

Vasileios Tzoumas

Massachusetts Institute of Technology
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ACADEMIC EMPLOYMENT

- Massachusetts Institute of Technology** October 2019-present
Research scientist
Laboratory for Information & Decision Systems (LIDS)
Department of Aerospace and Aeronautics (AeroAstro)
Mentor: Luca Carlone (MIT)
- Massachusetts Institute of Technology** July 2018-September 2019
Post-doctoral associate
Laboratory for Information & Decision Systems (LIDS)
Department of Aerospace and Aeronautics (AeroAstro)
Mentor: Luca Carlone (MIT)

EDUCATION

- University of Pennsylvania** May 2018
Ph.D. in Electrical and Systems Engineering, GPA: 3.91/4.00
General Robotics, Automation, Sensing and Perception Laboratory (GRASP)
Thesis: “Resilient Submodular Maximization for Control and Sensing”
Committee: Rakesh Vohra (UPenn); Hamed Hassani (UPenn); Luca Carlone (MIT)
Mentors: George J. Pappas (UPenn); Ali Jadbabaie (MIT)
- University of Pennsylvania** 2016
Master of Science in Electrical Engineering, GPA: 4.00/4.00
- Wharton School of Business - University of Pennsylvania** 2016
Master of Arts in Statistics, GPA: 3.94/4.00
- National Technical University of Athens** 2012
Diploma in Electrical and Computer Engineering, GPA: 9.54/10.00
Thesis: “A Game-Theoretic Analysis of Competitive Diffusion Processes over Social Networks”
Mentors: Evangelos Markakis (AUEB); Trifon Koussiouris (NTUA)

RESEARCH VISION & INTERESTS

My vision is to enable an *Internet of Resilient Robotic Teams* (IoR₂T), where robots will not only withstand attacks and failures but also will adapt and recover. To this end, I have worked on **robotics and control** towards a **provably robust autonomy** against deception and denial-of-service attacks and failures, identifying fundamental limits, and contributing provably optimal algorithms. I have built on **fundamental tools of** automatic control, robotic perception, statistics, combinatorial and non-convex optimization, and computational complexity. I validated experimentally my results on tasks of autonomous navigation for exploration, search and rescue, and public security. Towards the IoR₂T, I argue we need to wed tools for a robust autonomy with tools for a multi-robot **distributed intelligence** driven by **adaptive learning and control** capabilities.

AWARDS & DISTINCTIONS

Best Student Paper Award Finalist, IEEE Conference on Decision and Control (**CDC**), 2017; (4 finalists out of 1100 accepted papers).
MIT LIDS|ALL Magazine interview featuring my research on robust autonomy, “Algorithms that protect,” in press, 2019.
Best Presentation in Session Award, American Control Conference (**ACC**), 2015, 2016.
ECE Distinguished Research Fellowship, University of Illinois at Urbana-Champaign (**UIUC**), 2012; declined.
Jacobs Fellowship, University of California at San Diego (UCSD), 2012; declined.
Graduate Fellowship, University of Pennsylvania, 2012-2018.
Highest honors, National Technical University of Athens (NTUA), 2011.
Greek Scholarships Foundation Award, National Technical University of Athens (NTUA), 2008.
Education Award from Eurobank EFG Group, for ranking 1st among the students of the 1st Experimental Unified Lyceum of Athens at the Pan-Hellenic university admission examinations, 2005.

PAPERS IN PREPARATION FOR JOURNAL SUBMISSION

- IJRR 11. P. Antonante, H. Yang, **V. Tzoumas**, L. Carlone, “Outlier-Robust Estimation: Hardness, General-Purpose Algorithms, and Guarantees,” to be submitted to *International Journal of Robotics Research* (IJRR), 2019.
- TRO 10. B. Schlotfeldt, **V. Tzoumas**, D. Thakur, G. J. Pappas, “Resilient Active Information Gathering with Mobile Robots,” to be submitted to *IEEE Transactions on Robotics* (TRO), 2019.

