Hao-Lun Hsu

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Research Interests

Intersection of Reinforcement Learning and Robotics/ Neuromodulation, particularly focusing on improving safety, interpretability, and robustness with real-world data.

Education

Duke University Durham, NC, USA
Ph.D. Computer Science *Aug. 2022 – Present*

- NSF Traineeship: Advancement of Surgical Technologies (TAST)

Georgia Institute of Technology Atlanta, GA, USA
M.S. Biomedical Engineering *Aug. 2019 – May 2021*

- Diversity Ambassador, Georgia Tech Student Diversity Program, 2020
- Graduate Teaching assistant of CS 7280 Network Science

National Taiwan University Taipei, Taiwan
B.S. Mechanical Engineering *Sep. 2014 – Jun. 2018*

- Teaching Assistant of EE 5040 Clinical Application of Medical Electronic Device
- Teaching Assistant of Biomed 7110 Clinical Observation & Demands Exploration

Publications

Conference Papers

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

C2 **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

C1 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

W2 P Sarikhani, **HL Hsu**, JK Kim, S Kinzer, E Mascarenhas, H Esmaeilzadeh, and B Mahmoudi*, "Neuroweaver: Towards a Platform for Designing Translatable Intelligent Closed-loop Neuromodulation Systems", in *NeurIPS Research2Clinics Workshop*, 2021

W1 **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

A3 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

A2 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

A1 **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

Research Experience

Emory University Atlanta, GA, USA
Graduate Research Assistant *Jan. 2021 – July 2022*
Advisor: Prof. Babak Mahmoudi (Neuroinformatics & Intelligent System Lab)

- Used Bayesian Optimization automated tuning PI controllers for closed-loop neuromodulation
- Suppressed pathologically synchronous neurons for Parkinson's via RL approaches
- Regulated cardiovascular system via vagus nerve stimulation with set-point control based RL

Georgia Institute of Technology Atlanta, GA, USA
Graduate Research Assistant *Jan. 2020 – Oct. 2021*
Advisor: Prof. Sehoon Ha (Computer Animation & Robotics Lab)

- Integrated on-policy reinforcement learning (RL) agent with unsupervised action planning for safe exploration
- Deployed Augmented Random Search for training the power grid policy to adapt to less controllable renewables
- Sim-to-sim transfer for different power load with dynamic randomization

National Taiwan University Taipei, Taiwan
Undergraduate Research Assistant *Sep. 2015 – Sep. 2018*
Advisor: Hao-Ming Hsiao (Advanced Medical Device Laboratory)

- Designed a double spherical stent to reduce the blood flow volume by 44% for cerebral aneurysm treatment
- Invented a novel dural defect occluder to prevent bacterial meningitis and cerebrospinal fluid rhinorrhea after Expanded Endonasal Approach

Work Experience

Curai Health Palo Alto, CA, USA (Remote)
Machine Learning Research Intern *May 2022 – Aug. 2022*
Mentors: Dr. Anitha Kannan and Dr. Ilya Valmianski

- Building a Reinforcement Learning model for text response from patients to make diagnoses automatically via chatbots

Reazon Holdings, inc. Tokyo, Japan (Remote)
Machine Learning Research Intern *Oct. 2021 – Dec. 2021*
Mentors: MD. Shubham Gupta 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 – July 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

Talks and Presentations

Georgia Tech Robotics Research Showcase *Mar. 2022*
Poster
Improving Safety in Deep Reinforcement Learning Using Unsupervised Action Planning

Artificial Intelligence Medicine (AIM) Organization weekly webinar *Mar. 2021*
Invited Talk
Applications of Reinforcement Learning in healthcare and power grid control

Prof. Constantine Dovrolis's research group *Feb. 2021*
Invited Talk
Individual Difference in Humans' Brains from Functional Connectivity for Working Memory

Honors and Awards

Computer Science Fellowship @ Duke *Aug. 2022 – May 2024*
Awarded the fellowship by the department of Computer Science at Duke

"Thank a Teacher" @ Georgia Tech *April. 2021*
Recognition for excellence in teaching CS 7280 Network Science class

Silver Linings Global and Stanford Center on Longevity *Dec. 2016*
Finalist (8 out of 91) of Stanford Design Challenge Asia

Technical Skills

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