Spencer J. Chang, PhD

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Education

University of Florida (UF)	*05/2025*

Ph.D. in Electrical and Computer Engineering
Enhancing Semantic Segmentation Using Locally Learned Histogram Features. Prof. Alina Zare.

California Polytechnic State University - San Luis Obispo (CPSLO)	*06/2019*

M.S. Computer Science
Brain Tumor Classification Using Hit-or-Miss Capsule Layers. Prof. John Seng

California Polytechnic State University - San Luis Obispo (CPSLO)	*06/2017*

B.S. Computer Engineering (CPE), Minor in Mathematics
Graduated with Magna Cum Laude

Awards/Honors

SMART Scholarship, DoD	*08/2022 – Present*

Awarded fully paid tuition, a stipend, and health care stipend for three years. Approximately $250k.

ECE Graduate Student Service Excellence Award	*04/2025*

Nominated by Julissa Nuñez for excellent service to the ECE department during PhD spring visit weekends.

ECE Graduate Student Teaching Excellence Award	*05/2024*

Nominated by Dr. Catia Silva for providing thorough, constructive assignment and project feedback as a teaching assistant and supervised teacher.

Graduate School Preeminence Award, UF	*08/2019 – 07/2022*

Awarded fully paid tuition, stipend, and health care for up to 5 years. Funded as 1 of 16 fellowship recipients. Approximately $150k over 3 years.

Research Experience

Graduate Research Assistant, SMART Scholar	*08/2022 - 05/2025*

Prof. Alina Zare (Machine Learning and Sensing Lab, UF)
Focus: Learned histogram features for improving segmentation performance

Learning Histogram Features for Texture Analysis – learnable histogram layer, computer vision, semantic segmentation
– Improved segmentation architectures by up to 9 DICE points when using learnable histogram layers
– Investigated alternative ways of extracting features a radial basis function histogram layer
– Showed that learnable histogram layers can improve statistical feature representations in deep networks
– Applied models to RGB, hyperspectral, and LiDAR datasets in agriculture and land use land cover tasks
– Published hyperspectral, temporal, annotated mini-rhizobox dataset article to COMPAG'24.
– Submitted land use land cover results for publication (under double-blind review).

Graduate Research Assistant   *08/2019 - 07/2022*

Prof. José Príncipe (Computational NeuroEngineering Lab, UF)

Focus: Information-theoretic learning to understand and improve neural network training

Modularizing Deep Learning Networks with Sufficient Labels – kernel learning perspective, proxy labels
– Demonstrated that modular training of deep networks can be scaled to large multi-label datasets
– Compensated for heavy pairwise labeling imbalances with the Synthetic Minority Oversampling Technique
– Used the oversampling to verify that modular training can be as effective as end-to-end training
– Contributed to a paper published in JMLR'23

Understanding Deep Learning Dynamics Using Information Estimators – information-theoretic learning, Markov Chain perspective
– Explored the ability of measures of information to explain how learning models train
– Demonstrate the effective use of a matrix-based estimator to view learning models from a Markov Chain perspective
– Investigated the architecture choices for stacked autoencoders, multilayer perceptrons, and residual networks
– Published results in WCCI'22

Brain Tumor Classification Using Hit-or-Miss Capsule Layers *(M.S. Thesis)*   *04/2018 - 06/2019*

Committee (CPSLO): Prof. John Seng, Prof. Phillip Nico, Prof. Maria Pantoja

Focus: Create a system to help medical practitioners diagnose brain tumors using limited data

Brain Tumor Classification with Capsule Networks – deep active learning, capsule layers, object recognition
– Reproduced a neural network model from an IEEE ICIP paper in Keras using the TensorFlow backend
– Programmed the data preprocessing and results visualization using Python numpy libraries
– Validated the network using K-fold cross-validation in preparation for M.S. Thesis work
– Achieved best validation accuracy within first 12-24% of added data when classifying between 3 brain tumor labels

Publications

5. **S. J. Chang**, R. Chowdhry, A. Zare. Paper under double-blind review. 2025.

4. Y. Song, G. Sapes, **S. Chang**, R. Chowdhry, T. Mejia, A. Hampton, S. Kucharski, T. M. S. Sazzad, Y. Zhang, B. L. Tillman, M. F. R. Resende Jr, S. Koppal, C. Wilson, S. Gerber, A. Zare, W. M. Hammond. "Hyperspectral signals in the soil: Plant-soil hydraulic connection and disequilibrium as mechanisms of drought tolerance and rapid recovery," Plant Cell Environ., Jun. 2024, doi: 10.1111/pce.15011.