JOURNAL PUBLICATIONS & SUBMISSIONS

- TAC 9. **V. Tzoumas**, A. Jadbabaie, G. J. Pappas, “Robust and Adaptive Sequential Submodular Optimization,” under review in *IEEE Transactions on Automatic Control* (TAC), 2019.
arXiv preprint: 1909.11783.
- RAL/ICRA 8. H. Yang, P. Antonante, **V. Tzoumas**, L. Carlone, “Graduated Non-Convexity for Robust Spatial Perception: From Non-Minimal Solvers to Global Outlier Rejection,” under review in *IEEE Robotics and Automation Letters* (RAL) and *2020 IEEE International Conference on Robotics and Automation* (ICRA), 2019.
arXiv preprint: 1909.08605.
- RAL/ICRA 7. L. Zhou, **V. Tzoumas**, P. Tokekar, G. J. Pappas, “Distributed Robust Submodular Maximization for Multi-Robot Planning,” under review in *IEEE Robotics and Automation Letters* (RAL) and *2020 IEEE International Conference on Robotics and Automation* (ICRA), 2019.
arXiv preprint: 1910.01208.
- TAC 6. **V. Tzoumas**, A. Jadbabaie, G. J. Pappas, “Resilient Non-Submodular Maximization over Matroid Constraints,” under review in *IEEE Transactions on Automatic Control* (TAC), 2018.
arXiv preprint: 1804.01013.
- TAC 5. **V. Tzoumas**, L. Carlone, G. J. Pappas, A. Jadbabaie, “LQG Control and Sensing Co-Design,” under review in *IEEE Transactions on Automatic Control* (TAC), 2018.
arXiv preprint: 1802.08376.
- TAC 4. A. Jadbabaie, A. Olshevsky, G. J. Pappas, **V. Tzoumas**, “Minimal Reachability is Hard to Approximate,” *IEEE Transactions on Automatic Control* (TAC), Vol. 64, No. 2, 2019.
arXiv preprint: 1710.10244.
- RAL/ICRA 3. L. Zhou, **V. Tzoumas**, G. J. Pappas, P. Tokekar, “Resilient Active Target Tracking with Multiple Robots,” *IEEE Robotics and Automation Letters* (RAL) and *2019 IEEE International Conference on Robotics and Automation* (ICRA), Vol. 4, No. 1, 2019.
arXiv preprint: 1809.04032.

- TCNS 2. **V. Tzoumas**, Y. Xue, S. Pequito, P. Bogdan, G. J. Pappas, “Selecting Sensors in Biological Fractional-Order Systems,” *IEEE Transactions on Control of Network Systems* (TCNS), Vol. 5, No. 2, 2018.
DOI: 10.1109/TCNS.2018.2809959.
- TCNS 1. **V. Tzoumas**, M. A. Rahimian, G. J. Pappas, A. Jadbabaie, “Minimal Actuator Placement with Bounds on Control Effort,” *IEEE Transactions on Control of Network Systems* (TCNS), Vol. 3, No. 1, 2016.
arXiv preprint: 1409.3289.

CONFERENCE PUBLICATIONS

- IROS 11. **V. Tzoumas**, P. Antonante, L. Carlone, “Outlier-Robust Spatial Perception: Hardness, General-Purpose Algorithms, and Guarantees,” *IEEE/RSJ International Conference on Intelligent Robots and Systems* (IROS), 2019.
arXiv preprint: 1903.11683.
- CDC 10. **V. Tzoumas**, A. Jadbabaie, G. J. Pappas, “Resilient Monotone Sequential Maximization,” *57th IEEE Conference on Decision and Control* (CDC), 2018.
arXiv preprint: 1803.07954.
Invited paper.
- IROS 9. B. Schlotfeldt, **V. Tzoumas**, D. Thakur, G. J. Pappas, “Resilient Active Information Gathering with Mobile Robots,” *IEEE/RSJ International Conference on Intelligent Robots and Systems* (IROS), 2018.
arXiv preprint: 1803.09730.
- ACC 8. **V. Tzoumas**, L. Carlone, G. J. Pappas, A. Jadbabaie, “Sensing-Constrained LQG Control,” *American Control Conference* (ACC), 2018.
arXiv preprint: 1709.08826.
Invited paper.
- CDC 7. **V. Tzoumas**, K. Gatsis, A. Jadbabaie, G. J. Pappas, “Resilient Monotone Submodular Function Maximization,” *56th IEEE Conference on Decision and Control* (CDC), 2017.
arXiv preprint: 1703.07280.
Invited paper.
[Best Student Paper Award Finalist].
- ACC 6. **V. Tzoumas**, N. A. Atanasov, A. Jadbabaie, G. J. Pappas, “Scheduling Nonlinear Sensors for Stochastic Process Estimation,” *American Control Conference* (ACC), 2017.
arXiv preprint: 1609.08536.
- CDC 5. **V. Tzoumas**, A. Jadbabaie, G. J. Pappas, “Near-Optimal Sensor Scheduling for Batch State Estimation: Complexity, Algorithms, and Limits,” *55th IEEE Conference on Decision and Control* (CDC), 2016.
arXiv preprint: 1608.07533.
Invited paper.
- ACC 4. **V. Tzoumas**, A. Jadbabaie, G. J. Pappas, “Sensor Placement for Optimal Kalman Filtering,” *American Control Conference* (ACC), 2016.
arXiv preprint: 1509.08146.
Invited paper; best presentation in session.
- CDC 3. **V. Tzoumas**, A. Jadbabaie, G. J. Pappas, “Minimal Reachability Problems,” *54th IEEE Conference on Decision and Control* (CDC), 2015.
arXiv preprint: 1503.07021.
- ACC 2. **V. Tzoumas**, M. A. Rahimian, G. J. Pappas, A. Jadbabaie, “Minimal Actuator Placement with Optimal Control Constraints,” *American Control Conference* (ACC), 2015.
arXiv preprint: 1503.04693.
Best presentation in session.

