Diane Adjavon

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Education

PhD in Quantitative Biology 2018-2021
Swain Lab, SynthSys
University of Edinburgh, School of Biological Sciences

Master of Computer Science 2017
Specialization in Modeling of Complex Systems
ENS Lyon

Swiss-European Mobility Exchange 2016-2017
Specialization in hardware and wireless security
ETH Zurich, D-ITET

Master of Telecommunications 2016
Specialization in Communication Systems Security
French Engineering program - Master Equivalent
Telecom ParisTech - EURECOM

Bachelor of Telecommunications 2015
French Engineering program - Bachelor Equivalent
Lycée Faidherbe, Telecom ParisTech

Research Experience

Funke Lab, HHMI Janlelia Research Campus 2021-Present
Machine Learning Researcher
In order to trust AI to generate hypotheses for the biological sciences, we need to be able to reverse-engineer the decision making of the algorithms. I developed Quantitative Attributions with Counterfactuals, a method to explain the often subtle differences in images that underpin a classifier's decisions. I have verified QuAC with biologically-inspired baselines, and applied it to understanding how structure relates to function in *Drosophila melanogaster* synapses. I am currently working on applying QuAC to new datasets, and upgrading the generative models used in the method to state-of-the-art.
The results of this work can be found as a pre-print on bioRxiv, as well as in detail in the documentation.

Swain Lab, University of Edinburgh 2018-2021
Computational analysis of single-cell dynamics
Cells need to be able to quickly adapt to their environment to survive. When studying the molecular processes underpinning this adaptation, we often turn to fluorescence time-lapse microscopy. Time-lapse microscopy generates large amounts of complex data, making it difficult to analyze manually. I developed machine learning algorithms to automatically annotate microscopy data, and extract quantitative and dynamic information. I showed that these methods are equivalent to conventional biochemical alterations, and far less costly. I also showed that, in some cases, computers are capable of better-than-human annotations of images. This opens the door to computer-aided hypothesis generation for cell biology.
The results of this work are in a manuscript under preparation; they have also been accepted for a short talk at SysBio Innsbruck.

Systems Biology of Decision Making, ENS Lyon 2017-2018
Quantifying Directed Information Transfer in in silico Gene Regulatory Networks
Group led by Dr. Olivier Gandrillon
Genes interact in a cell: the expression of one gene can regulate the activity of another. Although the correlations of gene expression are often studied, there are no clear methods for establishing the direction of the interaction. Using a simulated Gene Regulatory Network, I evaluated the suitability of Transfer Entropy as a metric for directed information between genes. I then evaluated different gene regulatory motifs on how well they transmit information in the presence of noise.
This work has been presented at the International Conference for Systems Biology as a poster presentation.

Products and Services, Orange Labs 2017
Packet acceleration in the Linux Kernel in a virtualized environment
Group led by Dr. Kahina Lazri
An increasing amount of our web services are hosted on virtual machines and made available through cloud services such as Amazon AWS. Virtual machines are more susceptible to Denial of Service (Dos) attacks because of their limited computing power. I developed a method to catch Denial of Service attacks before they reach virtual machines by stopping them at the kernel level. I modified the e1000 kernel driver to have access to it from within a virtual machine. I implemented the permissions on the virtual machine to prevent make client-side tampering, protecting the cloud service provider.
The results of this work were presented as a Workshop paper at SIGCOMM.

PUBLICATIONS

Adjavon, **D.-Y.**, N. Eckstein, A. S. Bates, G. S. Jefferis, and J. Funke (Dec. 2024). ***Quantitative Attributions with Counterfactuals***. In: *biorxiv*, DOI: `10.1101/2024.11.26.625505`.

Patton, W., J. L. Rhoades, M. Zouinkhi, D. G. Ackerman, C. Malin-Mayor, **D. Adjavon**, L. Heinrich, D. Bennett, Y. Zubov, C. P. Team, A. V. Weigel, and J. Funke (Aug. 2024). ***DaCapo: A Modular Deep Learning Framework for Scalable 3D Image Segmentation***. In: arXiv:2408.02834. DOI: `10.48550/arXiv.2408.02834`.