3. **S. J. Chang**, R. Chowdhry, Y. Song, T. Mejia, A. Hampton, S. Kucharski, TM Sazzad, Y. Zhang, S. J. Koppal, C. H. Wilson, S. Gerber, B. Tillman, M. FR Resende Jr., W. M Hammond, A. Zare. "HyperPRI: A Dataset of Hyperspectral Images for Underground Plant Root Study." 2023. Computers and Electronics in Agriculture, Volume 225, 2024, 109307, ISSN 0168-1699, doi: 10.1016/j.compag.2024.109307.

2. S. Duan, **S. Chang**, and J. C. Principe, "Labels, Information, and Computation: Efficient Learning Using Sufficient Labels," J. Mach. Learn. Res., vol. 24, no. 31, pp. 1–35, 2023. http://jmlr.org/papers/v24/22-0019.html. doi: 10.48550/arXiv.2104.09015.

1. **S. Chang** and J. C. Principe, "Explaining Deep and ResNet Architecture Choices with Information Flow," 2022 International Joint Conference on Neural Networks (IJCNN), Padua, Italy, 2022, pp. 1-6, doi: 10.1109/IJCNN55064.2022.9892065.

Teaching Experience

Teaching Assistant & Supervised Teacher – UF *01/2021 - 12/2024*

Taught multiple lectures on convolutional neural networks, Gaussian Mixture Models, and cluster validity metrics. Designed programming questions based on Gaussian Mixture Models. Graded concept-based and programming-based assignments. Provided office hours. Posted course content for supervising professors.

– Teaching Assistant, Fundementals of Machine Learning *(08/2024 - 12/2024)*
– Supervised Teacher, Fundamentals of Machine Learning *(01/2024 - 05/2024)*
– Teaching Assistant, Applied Machine Learning *(08/2023 - 12/2023)*
– Teaching Assistant, Machine Learning for Time Series *(08/2021 - 12/2021)*
– Teaching Assistant, Neural Networks & Deep Learning *(01/2021 - 05/2021)*

Graduate Teaching Associate – CPSLO *09/2018 - 06/2019*

Guided students in the use of oscilloscopes, power supplies, and multimeters and the connection of basic electronic components. Created lab quizzes and lab exams based on course materials provided by Prof. Gary Perks.

– Circuits I Laboratory *(03/2019 - 06/2019)*
– Microelectronics Laboratory *(01/2018 - 03/2019)*
– Introduction to EE Laboratory *(09/2018 - 12/2018)*

Working Experience

SMART Scholar Intern, NSWC-PCD, Panama City Beach, FL *05/2023 - 08/2023*

Programmed a synthetic data generator for underwater acoustic time series data for use in machine learning applications (based on SWellEx-96 data). Suggested and evaluated learning architecture changes to my supervisor's models.

NREIP Intern, NSWC-PCD, Panama City Beach, FL *05/2021 - 07/2021*

Utilized matrix-based information estimators to research possible improvements to asynchronous actor-critic (A2C) reinforcement learning methods. Tested the system's effectiveness in the OpenAI Atari 2600 game environment.

Computer Engineer Technical Intern, Medtronic, North Haven, CT *06/2018 - 08/2018*

Transferred hundreds of product testing protocols into a database for better Quality Assurance (QA) management. Collaborated with the lead programmer to automate part of QA analyst workflow through the creation of a Windows CSV converter application and plugin in both Visual Basic and C#.

Product Development Engineer Intern, RRS, San Luis Obispo, CA *07/2017 - 12/2017*

Wrote and debugged C++ firmware and software for a new electronics system to be integrated into existing company products. Communicated with chip vendors about integrating their products into the system. Conducted tests for sensitive components using a heat chamber.

Software Development Engineer Intern, Amazon, Seattle, WA *06/2016 - 09/2016*

Automated the launch process for various products, saving time for the Kindle Device family. Launched two products with the project to validate and verify the implementation.

Involvement & Leadership Experience

High School Research Mentor, Junior Science and Humanities Symposium   *01/2023 - Present*

Guiding US high school students interested in pursuing STEM research. Teaching general scientific practices including presentation of and experimentation with machine learning algorithms.

President, GradCru, UF   *01/2020 - 05/2023*

Started a graduate student ministry under the larger Cru organization at UF. Organized monthly gatherings for graduate students across the university. Provided student government funded reading material for club members.

College of Engineering Spring Visit Volunteer, UF   *2020 - 2025*

Introduced prospective PhD engineering students to Gainesville. Facilitated transportation of approximately 100 students from the airport to a hotel. Answered student questions about the city, housing, graduate school, and my personal experience. Participated in a student panel for the Electrical and Computer Engineering department.

References

Dr. Alina Zare

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Dr. José C. Príncipe

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