

Hao-Lun Hsu

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Education

Duke University

Ph.D. Computer Science in Reinforcement Learning (RL)

Medical Robotics Certificate

Durham, NC, USA

Aug. 2022 – Present

Georgia Institute of Technology

M.S. Biomedical Engineering

Atlanta, GA, USA

Aug. 2019 – May 2021

National Taiwan University

B.S. Mechanical Engineering

Taipei, Taiwan

Sep. 2014 – Jun. 2018

Publications

Conference Papers

- C1. **HL Hsu**, Q Gao, and M Pajic, “ ϵ -Neural Thompson Sampling of Deep Brain Stimulation for Parkinson Disease Treatment”, in *International Conference on Cyber-Physical Systems (ICCPs)*, 2024
- C2. T Jin, **HL Hsu**, W Chang, and P Xu, “Finite-Time Frequentist Regret Bounds of Multi-Agent Thompson Sampling on Sparse Hypergraphs”, in *38th AAAI Conference on Artificial Intelligence (AAAI)*, 2024 (**Oral**)
- C3. P Sarikhani, **HL Hsu**, and B Mahmoudi, “Automated Tuning of Closed-loop Neuromodulation Control Systems using Bayesian Optimization”, in *44rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2022
- C4. **HL Hsu**, Q Huang, and S Ha, “Improving Safety in Deep Reinforcement Learning Using Unsupervised Action Planning”, in *IEEE International Conference on Robotics and Automation (ICRA)*, 2022
- C5. JH Chen, **HL Hsu**, WH Yang, YC Chen, and HM Hsiao, “New Spherical Stent Concept for Occlusion”, in *Annual Scientific Meeting of Taiwanese Society of Biomechanics*, 2017

Workshop Papers

- W1. P Sarikhani, **HL Hsu**, JK Kim, S Kinzer, E Mascarenhas, H Esmailzadeh, and B Mahmoudi, “Neuroweaver: Towards a Platform for Designing Translatable Intelligent Closed-loop Neuromodulation Systems”, in *NeurIPS Research2Clinics Workshop*, 2021
- W2. **HL Hsu**, Q Huang, and S Ha, “Safe Exploration for Reinforcement Learning Using Unsupervised Action Planning”, in *RSS Workshop on Integrating Planning and Learning*, 2021

Abstract

- A1. P Sarikhani, H Xu, ST Wang, S Kinzer, **HL Hsu**, Y Zhu, J Krasney, J Manns, H Esmailzadeh, B Mahmoudi, “Neuroweaver: a translational platform for embedding artificial intelligent in closed-loop neuromodulation systems”, in *Neuroscience 2023, 52nd Annual Meeting*, 2023
- A2. P Sarikhani, **HL Hsu**, M Zeydabadinezhad, Y Yao, M Kothare, and B Mahmoudi, “Sparc: Adaptive Closed-loop Control of Vagal Nerve Stimulation for Regulating Cardiovascular Function Using Deep Reinforcement Learning: A Computational Study”, in *Neuroscience 2021, 50th Annual Meeting*, 2021

- A3. P Sarikhani, **HL Hsu**, O Kara, JK Kim, H Esmaeilzadeh, and B Mahmoudi, “Neuroweaver: A Platform for Designing Intelligent Closed-loop Neuromodulation Systems”, in *4th International Brain Stimulation Conference*, 2021
- A4. **HL Hsu**, “Functional Connectivity Correlates to Individual Difference in Human Brains during Working Memory Task and Resting State”, in *IEEE EMBS North American Virtual International Student Conference*, 2021

Honors & Awards

AAAI 2024 Oral , acceptance rate 2.3 %	Feb. 2024
NSF TAST-NRT Fellowship , 1 of 6 awardees	Aug. 2022 - Jul. 2023
Ph.D. Departmental Fellowship , Computer Science, Duke University	Aug. 2022 - Jul. 2024
Thank a Teacher Award , Center of Teaching and Learning, Georgia Tech	Apr. 2021
Travel Grants for Ph.D. Fellowship workshop , Hong Kong government	Jul. 2018
Material Innovation Award , Material Research Society Taiwan	Oct. 2016
Third Prize , Manufacturing Practice Competition, Mechanical Engineering, NTU	Jan. 2015

Research Experience

Duke University <i>Cyber-Physical Systems Lab</i> Advisor: Prof. Miroslav Pajic	Durham, NC, USA Aug. 2022 – Present
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- Robust RL with (1) adversarial herding and (2) adaptive adversary
- Pulse frequency prediction of deep brain stimulation with (1) less exploration via ϵ -Neural Thompson Sampling and (2) robust exploration
- Offline RL (1) via transformer-based supervised learning with guidance via temporal difference (2) for selecting frames with ORB features in SLAM

