Kai M. Hung

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Research Interests: Statistical Learning, Optimal Transport, Networks, ML for Healthcare

Education

Rice University   Houston, TX, USA

   B.A. in Computer Science (GPA: **3.92**/4.0)   05/2024

- Minor in Statistics
- Software Developer / Technical Lead @ Rice Apps
  - Build **Rice Carpool**, a ride-sharing app with **1031 registered users and 1198 scheduled rides**. Code here.
  - Leading a team of 6 developers to build a donation impact calculator for the United Way of Houston.
- Head Peer Academic Advisor
  - Led the curation of a 67-paged academic advising guide with advice spanning all 50+ majors at Rice.
  - Connected URM students to funding for Grace Hopper Conference, Google CS Research Mentorship Program, a 3-day workshop to combat gender imbalance in CS research hosted by CMU, etc.

Publications

[1] Zalles, A., **Hung, K.**, et al. (2023). *Network Regression with Wasserstein Distances*. NeurIPS 2023 Workshop on Optimal Transport for Machine Learning.

Posters & Oral Talks

[2] **Hung, K.**, Finneran, A., et al. (2023). *A Gromov-Wasserstein Approach for Food Web Network Analysis*. Poster presented at the Texas Colloquium on Distributed Learning.

[3] **Hung, K.**, Lipnick, A., et al. (2023). *Variability Reduction using Optimal Transport*. Talk presented at the New York University AM-SURE Summer Research Symposium.

[4] **Hung, K.**, Finneran, A., et al. (2023). *A Gromov-Wasserstein Approach for Food Web Network Analysis*. Poster presented at the Rice Undergraduate Research Symposium.

[5] **Hung, K.**, Yiu, E., Gopnik, A. (2022). *Computational Modeling for Approach-Avoid Task with Reinforcement Learning Frameworks*. Talk and Poster presented at the UC Berkeley SUPERB REU Summer Research Symposium.

[6] **Hung, K.**, Hegde, V. Sastry, J. (2021). *Gene Expression and Biological Pathways Associated with Differential Responsiveness to Anti-PD1 Immunotherapy in Preclinical HPV+ Tumors*. Poster presented at the CPRIT CURE Summer Research Symposium.

Honors & Awards

Scholarships & Travel Awards

- Louise J. Walsh Engineering Scholarship ($2,500)   08/2023
  Awarded annually to the top academically performing seniors in the George R. Brown School of Engineering.
- Cornell, Maryland, Max Planck Pre-Doctoral Research School   08/2023
  Selected as participant for an international computer science summer research school in Saarbrucken, Germany.
- Rice Undergraduate Scholars Program ($1,000)   05/2023
  Awarded annually to 25 seniors university-wide for the honors research thesis program.
- SRCOS Statistics Undergraduate Research Experience   10/2021
  Selected as 1 of ~20 participant for a NSF-funded conference to support rising talent in the statistical sciences.

Honors

- President's Honor Roll (3x; Fall 2020, Spring 2021, Spring 2022)
  Awarded semesterly to the Rice students with the top 30% grade point averages across the university.
- Peer Academic Advisor of the Month   09/2021
  Recognized as the top performing peer academic advisor at Rice University (out of 70+) for leading the curation of an academic guide encompassing advising guides and extracurricular listings for all 50+ majors at Rice.

Research Experience

Undergraduate Research Assistant | Optimal Ensemble Lab, Rice University   08/22 - Now
    Title: *A Gromov-Wasserstein Approach for Food Web Network Analysis* | Poster, Paper [1]
    Advisor(s): Dr. César A. Uribe, Dr. Lydia Beaudrot

- Investigating the Gromov-Wasserstein distance as a graph metric for downstream, interpretable machine learning methods over ecological networks.
- Analyzed 170 Sub-Saharan African mammal food webs using the GW Factorization method, uncovering two latitudinally motivated clusters under TSNE projection.
- Achieved 93% classification rate for cycle, path, and star graphs prior to application on real networks.
- Building a software library for ecologists to leverage OT for food webs, current features include experiment logging, 3D species-interactions network visualization, geospatial visualizations.

AM-SURE Intern | Courant Institute of Mathematical Sciences, New York University   05/23 - 07/23
    Title: *Variability Reduction via Optimal Transport* | Report, Slides, Code
    Advisor(s): Dr. Esteban G. Tabak

- Developed a semi-supervised algorithm for computing barycenter of conditional distributions.
  - Motivation: Often, we want to filter out the effect, or variability, of "unwanted" features: batch effect in medical testing or demographic attributes in fairness-critical applications.
  - Yet, exact pairings of data to unwanted features are not always known. My method aims to address this gap.
- Implemented the proposed algorithm with a suite of supporting modules for hyperparameter scheduling, convergence metrics, and visualization of barycenter optimizer progression in Python.
- Leveraged finite difference approximation to validate analytically-derived gradient.

Berkeley AI REU Intern | University of California, Berkeley   05/22 - 08/22
    Title: *Computational Modeling for Approach-Avoid Task with RL Frameworks* | Poster, Slides, Code
    Advisor(s): Dr. Alison Gopnik

- Developed a suite of Q-Learning models with cognitive psychology motivated components to capture differential learning patterns between children and adults in an approach-avoid task.
- Implemented a pythonic pipeline for parameter estimation (inverse RL) of human subject policies.
- Achieved 55% performance bonus (earned rewards) than baseline epsilon-greedy Q-Learning model.

Undergraduate Research Assistant | Computational Wellbeing Group, Rice University   08/21 - 05/22
    Title: *Modeling Productivity via Physiological Signals and Survey Responses*
    Advisor(s): Dr. Akane Sano

- Identified that the response feature, self-reported productivity, is filled with missing values.
- Validated feature absence correlation with differential patterns in other productivity-associated features such as time spend working, happiness, etc. using nonparametric statistical tests.
- Conducted exploratory data analysis to visualize study participant activity pattern across multiple modalities: daily website visits, distribution of survey responses, productivity shifts over time, etc.

CPRIT-CURE Intern | MD Anderson Cancer Center   06/21 - 08/21
    Title: *Gene Expression and Biological Pathways Associated with Differential Responsiveness to Anti-PD1 Immunotherapy in Preclinical HPV+ Tumors.* | Poster
    Advisor(s): Dr. Jagan Sastry, Dr. Venkatesh Hegde

- Analyzed RNA-sequencing data to identify causal factors for cancer treatment response discrepancy.
- Identified 485 differential expressed genes and 4 biological pathways contributing to 54% sustained tumor regression in anti-PD1 immunotherapy treatment.

<u>Teaching Experience</u>

Teaching Assistant | COMP 382 Reasoning about Algorithms   Fall 2022
Teaching Assistant | STAT 315 Probability & Statistics for Data Science   Spring 2022
Teaching Assistant | STAT 310 Probability & Statistics   Fall 2021

<u>Skills</u>

Programming Languages: Python, C, R, Typescript, Golang, Javascript, Java, SQL, GraphQL
Libraries & Frameworks: PyTorch, NetworkX, Scikit-Learn, Pandas, ReactJS, PySpark
Tools: Jupyter Notebooks, AWS (Lambda & EC2), MongoDB, Git, Linux
Foreign Languages: Chinese (Mandarin, Cantonese), Japanese