
Hsin-Yu (Jane) Lai <janelai22@gmail.com>

CAREER OBJECTIVES

My interests include signal processing, Bayesian inference, machine learning, and reinforcement learning. I have a solid background in math and am confident in learning new knowledge. My master experience allowed me to explore theoretical signal processing, whereas my Ph.D. and Postdoc experience trained me to connect theories with real-world applications.

EDUCATION

Harvard University

September 2021-

Postdoc in Statistics

- Supervisor: Professor Susan Murphy

Massachusetts Institute of Technology

September 2014-June 2021

M.S./Ph.D. in EECS

- Ph.D. Advisors: Professor Thomas Heldt and Professor Vivienne Sze
- M.S. Advisor: Professor Alan Oppenheim
- Master Thesis: "Reconstruction Method for Level-crossing Sampling"
- GPA: 5.0/5.0

National Taiwan University (NTU)

September 2010-June 2014

BS. in Math and EECS

- Research Advisors: Professor Andy Wu and Professor Benson Yeh
- GPA: 4.25/4.3 (Rank 1st/198)

MIT GRADUATE COURSES HIGHLIGHT AND PROGRAMS

- **EECS Department:** Bayesian Statistics, Inference and Information, Fundamental of Probability, Discrete-time Signal Processing, Speech Recognition, Computer Vision, Advanced Signal Processing, Semidefinite Optimization, Linear Programming, Information Theory, Digital Communication
- **Math Department:** Theory of Probability, Mathematical Statistics, Number Theory
- **Impact Program:** A program designed to train Ph.D. students and Postdocs to define the impact of their research and develop an ability to explain research to people outside of their fields (<https://impact-program.org/about/>)

RESEARCH EXPERIENCE

Designing RL algorithms for Mobile Health Applications

September 2021-

Harvard Department of Statistics, Statistical Reinforcement Learning Lab

- Use a directed acyclic graph to help develop RL algorithms to use mediators (e.g., daily step counts) to optimize the sparse reward (e.g., the activeness of a person) that can only be measured at a monthly level.
- Develop a toolbox to help behavioral scientists design the prior hyperparameters for Thompson sampling as the decision-making algorithms for their personalizing digital mobile-health interventions. Then, provide them with an API so that they can run their designs in their studies.

Using eye movements collected from mobile devices to track neurodegenerative diseases

November 2016-June 2021

Research Laboratory of Electronics, Energy-Efficient Multimedia Systems Group

- Used machine-learning-based eye tracking algorithms to extract promising eye movement features (visual reaction time, error rate) for monitoring neurodegenerative disease progression [2,3,4,6,7].
- Designed an iOS app that can collect and measure eye movement features [2,3].
- Developed a disease progression model using Gaussian processes to learn the correlation between eye movement features and individual disease states [1,3].

Amplitude sampling: theory and reconstruction algorithms

September 2014-June 2016

Research Laboratory of Electronics, Digital Signal Processing Group

- Analyzed properties of amplitude sampling, a recently proposed approach to representing a signal with quantized amplitudes and continuous time instants [8,10].
- Developed the iterative amplitude sampling reconstruction (IASR) algorithm that empirically converges within much fewer iterations than the most efficient nonuniform sampling reconstruction method (the Voronoi method) under the scheme of amplitude sampling [5,8,9].

Feature extraction from EEG and ABP signals

September 2012-June 2014

NTU, Access IC Design Lab

- Investigated artifact removal of Electroencephalography (EEG) using Independent Component Analysis (ICA).
- Utilized SVM and Neural Network classifiers for stroke outcome prediction based on Arterial blood pressure (ABP).

- Investigated distance estimation of concentration-based molecular communication [11].

