

Stas Tiomkin, PhD

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Research Interests

Artificial Intelligence, **R3** Learning (**R**einforcement, **R**epresentation, **R**obot), Control and Information Processing in Dynamical Systems, Intrinsic Motivation, Human-AI Interaction, Resiliency.

Exemplar Research Projects: Structure of Manifolds for efficient learning and control of Robotic Systems ✦ Multivariate Information Bottlenecks for challenging problems in Data Science and AI ✦ Novel unsupervised reward measures for safe human-AI Interaction ✦ Guarantees from optimal control theory for deep neural networks ✦ Information theoretical principles for the Multimodal Perception-Action Loop ✦ Generative modeling of dynamics and algebraic constraints in Cyber-Physical systems ✦ New theoretical results on transfer learning in AI by non-equilibrium statistical mechanics.

Research Lab: ‘Computational Intelligence, Control & Information’, **CI2**, WCoE, TTU.

Academic Appointments

- current- Assistant Professor, Department of Computer Science, Whitacre College Of Engineering, Aug 2024 Texas Tech University, Lubbock, Texas.
- Aug 2024- Assistant Professor, Department of Computer Engineering, Davidson College Of Engi- Aug 2021 neering, San Jose State University, California.

Education and Training

- Aug 2021- **Post-Doctorate** in Berkeley Artificial Intelligence Research (BAIR), ‘Robot Learning Lab’ by Jan 2019 Professor Pieter Abbeel University of California at Berkeley, CA.
- Jun 2018- **Visiting Research Fellow** in ‘The Institute for Quantitative Theory and Methods’, Professor Mar 2018 Ilya Nemenman’s Lab Emory University, Atlanta, GA.
- 2019 **PhD**. Dissertation topic: ‘Intrinsic Motivation - An Information Theoretic Approach’ Hebrew University at Jerusalem advisors: Prof Naftali Tishby and Prof Daniel Polani.
- 2008 **MSc**. Thesis topic: ‘Statistical Text to Speech Synthesis’ Dept. of Electrical and Computer Engineering, Technion I.I.T, Israel. advisor: Prof David Malah
- 2005 **BSc** (double major), Computer Engineering and Physics Hebrew University, Israel.

Grants and Awards

- Mar 2023 **NSF CRII in Robust Intelligence, Division of Information and Intelligent Systems**
PI ‘Interpretable Framework and Transformative Applications for Viability in Autonomous Agents’; Award number: 2246221; Award amount: \$174,874.00.

- Sep 2023 [NSF CloudBank 22-087](#)
PI Award amount: \$34,597.00.
- Oct 2023 [PAZI Excellence in Science Foundation](#)
CoPI 'Discovery and Utilization of Symmetries in Dynamical Systems'; Award amount: \$32,000.00.
- Feb 2022 [Renault-Nissan-Mitsubishi Alliance Innovation Lab - Silicon Valley \(AIL-SV\) California](#)
PI 'Decision-Making, Control, and Reinforcement Learning in Robotics'; Award amount: \$49,000.00.
- Oct 2022 [SGP, CoE SJSU](#)
PI 'Control Theoretic Framework for Design and Analysis of Closed-Loop Brain Stimulation';
CoPI: Prof Gautam Kumar; Award amount: \$49,000.00.
- Oct 2023 [University Grant Academy Research Clusters, SJSU](#)
PI Award amount: release from teaching assignment.
- May 2022 [Qualcomm, Faculty Teaching Fellow](#)
Competitive teaching award; Award amount: \$3,000.00.
- Dec 2021 [University Grant Academy, SJSU](#)
PI Award amount: \$4,500.00.
- Dec 2021 [Lockheed Martin, Senior Project Award](#)
Competitive undergraduate project award; Award amount: \$2,100.00.
- Apr 2022 [Research Foundation Awards for student supervision](#)
- May 2024 'Research, Scholarship, and Creative Activity'; total award amount: \$25,900.00.

Selected Publications ([Full List at Google Scholar](#))

- PRX Life 24 '[Intrinsic Motivation in Dynamical Systems](#)' in 'PRX Life - Physical Review Journals, APS' with Ilya Nemenman, Daniel Polani, Naftali Tishby. Keywords: Empowerment, Channel Capacity, Lyapunov Exponents.
- UAI 23 '[Bounding the Optimal Value Function in Compositional Reinforcement Learning](#)' in 'Uncertainty in Artificial Intelligence' with Jacob Adamczyk, Volodymyr Makarenko, Argenis Arriojas, Rahul V. Kulkarni. Acceptance rate, 30%. Keywords: theoretical bounds on compositionality.
- UAI 23 '[Bayesian Inference Approach for Entropy Regularized Reinforcement Learning with Stochastic Dynamics](#)' in 'Uncertainty in Artificial Intelligence' with Argenis Arriojas, Jacob Adamczyk, Rahul V. Kulkarni. **Spotlight acceptance rate, 3%**. Keywords: exact Bayesian inference in Markov Decision Processes with stochastic dynamics.
- AAAI 23 '[Utilizing Prior Solutions for Reward Shaping and Composition in Entropy-Regularized Reinforcement Learning](#)' in 'Thirty-Seventh AAAI Conference on Artificial Intelligence' with Jacob Adamczyk, Argenis Arriojas, Rahul V. Kulkarni. Acceptance rate, 19%. Keywords: theoretical bounds on transfer learning, compositionality in entropy-regularized RL.

