, D. Shishika, P. Tsiotras | arXiv preprint arXiv:2209.13606, 2022. (Submitted to ACC-2023)
2. "Jump Law of Co-State in Optimal Control for State-Dependent Switched Systems and Applications" | M. Zhou, E. I. Verriest, **Y. Guan**, C Abdallah | arXiv preprint arXiv:2209.12775, 2022. (Submitted to ACC-2023)

Working Manuscripts

1. "Zero-Sum Mean-Field Team Games" | **Y. Guan**, M. Afshari, P. Tsiotras.
2. "A Complete Characterization of Dynmaic Resource Allocation Games" | **Y. Guan***, D. Shishika*, J.R. Marden, M. Dorothy, P. Tsiotras, V. Kumar.

PROFESSIONAL SKILLS

Programming: Python (PyTorch, TensorFlow), MATLAB, ROS, C++, R

Skills: ML (Supervised, Unsupervised, Reinforcement Learning, DNNs), AI (Search Algorithms, Classification, Clustering, Regression), Optimization (Linear Optimization, Convex Optimization, Stochastic Optimization), Control (Linear, Nonlinear, Optimal, Hybrid Control Design, Kalman Filtering), Mathematics (Game Theory, Real Analysis, Probability Theory, Operator Theory, Stochastic Processes)

HONORS AND AWARDS

- **Outstanding Undergraduate Teaching Assistant**: School of Mathematics, (two recipients per year), Georgia Institute of Technology, 2018
- **DAAD Scholarship**: awarded by the German Academic Exchange Service for research internship at Technical University of Munich, 2017
- **Halle Foundation Scholarship**: awarded by the Halle Foundation for conducting research related to German Study, 2016

SERVICES AND MEMBERSHIPS

- **Co-Chair:** School of Aerospace Engineering Student Advisary Council (SAESAC), Georgia Institute of Technology (August 2017 – May 2018)
- **IEEE Student Member:** Institute of Electrical and Electronics Engineering student member (May. 2020 – Current)
- **Sigma Gamma Tau:** Member, the American honor society in Aerospace Engineering (August 2015 – May 2018)
- **Technical Manuscript Reviewer For:**
  - International Conference on Robotics and Automation (ICRA): 2022
  - American Control Conference (ACC): 2021, 2022
  - Conference on Decision and Control (CDC): 2022
  - IEEE Control Systems Letters (L-CSS): 2022
  - Workshop on Learning Theory (ICML): 2021

TEACHING

Teaching Assistantship:

1. Online Decision Making (ECE8803-ODM) – Graduate Section, School of Electrical and Computer Engineering, Georgia Tech (Fall 2022), *Supervisor: Prof. Vidya K. Muthukumar*
2. Optimal Control (AE6580-A) – Graduate Section, School of Aerospace Engineering, Georgia Tech (Fall 2021), *Supervisor: Prof. Panagiotis Tsiotras*
3. Mathematical Principles of Planning and Decision-making for Autonomy (AE8803-TSI) – Graduate Section, School of Aerospace Engineering, Georgia Tech (Spring 2022), *Supervisor: Prof. Panagiotis Tsiotras*