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# CHI-HENG (HENRY) LIN

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ECE PhD student @ GeorgiaTech

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## Education

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- 09/2017 - 12/2022    Ph.D. in Electrical and Computer Engineering. Advisor: Eva L. Dyer  
*Georgia Institute of Technology, Atlanta, GA*  
GPA: 4, Selected Courses: Advanced digital signal processing, Machine learning theory, Nonlinear optimization
- 09/2015 - 12/2016    M.A. in Statistics.  
*Columbia University, New York, NY*  
GPA: 4, Selected Courses: Financial engineering, Game theory, Probability theory, Information theory
- 09/2007 - 06/2013    B.S. & M.S. in Electrical Engineering  
*National Taiwan University (NTU), Taipei, Taiwan*  
GPA: 3.8, Selected Courses: Real analysis, Communication theory, Advanced calculus, Stochastic processes

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## Research Projects

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**Understanding the Implicit Regularization with Data Augmentations**, Neural Data Science Lab, Georgia Tech

- Characterized the bias and variance of generalization error in linear regression with various data augmentations.
- Systematically analyzed the implicit regularization arisen from data augmentation's bias and covariance operator.
- Empirical studies on augmentations in neural network training using the neural spike train and 1-d MNIST dataset.

**Analyzing the Representations with Mined Views in Self-Supervised Learning**, Neural Data Science Lab, Georgia Tech

- Analyzed the mechanism behind boosting representation learning from similar data in the feature space.
- Extended the SSL framework of BYOL's applicability to scenarios where efficient data augmentation is unknown/scarce.
- Applied the algorithm Mine Your Own view to CIFAR, ImageNet dataset, and neuro data from the primate brain.

**Optimal Transport for Interpretable Data Alignment**, Neural Data Science Lab, Georgia Tech

- Developed a low-rank distribution alignment method using the concept of unsupervised hierarchical optimal transport.
- Applied to GMM models, domain adaptations of USPS/MNIST, and MNIST/MNIST with drop-out augmentations.
- Derived the geometric properties of the proposed latent Wasserstein discrepancy and provided an optimal cost guarantee.

**Theoretical Analysis on the Neural Network Training**, Machine Learning Theory Group, Georgia Tech

- Proved Polyak's momentum acceleration on convex functions, deep linear networks, and two-layer ReLU networks.
- Characterized the nonasymptotic convergent rate as functions of condition number with a compact modular analysis.

**Bayesian Optimization for Modular Black-box Systems with Switching Costs**, Neural Data Science Lab, Georgia Tech

- Designed a cost-efficient hyperparameter tuning algorithm for a modular pipelined system using a novel combination of Bayesian optimization and a slowly moving bandit algorithm, and proved the asymptotic optimality in augmented regret.
- Applied to 3D image reconstruction in a neuroimaging task consisting of a U-Net and multiple data processing stages.

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## Publications

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### Accepted:

- [1] Ran Liu, Mehdi Azabou, Max Dabagia, **Chi-Heng Lin**, Mohammad Gheshlaghi Azar, Keith B Hengen, Michal Valko, Eva L Dyer. Drop, Swap, and Generate a Self-Supervised Approach for Generating Neural Activity. *NeurIPS 2021 Selected for Oral Presentation (<1%)*.
- [2] **Chi-Heng Lin**, Mehdi Azabou, Eva L Dyer. Making Transport More Robust and Interpretable by Moving Data through a Small Number of Anchor Points. *ICML 2021 (21.5%)*.
- [3] **Chi-Heng Lin**, Joseph D Miano, Eva L Dyer. Bayesian Optimization for Modular Black-Box Systems with Switching Costs. *UAI 2021 (26%)*.
- [4] Jun-Kun Wang, **Chi-Heng Lin**, Jacob Abernethy. A Modular Analysis of Provable Acceleration via Polyak's Momentum: Training a Wide ReLU Network and a Deep Linear Network. *ICML 2021 (21.5%)*.
- [5] Jun-Kun Wang, **Chi-Heng Lin**, Jacob Abernethy. Escaping Saddle Points Faster with Stochastic Momentum. *ICLR 2020 (26.5%)*.
- [6] Ebrahim Baktash, **Chi-Heng Lin**, Xiaodong Wang, Mahmood Karimi. Downlink Linear Precoders based on Statistical CSI for Multi-Cell MIMO-OFDM. *Wireless Communications and Mobile Computing*.
- [7] **Chi-Heng Lin**, De-Niang Yang, Ji-Tang Lee, Wanjium Liao. Efficient Error-Resilient Multicasting for Multi-View 3D Videos in Wireless Networks. *IEEE GLOBECOM 2016 (36.7%)*.
- [8] Fan-Min Tseng and **Chi-Heng Lin** and Kwang-Cheng Chen. In-network Computations of Machine-to-Machine Communications for Wireless Robotics. *Wireless Pers Commun*.

### In Submission:

- [9] Mehdi Azabou, Max Dabagia, Ran Liu, **Chi-Heng Lin**, Keith B. Hengen, Eva L. Dyer. Using Self-Supervision and Augmentations to Build Insights into Neural Coding. *NeurIPS 2021 Workshop: Self-Supervised Learning - Theory and Practice*
- [10] Mehdi Azabou, Mohammad Gheshlaghi Azar, Ran Liu, **Chi-Heng Lin**, Erik Johnson, Kiran Bhaskaran-Nair, Max Dabagia, Bernardo Avila Pires, Lindsey Kitchell, Keith Hengen, William Gray Roncal, Michal Valko, Eva Dyer. Mine Your Own view: a Self-Supervised Approach for Learning Representations of Neural Activity. *NeurIPS 2021 Workshop: Self-Supervised Learning - Theory and Practice*

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## Honors and Awards

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Oct 2020	IDEaS-TRIAD Research Scholarship - Georgia Tech
Jan, Jun 2016	Davis Fellowships (two times) - Department of Statistics in Columbia University
Aug 2017	Scholarship to Study Abroad - Taiwan Ministry of Education
Aug 2017	M&H Bourne Fellowship - ECE Department in Georgia Tech
Aug 2010	Presidential Award - EE Department in National Taiwan University

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## Work Experience

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Jan 2015 - Jul 2015	Research Assistant <i>Academia Sinica</i> <b>Project Title:</b> Development of a multi-view 3D video broadcast protocol. <b>Accomplishment:</b> Published "Efficient Error-Resilient Multicasting for Multi-View 3D Videos in Wireless Networks" in <i>IEEE GLOBECOM 2016</i> .
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## Skills

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**Programming Languages / Packages:** R, SQL, Python, Pytorch, MATLAB, Wolfram Mathematica, LaTeX

**Speaking Languages:** Chinese (native), English (full professional proficiency)