CAT P. LE

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EDUCATION

Duke University   Durham, NC
Ph.D., Electrical and Computer Engineering   Expected May 2023
Research: *Machine Learning*
Thesis: *Task Affinity and Its Applications in Machine Learning*
Advisor: Dr. Vahid Tarokh

California Institute of Technology   Pasadena, CA
M.S., Electrical Engineering   June 2017
GDP: 4.00
Advisor: Dr. Babak Hassibi

Rutgers University – New Brunswick   New Brunswick, NJ
B.S., Electrical and Computer Engineering   May 2016
GDP: 4.00
Honors: *Summa Cum Laude, Matthew Leydt Society, John B. Smith Award,*
Outstanding Engineering Scholar, E. M. Toomey Scholarship, Tau Beta Pi, Eta Kappa Nu

PROFESSIONAL EXPERIENCE

Amazon – Alexa Natural Understanding   Arlington, VA
Research Scientist   June 2022 – September 2022
- Conducted large-scale analysis of open-domain Alexa dialogues to identify key drivers of customer satisfaction using sentiment, relevance, and specificity metrics.
- Built a feature extraction framework that improved the accuracy of customer rating prediction by leveraging conversational context and linguistic cues.
- Developed an advanced dialogue evaluation model combining BERT, LSTM, and causal inference, achieving stronger alignment with human ratings from customers and experts.
- Applied causal inference techniques to uncover cause–effect relationships in conversational quality, enhancing model interpretability and prediction performance.

Motorola Solutions   Dallas, TX
Software Engineer   June 2017 – August 2018
- Engineered a camera shutter synchronization system with LED strobing to enhance image clarity for license plate recognition.
- Optimized the OCR algorithm to improve recognition speed and accuracy for license plate detection.
- Reduced energy consumption while boosting detection performance for both license plate and facial recognition cameras through system-level optimization.
- Designed and implemented firmware supporting advanced image processing and real-time recognition capabilities.

RESEARCH EXPERIENCE

Duke University   Durham, NC
Postdoctoral Research Associate   May 2023 – Present
- Developed a time-series prediction model using Transformer-Attentional Copulas for Time Series and Large Language Models (LLMs) to capture complex temporal dependencies in mechanical systems.
- Implemented a flow-based generative model for backscatter imaging of titanium alloys, reducing time and cost in imaging generation.
- Applied the prediction model as a detection system for mechanical part malfunctions in airplanes, enabling proactive maintenance and improved safety.
- Collected and analyzed upstream and downstream virus production process data, integrating visual and textual inputs to predict optimal harvest times and maximize yield efficiency.

Duke University   Durham, NC
Graduate Research Assistant   August 2018 – May 2023
- Developed a novel task affinity metric using Fisher Information matrices and a maximum bipartite matching algorithm to quantify knowledge transferability between tasks.
- Demonstrated that the task affinity is non-commutative and invariant to label permutation, capturing asymmetric relationships in task complexity.
- Designed frameworks to integrate task affinity into Neural Architecture Search, Transfer Learning, Few-Shot Learning, Continual Learning, Multi-Task Learning, Causal Inference, and Image Generative Models, enabling more efficient and informed model development.

California Institute of Technology   Pasadena, CA
Graduate Research Assistant   September 2016 – June 2017
- Designed a framework to interpret American Sign Language using the NASA JPL Sleeve, mapping signals from 20 hand muscles to alphabet characters with high accuracy.
- Developed real-time musical note detectors leveraging FPGA implementation and FFT analysis, enabling low-latency audio processing.

Rutgers University   New Brunswick, NJ
Undergraduate Research Assistant   August 2015 – May 2016
- Developed a Radio Access Network (RAN) as part of the NSF REU Funding Program, advancing hands-on research in wireless communications.
- Designed a simulation with three OpenAirInterface base stations using USRP B210, enabling dynamic resource allocation based on user demand.
- Evaluated data transmission performance across varying bandwidths using spectrum, waterfall, and constellation plots, optimizing network efficiency and reliability.

WINLAB   North Brunswick, NJ
Undergraduate Research Assistant   May 2015 – August 2015

- Developed a framework supporting Wi-Fi, LTE, and LTE in unlicensed spectrum, enabling comparative performance analysis across wireless technologies.
- Designed a simulation of LTE base stations (eNB) and user equipment (UEs) using USRP B210, leveraging OMF and OpenAirInterface for realistic network modeling.
- Evaluated data transmission performance across varying bandwidths using spectrum, waterfall, and constellation plots, informing optimization of network throughput and reliability.