PUBLICATIONS

- [1] Hsin-Yu Lai, Charlie G. Sodini, Thomas Heldt, Vivienne Sze, "Individualized Tracking of Neurocognitive-State-Dependent Eye-Movement Features Using Mobile Devices," *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, vol. 7, issue 1, no. 19, pp. 1-23, 2023.
- [2] Hsin-Yu Lai, Gladynel Saavedra-Peña, Charlie G. Sodini, Thomas Heldt, Vivienne Sze, "App-Based Saccade Latency and Error Determination across the Adult Age Spectrum," *IEEE Transactions on Biomedical Engineering*, vol. 69, no. 2, pp. 1029-1039, 2022.
- [3] Hsin-Yu Lai, "Tracking of Eye Movement Features for Individualized Assessment of Neurocognitive State Using Mobile Devices.," *Doctoral Thesis*, 2021.
- [4] Hsin-Yu Lai, Gladynel Saavedra-Peña, Charlie G. Sodini, Vivienne Sze, Thomas Heldt, "Measuring Saccade Latency using Smartphone Cameras," *IEEE Journal of Biomedical and Health Informatics*, vol. 24, no. 3, pp. 885-897, 2020.
- [5] Pablo Martínez Nuevo, Hsin-Yu Lai, and Alan V. Oppenheim, "Delta-ramp encoder for amplitude sampling and its interpretation as time encoding," *IEEE Transactions on Signal Processing*, vol. 67, no. 10, pp. 2516-2527, 2019.
- [6] Hsin-Yu Lai, Gladynel Saavedra-Pena, Charlie G. Sodini, Thomas Heldt, Vivienne Sze, "Enabling Saccade Latency Measurements with Consumer-Grade Cameras," *IEEE International Conference on Image Processing*, 2018.
- [7] Gladynel Saavedra-Pena, Hsin-Yu Lai, Vivienne Sze, Thomas Heldt, "Determination of Saccade Latency Distributions using Video Recordings from Consumer-Grade Devices," *IEEE International Engineering in Medicine and Biology Conference*, 2018.
- [8] Hsin-Yu Lai, Pablo Martínez Nuevo, and Alan V. Oppenheim, "An Iterative Reconstruction Algorithm for Amplitude Sampling," *IEEE International Conference on Acoustics, Speech, and Signal Processing*, 2017.
- [9] Pablo Martínez Nuevo, Hsin-Yu Lai, and Alan V. Oppenheim, "Amplitude Sampling," *Allerton*, 2016.
- [10] Hsin-Yu Lai, "Reconstruction Method for Level-crossing Sampling," *Master Thesis*, 2016.
- [11] Jiun-Ting Huang, Hsin-Yu Lai, Yen-Chi Lee, Chia-Han Lee, and Ping-Cheng Yeh, "Distance Estimation in Concentration-Based Molecular Communications," in *IEEE Conference on Global Communications*, 2013.

WORK EXPERIENCE

Incorporating auditory perception in soundfield reconstruction

June 2016-August 2016

Bose Corporation

- Factored spatial perception into soundfield reconstruction by optimizing the time delay and phase delay between the left and right channel.
- Developed an iterative algorithm that can weigh time delay and phase delay correspondingly for each frequency, which in simulations improved the hearing experience compared with least square optimization.

CNN-based stereo depth estimation

June 2015-August 2015

Texas Instrument

- Developed CNN-based stereo depth estimation to improve the accuracy compared to traditional stereo methods.

TEACHING EXPERIENCE

6.041/6.341 Probabilistic Systems Analysis, MIT

February 2017-May 2017

- Held tutorials and office hours to help students with weekly materials and problem sets.
- Assisted in designing exam questions and grading.
- Held review sessions to help students encapsulate concepts they learn in class.

6.431 Discrete Time Signal Processing, MIT

September 2016-December 2016

- Held recitations and office hours to help students with weekly materials and problem sets.
- Assisted in designing term projects, exam questions, and grading.
- Maintained MITx on the edX platform to improve students' learning experience.

HONORS

- Impact Fellow Fall 2019
- MIT IBM-AI Best Poster Award 2019
- MIT MARC (student conference) Presentation and Poster Award 2018
- Siebel Scholar 2015
- Jacobs Presidential Fellowship 2014
- Presidential Awards (6 times out of 8 semesters) at NTU
- InnovateAsia FPGA Workshop and Design Contest Silver Award
- IMO training camp

LEADERSHIP

- MIT MARC (student conference) 2018, 2019, 2020, 2021 session chair
- MIT Sidney Pacific (graduate dormitory) trustee, brunch chair, and environment chair
- Vice minister of academic department in student association of EE department at NTU

SKILLS

- Program in languages including Matlab, Python, R, Swift, C++, Java, and Verilog.
- Experience in tools such as Julia, CVX, Caffe, and Torch.
- Language: English, Chinese