Pietsch, J. M., A. F. Muñoz, **D.-Y. A. Adjavon**, I. Farquhar, I. B. Clark, and P. S. Swain (2023). ***Determining growth rates from bright-field images of budding cells through identifying overlaps***. In: *Elife*, **12**: e79812. DOI: `10.7554/eLife.79812`.

Chaignon, P., **D. Adjavon**, K. Lazri, J. François, and O. Festor (2018). ***Offloading security services to the cloud infrastructure***. In: *Proceedings of the 2018 Workshop on Security in Softwarized Networks: Prospects and Challenges*, pp. 27–32.

CONFERENCES AND WORKSHOPS

Images to Knowledge 2024
Segmentation of Budding Yeast Organelles from Bright-field Time-lapses
Poster presentation

Connectomics 2024
Explainable AI for Connectomics: The Case of the Mispredicted Kenyon Cells
Selected Talk

AI and Biology 2024
Learning and Visualizing the Morphological Differences between Synapses of Different Types
Selected Talk

SysBio Innsbruk 2020
Deep Learning for automatic annotation of Budding Yeast Images
Selected Talk

CompSysBio 2019
Metabolic Oscillations in Yeast as an Optimization Problem
Poster Presentation

International Conference for Systems Biology 2018
Quantifying Directed Information Transfer in in silico Gene Regulatory Networks
Poster Presentation

TEACHING AND MENTORING

Lead Teaching Assistant 2023, 2024
Deep Learning Course, Marine Biological Lab
Co-supervised all of the teaching assistants during pre-course preparation. Recreated and lead the tutorial on the

Knowledge Extraction exercise. Co-led a group of students through the project phases on knowledge extraction and unsupervised discovery.

Lead Teaching Assistant 2024
Deep Learning for Microscopy Image Analysis, Human Technopole
Supervised all of the teaching assistants during pre-course preparation. Defined the curriculum of the exercise portion of the course. Oversaw the creation of fully new exercises. Gave a talk on Generative Adversarial Models.

Supervisor 2024
Meyerhoff Summer Project of Kieran Sturges
Synister v2: An updated classification of synapses from Electron Microscopy

Teaching Assistant 2022
Deep Learning Course, Marine Biological Lab
Re-worked and lead the tutorial on the Knowledge Extraction exercise.

Supervisor 2020
Master project of Karen Trippler
Automatic Identification of Cell Cycle Stages in Budding Yeast

Teaching Assistant 2019
Deep Learning Course, SynCrop
Gave a lecture and practical on Computer Vision basics for biologists.

SKILLS AND PROFICIENCIES

Python, scientific python, and pytorch Advanced
I have been involved in many python projects, and use scientific python packages such as `numpy, scipy, tensorstore`, and `xarray` in my daily work. I am familiar with python packaging, testing, and best practices.

Software Development Proficient
I have a background in computer science and engineering, and have been involved in software development my entire adult life. I am familiar with version control software, CI/CD, and have even worked at a low-level with the Linux kernel in the past.

High performance computing, large data Advanced
I routinely run large experiments on the Janelia cluster, and have worked with other clusters in the past. Furthermore, I am well-versed in several packages built specifically for large, potentially multi-scale, 3D volumes such as `Gunpowder, Da Capo, daisy` and `dask`.

Public speaking, outreach, and engagement Proficient
I have been involved in scientific outreach for several years, working with children in schools but also adults at events such as Pint of Science. I enjoy and take pride in making my science available, in depth, to others.

Scientific writing and visualization Proficient
I have experience writing science and making scientific figures for publications, posters, and presentations. I am proficient with LaTeX, including `tikz` for making figures, and have experience with using both Adobe Illustrator and Affinity Illustrator.

English, French Native