TEACHING EXPERIENCE

Duke University   Durham, NC

- ECE 681 - Pattern Classification and Recognition Technology
- ECE 685 - Introduction to Deep Learning
- ECE 689 – Advanced Topics in Deep Learning

California Institute of Technology   Pasadena, CA

- APh/EE 9 - Solid-State Electronics for Integrated Circuits

Rutgers University   New Brunswick, NJ

- 14:332:346 - Digital Signal Processing

PUBLICATIONS

- C. P. Le, M. LaRosa, V. Tarokh. (2025). Generative Models and Bootstrapping for Titanium Alloy Microstructure Analysis. In International Conference on Pattern Recognition (ICPR).
- C. P. Le, J. Dong, A. Aloui, and V. Tarokh (2025). Task-Aware Lifelong Learning for Generative Adversarial Networks. In International Conference on Pattern Recognition (ICPR).
- Aloui, A., Dong, J., Le, C. P., & Tarokh, V. (2025). CATE Estimation With Potential Outcome Imputation From Local Regression. In *Uncertainty in Artificial Intelligence*. PMLR.
- Le, C. P., Cannella, C., Hasan, A., Ng, Y., & Tarokh, V. (2024, December). Perceiving Copulas for Multimodal Time Series Forecasting. In 2024 Winter Simulation Conference (WSC) (pp. 690-701). IEEE.
- C. P. Le, L. Dai, M. Johnston, Y. Liu, M. Walker, R. Ghanadan, "Improving Open-Domain Dialog Evaluation with a Counterfactual LSTM," in Diversity in Dialogue Systems, IWDSD, 2023.
- Aloui, A., Dong, J., Le, C. P., & Tarokh, V. (2023, July). Transfer learning for individual treatment effect estimation. In *Uncertainty in Artificial Intelligence* (pp. 56-66). PMLR.
- C. P. Le, J. Dong, M. Soltani, and V. Tarokh, "Task Affinity with Maximum Bipartite Matching in Few-Shot Learning," in International Conference on Learning Representations (ICLR), 2022.
- C. P. Le, M. Soltani, J. Dong, and V. Tarokh, "Fisher Task Distance and Its Applications in Neural Architecture Search and Transfer Learning," in IEEE Access 10, 2022.

- C. P. Le, M. Soltani, R. Ravier, and V. Tarokh, "Task-Aware Neural Architecture Search," in IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2021.
- C. P. Le, M. Soltani, R. Ravier, and V. Tarokh, "Improved Automated Machine Learning from Transfer Learning," in CoRR, 2021.
- C. P. Le, Zhou, Y., Ding, J., and V. Tarokh, "Supervised Encoding for Discrete Representation Learning," in IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2020.

HONORS & AWARDS

- **Best Paper Award –** IWSDS 2023   2023
  "Improving Open-Domain Dialog Evaluation with a Counterfactual LSTM"
- **Matthew Leydt Society** – Rutgers University   2016
  Top 1% Highest-Achieving Graduates of the Class of 2016
- **Outstanding Engineering Scholar** – Rutgers University   2016
  The Highest Cumulative GPA Graduate in the School of Engineering
- **John B. Smith Award** – Rutgers University   2016
  The Highest-Ranking Graduate in the Department of Electrical Engineering
- **Nikola Tesla Scholar** – Columbia University   2016
- **E. M. Toomey Scholarship** – Rutgers University   2015

PROFESSIONAL AFFILIATIONS AND HONOR SOCIETIES

Sigma Alpha Pi
Eta Kappa Nu
Tau Beta Pi

SKILLS

- **Programming Language** – Python, C/C++, Matlab, Git, Numpy, Scipy, Scikit-learn, Pandas, Matplotlib, Seaborn, OpenCV, Tensorflow, Keras, Pytorch
- **ML Framework** – Transfer Learning, Continual Learning, Few-Shot Learning, Prompt Tuning, Reinforcement Learning, Computer Vision, Neural Architecture Search, Natural Language Understanding

REFERENCES

- **Dr. Vahid Tarokh** (vahid.tarokh@duke.edu)
  Distinguished Professor of Electrical and Computer Engineering, Duke University
- **Dr. Reza Ghanadan** (rezag@umd.edu)
  Professor and Executive Director of Innovations in AI, University of Maryland
- **Dr. Babak Hassibi** (hassibi@caltech.edu)
  Professor of Electrical Engineering and Computing and Mathematical Sciences, California Institute of Technology
- **Dr. Yicheng Lu** (ylu@ece.rutgers.edu)
  Distinguished Professor of Electrical and Computer Engineering, Rutgers University