- PRR 23 ‘Entropy Regularized Reinforcement Learning using Large Deviation Theory’ in ‘Physical Review Research, American Physical Society’ with Argenis Arriojas, Jacob Adamczyk, Rahul V. Kulkarni. Q1 journal. Keywords: statistics of rare events in RL, non equilibrium statistical mechanics, free energy.
- IROS 22 ‘Multi-Objective Policy Gradients with Topological Constraints’ in ‘IEEE International Conference on Intelligent Robots and Systems’ with Kyle Hollins Wray, Mykel J. Kochenderfer, Pieter Abbeel. Acceptance rate, 47%. Keywords: robotics, deep multi-objective reinforcement learning, constrained policy gradients.
- ICLR 21 ‘Efficient Empowerment Estimation for Unsupervised Stabilization’ in ‘International Conference on Learning Representations’ with Ruihan Zhao, Kevin Lu, Pieter Abbeel. Acceptance rate, 28%. Keywords: representation learning of dynamical control systems, estimation of information channel capacity from images, intrinsic motivation.
- NeurIPS 20 ‘AvE: Assistance via Empowerment’ in ‘Advances in Neural Information Processing Systems’ with Yuqing Du, Emre Kiciman, Daniel Polani, Pieter Abbeel, Anca Dragan. Acceptance rate, 20%. Keywords: Human-AI intrinsic interaction, deep reinforcement learning, control of partially-controllable machinery, user study.
- CDC 15 ‘Past-future Information Bottleneck for Linear Feedback Systems’ in ‘54th IEEE Conference on Decision and Control’ with Amir Nadav and Naftali Tishby. Keywords: information bottleneck, complexity of dynamical control systems.

Service

NSF panelist; Reviewer in: NeurIPS, IEEE, ICLR, ICRA, IROS, UAI, ICML, eLife, PRX Life.

Dec 2024 Area Chair in NeurIPS 2024.

Jul 2024 Organizer of a special track on ‘Smart Machine Computing and Intelligence’ in the 19-th International Conference, IEEE CISOSE2024.

Aug24-Aug23 Graduate Studies Committee at College of Engineering, SJSU.

Aug24-Aug21 Graduate Studies Committee at Computer Engineering, CoE, SJSU.

Jul23-Aug22 Research Committee at College of Engineering, SJSU.

Mentoring Graduate Students

Graduated / Current

Fall 2023 Suruchi Sharma; topic: ‘Controllability-Constrained Deep Neural Network Models for Enhanced Control of Dynamical Systems’
keywords: control-theoretic constraints on deep networks, dynamics learning from images

Fall 2023 Johnny Liang; topic: ‘Reinforcement Learning Methods for Efficient Cross-Training between Real and Simulated Robots in Cyber-Physical Systems’
keywords: robotics, sim2real, ensemble learning, cyber-physical system

Fall 2023 Fnu Ankur; topic: ‘Reinforcement Learning with elements of group theory and symmetries’
keywords: deep RL, group theory, symmetry, sample efficiency, equivariance

Fall 2023 Phu Nguyen; topic: ‘Intrinsic Motivation by the Principles of Non-Linear Dynamical Systems’
keywords: unsupervised learning, estimation of Lyapunov Exponents, intrinsic motivation

- Fall 2023 Alavi Khan; topic: ‘Exploring the Design Space of Simulated Robotic Arms with Tactile Stimuli for Object Manipulation using Reinforcement Learning Methods’
keywords: multi-modal perception-action in robotic arms, reinforcement learning
- Spring 2023 Ezgi Kaya; topic: ‘Sample-based Learning of Hybrid Dynamical Systems’
keywords: hybrid dynamics, differential algebraic equations, implicit learning.
- Spring 2023 Tristan Shah; topic: ‘Wave Manipulation with Reinforcement Learning’
keywords: PDE control, reinforcement learning, acoustics, meta-materials
- Spring 2023 Paul Mello; topic: ‘Information Processing by Diffusion Processes’
keywords diffusion models, generative AI, information estimators, information bottlenecks
- Spring 2023 Himaja Papala; topic: ‘Decentralized traffic congestion control using self-motivated AI’
keywords: decentralized control, traffic dynamics, empowerment, transportation
- Spring 2023 Wooyoung Chung; topic: ‘Symmetry Discovery by Reinforcement Learning’
keywords: manifold learning, deep reinforcement Learning with geometric constraints
- current Enosh Shrestha; topic: ‘Learning to play via maximization of directed information’
keywords feedback capacity, directed information, unsupervised reinforcement learning
- current Ankit Pal; topic: ‘Multimodal Intrinsic Motivation for Object Manipulation’
keywords: empowerment, unsupervised learning, multimodal sensor fusion, tactile, vision
- current Vlad Makarenko; topic: ‘Data Analysis with Information Theoretic Methods’
keywords: multivariate information bottleneck, capacity of neural models, generalization in neural models, reinforcement learning