- WINE 1. **V. Tzoumas**, C. Amanatidis, E. Markakis, “A Game-Theoretic Analysis of Competitive Diffusion Processes over Social Networks,” *8th International Conference on Web and Internet Economics (WINE)*, 2012.
DOI: 10.1007/978-3-642-35311-6_1.
[Acceptance rate 25%].

THESES PUBLICATIONS

2. **V. Tzoumas**, “Resilient Submodular Maximization for Control and Sensing,” Ph.D. thesis, University of Pennsylvania, 2018.
1. **V. Tzoumas**, “A Game-Theoretic Analysis of Competitive Diffusion Processes over Social Networks,” Diploma thesis, National Technical University of Athens, 2011.

INVITED TALKS

LIDS Student Conference, Massachusetts Institute of Technology, 2018.
Institute of Informatics and Telecommunications Seminar, Demokritos, 2018.
IEEE Conference on Decision and Control (CDC), 2018.
IEEE Conference on Decision and Control (CDC), 2017.
IEEE Conference on Decision and Control (CDC), 2016.
American Control Conference (ACC), 2018.
American Control Conference (ACC), 2016.

MENTORSHIP EXPERIENCE

Mentoring 3 Ph.D. students with current outcome: 5 publications (2 under review), and 2 papers in final preparation for journal submission.

Massachusetts Institute of Technology

3. Pasquale Antonante (Ph.D. advisor: Luca Carlone), 2018-present
Project: “Outlier-robust spatial perception.”

University of Pennsylvania

2. Brent Schlotfeldt (Ph.D. advisor: George J. Pappas), 2018-present
Project: “Resilient active information gathering with mobile robots.”

Virginia Tech

1. Lifeng Zhou (Ph.D. advisor: Pratap Tokekar), 2018-present
Project: “Resilient active target tracking with multiple robots.”

TEACHING EXPERIENCE

Massachusetts Institute of Technology

- Designed and delivered 3 lectures (1-hour each) on advanced topics of outlier-robust estimation, for the graduate level course *16.485 - Visual Navigation for Autonomous Vehicles*.
- [*Kaufman Teaching Certificate*](#) (2-month workshop of 8 sessions, 2-hour each), 2019.

University of Pennsylvania

- *Linear Optimization* (graduate level), Teaching Assistant, 2013.
- *Linear Systems* (graduate level), Teaching Assistant, 2014.

COMMUNITY SERVICE

LIDS mentoring committee, Massachusetts Institute of Technology, 2018-present.

- Led the organization of monthly meetings between Ph.D. students and post-docs to discuss questions of the Ph.D. students about their research and career progress.
- Organized 1 hour-long events on academic faculty applications, which attracted the majority of the LIDS Ph.D. student and post-doc community (more than 60 attendants per event).

LIDS post-doctoral committee, Massachusetts Institute of Technology, 2018.

- Co-founded the committee to foster a post-doc community where post-docs share their career growth experience and best practices.
- Organized 1 hour-long events on academic faculty applications, where LIDS post-docs with faculty position offers discussed their interview experience with the rest of the LIDS post-docs.
- Organized 1 hour-long events for the LIDS post-docs in the academic market to practice their interview presentations.

PROFESSIONAL SERVICE

Session organizer:

- IEEE Conference in Decision and Control (CDC), 2016; (with Tyler H. Summers).

Session chair:

- American Control Conference (ACC), 2018.
- IEEE Conference in Decision and Control (CDC), 2016.

Reviewer for journal submissions:

- IEEE Transactions on Automatic Control (TAC), 2014-present.
- Automatica, 2014-present.
- International Journal of Robotics Research (IJRR), 2018-present.
- IEEE Transactions on Robotics (TRO), 2018-present.
- Autonomous Robots (AURO), 2018-present.
- IEEE Transactions on Control of Network Systems (TCNS), 2014-present.
- IEEE Robotics and Automation Letters (RAL), 2019-present.
- IEEE Transactions on Network Science and Engineering (TNSE), 2016.
- IEEE Transactions on Signal Processing (TSP), 2017-present.
- IEEE Sensors, 2018.
- IEEE Signal Processing Letters (SPL), 2017.
- Physics Letters, 2017.
- Scientific Reports, 2017.

Reviewer for conference submissions:

- IEEE Conference on Decision and Control (CDC), 2014-present.
- American Control Conference (ACC), 2014-present.
- IEEE Conference on Robotics and Automation (ICRA), 2018-present.
- IEEE Conference on Cyber-Physical Systems (ICCPS), 2017.
- IEEE Conference on Control Technology and Applications (CCTA), 2019.
- European Control Conference (ECC), 2015.
- Conference on Web and Network Economics (WINE), 2013-2014.
- Conference on Economics and Computation (EC), 2013.

REFERENCES

George J. Pappas
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JR East Professor of Engineering and Associate Director
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