Duke University <i>Theoretical RL group</i> Advisor: Prof. Pan Xu	Durham, NC, USA Feb. 2023 – Present
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- Cooperative framework with randomized exploration for multi-Agent RL via Thompson sampling and Langevin Monte Carlo
- Multi-agent Thompson sampling on sparse hypergraphs with frequentist regret bounds

Emory University <i>Neuroinformatics & Intelligent System Lab</i> Advisor: Prof. Babak Mahmoudi	Atlanta, GA, USA Jan. 2021 – Jul. 2022
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- Deep brain stimulation improvement in (1) computation cost reduction via quantization RL, (2) automated PI controller via Bayesian optimization, and (3) safe RL with penalty for neuron suppression in Parkinson’s diseases
- Vagus nerve stimulation with (1) set-point control based RL and (2) Few-shot adaption from healthy to hypertension cardiac model via transfer learning

Georgia Institute of Technology <i>Robotics & Computer Animation Lab</i> Advisor: Prof. Sehoon Ha	Atlanta, GA, USA Jan. 2020 – Oct. 2021
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- Integrated on-policy RL agent with unsupervised action planning for safe exploration
- RL transfer for power grid control via (1) Augmented Random Search to adapt to less controllable renewables and (2) domain randomization for different power load

Work Experience

Curai Health

Palo Alto, CA, USA (Remote)

Machine Learning Research Intern

May 2022 – Sep. 2022

Mentors: Dr. Anitha Kannan and Dr. Ilya Valmianski

- Built Decision Transformer for sequence modeling in high dimensional medical history taking
- Interpreted connection between queries and diagnosis with scalability and generalization

Reazon Holdings, Inc.

Tokyo, Japan (Remote)

Machine Learning Research Intern

Oct. 2021 – Dec. 2021

Mentors: Shubham Gupta MD. and Dr. Daijro Mori

- Built ShuffleNet and GhostNet for gaze estimation and eye moving tracking on mobile devices improving upon published accuracy
- Adapted a Capsule Network to gaze estimation problem including eyes, face, and gray frame models and incorporated reconstruction loss to the original objective function
- Abstracted original PyTorch implementation via PyTorch Lightning

Abbott Vascular Taiwan

Taipei, Taiwan

Software Engineering Intern

Jun. 2018 – Jul. 2019

- Built an administrative system to share information among marketing, sales, and finance departments, and improved 75% of operation time in the sales database of vascular products, facilitating fast targeting
- Forecasted vascular product marketing trend by digitizing routine documents and incorporated the original database with Power BI to provide interactive visualizations and business intelligence capabilities to create reports and dashboards

Academic Service

Paper Review: ICRA'23-24, IROS'23, NeurIPS'23, ICLR'24, AISTATS'24, ICML'24, ICML'23 Frontiers4LCD, NeurIPS'23 AI4Science, NeurIPS'23 GenBio

Research Proposal Review: PURA (President's Undergraduate Research Award) Fall 2022

Teaching Assistant: Algorithmic Game Theory (Expected Spring 2024), Data Science (Spring 2023), Network Science (Spring, Summer, and Fall 2021), Clinical Application of Medical Electronic Device (Fall 2017), Clinical Observation & Demands Exploration (Summer 2017)

Research Mentoring (RL for Science):

- Yang Chen (UC Berkeley): safe surgical robotics (Fall'23)
- Alexander Wang (West Windsor Plainsboro High School North): fake news detection (Fall'23)
- Nirav Jaiswal (Foothill High School): cloud computing (Summer'23)
- Indu Arimilli (Redmond High School): diagnosis prediction (Summer'23)
- Ian Choe (St. Mark's School): deep brain stimulation (Summer'23)

Talks & Presentations

AFOSR Center "Assured Autonomy in Contested Environments" (Poster) Dec. 2023

Robust Reinforcement Learning with Structured Adversarial Ensemble

NCTPASS 2022 Annual Symposium (Young Scholar Presentation) Nov. 2022

AI for Dynamical and Safety-critical Systems

Curai Health ML paper club (Invited Talk) Jul. 2022

Possible Reinforcement Learning Approaches to History Taking

Georgia Tech Robotics Research Showcase (Poster) Mar. 2022

Improving Safety in Deep Reinforcement Learning Using Unsupervised Action Planning

- Artificial Intelligence Medicine Organization weekly webinar** (Invited Talk) Mar. 2021
Applications of Reinforcement Learning in healthcare and power grid control
- Prof. Constantine Dovrolis's research group** (Invited Talk) Feb. 2021
Individual Difference in Humans' Brains from Functional Connectivity for Working Memory
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Technical Skills

Programming: Python, MATLAB, C++, C#, Julia, VBA
Software: AutoCAD, SolidWorks, Creo Parametric, ABAQUS, Qblade
OS: Linux (Ubuntu), Microsoft Windows, iOS
ML: Tensorflow, PyTorch, Keras, Scikit-learn, PyTorch Lightning
Simulation Environment: OpenAI Gym, Mujoco