Undergrad / Grad

Teaching

- CS 3368 ‘Intro to Artificial Intelligence’, Spring 24, Whitacre CoE, Texas Tech U.
- CS 5392 ‘Reinforcement Learning’, Fall 24, Whitacre CoE, Texas Tech U.
- CMPE 260 ‘Reinforcement Learning’, Spring 22, 23, Fall 22, Davidson CoE SJSU.
- CMPE 252 ‘Artificial Intelligence and Data Engineering’, Fall 21, 22, 23, Spring 22, 23, Davidson CoE SJSU.
- CMPE 260 ‘Reinforcement Learning’, Spring 22, 23, Fall 22, Davidson CoE SJSU.
- CMPE 188 ‘Machine Learning for Big Data’, Fall 21, Davidson CoE SJSU.
- CMPE 289 ‘Special Problems’, Fall 22, 23, Spring 23, Davidson CoE SJSU.
- CMPE 180 ‘Individual Study’, Spring 22, Davidson CoE SJSU.
- CMPE 295 ‘Graduate Engineering Project’, Fall 21, 22, 23, Spring 22, 23 Davidson CoE SJSU.
- CMPE 195 ‘Undergraduate Engineering Project’, Fall 21, 22, 23, Spring 22, 23 Davidson CoE SJSU.
- CS 76929 ‘Dynamical Systems and Control’, Spring 13, 14, 15, CSE Hebrew University.
- CS 67738 ‘Smart Systems’, Fall 14, 15, 16, 17, CSE Hebrew University.
- EE 44130 ‘Signals and Systems’, Fall 05, 06, 07, Spring 05, 06, 07, ECE Technion.
- EE Labs ‘Signal and Image Processing’, Fall 05, 06, 07, Spring 05, 06, 07 ECE Technion.

Undergrad / Grad

Supervising Student Projects

- SP22-FL23 topic: ‘Object manipulation by simulated robotic arms with tactile sensing’

- SP22-FL23 topic: 'Model-free tracking utilizing properties of dynamical systems'
- SP22-FL23 topic: 'Enhancement of Superway Transportation by Machine Learning Approaches'
- SP22-FL23 topic: 'Optimization of the morphology of robotic arms'
- SP22-FL23 topic: 'Information theoretical and physical quantities for unsupervised learning'
- SP22-FL23 topic: 'Control of high-dimensional dynamics by sparse inputs and outputs'
- SP22-FL23 topic: 'Robo - Trainer'
- FL22-SP23 topic: 'Model-based reinforcement learning with geometric priors'
- FL22-SP23 topic: 'Rolling Stones Play Go by Self-Learning'
- FL22-SP23 topic: 'Investigation of latent factor analysis via dynamical systems'
- SP23-FL23 topic: 'Scalable Multiple-Service Architecture for an Autonomous Cyber-Physical Platform'
- FL22-SP23 topic: 'Development of autonomous CyberPhysical systems by reinforcement learning'
- FL22-SP23 topic: 'Improving safety of intelligent car breaks by reinforcement learning methods'
- FL22-SP23 topic: 'Information theoretic approach to decentralized control of traffic networks'
- FL22-SP23 topic: 'Reinforcement learning approach to the design of acoustic meta-material'
- SP23-FL23 topic: 'Large Scale Cyber Physical Platform for Artificial Intelligence Research'
- SP23-FL23 topic: 'Unsupervised Learning with Information Theoretic methods'
- FL23-SP24 topic: 'Multiple-Agent Reinforcement Learning for RoboCup Soccer Competition'
- FL23-SP24 topic: 'Real-time Data Processing and Machine Learning in Cyber Physical systems'
- FL23-SP24 topic: 'Classification of Pets in Natural Environment'
- FL23-SP24 topic: 'Real-time monitoring and analysis of Air Quality with Embedded Devices'

Industrial Research, Development, and Leadership

www.Voiceltt.com

Jan 2019 Co-Founder and Chief Technology Officer in 'Voiceltt Ltd.', developing AI technology for
 Sep 2022 the enhancement of social inclusion for people with disabilities.