

OWEN MARTIN



EDUCATION

Ph.D Candidate in Computer Science, University of Colorado Boulder August 2020 - Ongoing

Research assistant to Dr. Orit Peleg

Dissertation title: On Synchronization and Distinguishability in Firefly Flash Behavior

M.S. in Computer Science, University of Colorado Boulder August 2020 - December 2023

Area of Concentration: Complex Systems

GPA: 3.96

B.S. in Computer Science, Tufts University August 2013 - May 2017

RESEARCH PROJECTS

Broadly, I study animal communication and how individual variability influences collective behavior within communicating groups. Specifically, I study synchronization, behavioral phenology, and visual signal differentiation in the *Lampyridae* family.

Thesis project: Synchronization between LEDs and Fireflies

University of Colorado Boulder + Congaree National Park, South Carolina

- RaspberryPi + OpenCV integrating observed flash timings with synchronization model
- Designed and conducted experimental assays measuring interactions between fireflies and LED-camera system
- Data analysis with numpy, scipy, pandas to measure firefly phase response

Thesis project: Identifying and Classifying Firefly Species from Flash Patterns

University of Colorado Boulder

- Organized nationwide collection of flash pattern data and analyzed with stereoscopic computer vision techniques to create dataset of 3D reconstructions of flash pattern behavior
- Developed and trained RNN for species classification by sequence with PyTorch
- Developed unsupervised learning pipeline for flash motif separation and analysis
- Deployed model to Google Cloud Platform in containerized data processing pipeline

Thesis project: Communication Network Reconstruction in Synchronous Firefly Swarms

University of Colorado Boulder

- Designed and conducted experimental assays measuring individual variability within controlled firefly network structure
- Identified nodes with DBSCAN and edges with temporal Bayesian normalized count to produce an inferred network structure
- Analyzed network degree distributions and clustering with networkx

Thesis project: Agent based modeling of firefly synchronization

University of Colorado Boulder + Great Smoky Mountains National Park, Tennessee

- Designed and conducted experimental assays measuring flash pattern variance as it changes with density in controlled firefly swarms
- Programmed and simulated agent-based models of coupled oscillator synchronization to fit to experimental results

Disease Prevention Measures within Heterogeneous Communities

NetCOVID working group, COMBINE Institute, University of Maryland

- Agent-based SIR epidemic modelling of social distancing effectiveness in heterogeneous communities

Understanding Hummingbird Migration

University of Colorado Boulder

- Scraped migration data from the Cornell Ornithology Lab and wrangled with pandas
- Visualized yearly and monthly migration patterns of Colorado hummingbirds

Classifying Bird Species from Audio Recordings

Aquincum Institute of Technology, Budapest, Hungary

- Conducted exploratory data analysis on database of eighteen bird species to visualize their calls as spectrograms and understand class distribution
- Developed and trained a random forest classifier to identify features in the spectrograms and the species by their calls and locations

PUBLICATIONS

Behavioral phenology of Colorado Front Range firefly populations revealed by 3D reconstructions of flash patterns

October 2024

O. Martin, B. Russell, H. Burroughs, R. O'Brien, D. Frances, A. Walker, C. Fallon, and O. Peleg

In Preparation.

Embracing firefly flash pattern variability with data-driven species classification

February 2024

O. Martin, C. Nguyen, R. Sarfati, M. Chowdhury, M. Iuzzolino, D.M.T. Nguyen, R. Layer, O. Peleg

Scientific Reports. [DOI](#)

Crowdsourced dataset of firefly trajectories obtained by automated stereo calibration of 360-degree cameras

June 2023

R. Sarfati, O. Martin, J.C. Hayes, A.C.S. Owens, P. Shaw, C. Molloyhan, R.L. Day, P. C. Mauney, R.V. Joyce, J.Davis, P. Butler, R. Schreiber, B. Auman, and O. Peleg.

DataDryad. [DOI](#)

Emergent periodicity in the collective synchronous flashes of fireflies

March 2023

R. Sarfati, K. Joshi, O. Martin, S. Iyer-Biswas, O. Peleg.

eLife. [DOI](#)

TEACHING EXPERIENCE

Graduate Teaching Assistant

August 2020 - January 2023

University of Colorado Boulder

Data Structures (x3)

- Taught recitation, focusing on linked list, graph, tree, stack, and queue data structures and associated algorithms
- Wrote and shared assignment grading software for the TA staff
- Conducted in-person homework grading interviews and office hours
- Designed, produced, and graded quiz material

Senior Capstone Project

- Managed eight engineering teams comprised of senior undergraduate students
- Facilitated communication between teams and sponsor corporations
- Provided technical advice and assistance in application development

Dynamic Models in Biology

- Wrote and graded assignments focusing on simulating flocking behavior, random walks, and evolution
- Lectured on neurons, neuronal synchronization, and firefly behavior
- Ran homework groups in office hours

Jungle to the Sea in Ecuador

- Provided biodiversity expertise on 200+ Amazonian and Galapagan bird species
- Facilitated successful travel for fourteen undergraduates abroad
- Taught hands on field education in evolutionary biology

Undergraduate Teaching Assistant

January 2015 - May 2017

Tufts University

Courses taught: Data Structures (x4)

- Wrote and shared assignment grading software for the TA staff
- Conducted in-person homework grading interviews and office hours
- Designed, produced, and graded quiz and exam material

AWARDS

Boulder OSMP Research Grant

March 2024 - December 2024

*From spatiotemporal characterization to ecological insight:
leveraging flash patterns to explore behavioral trends in Colorado Photuris fireflies.*

\$12,000 USD

Featured in [this article](#)

1st Place, Best Student Talk

October 2023

Embracing behavioral variability for data-driven classification of firefly flash patterns

GeoBON Monitoring Biodiversity for Action, Montreal, Canada

Outstanding Teaching Assistant

May 2022

University of Colorado Boulder CS Department

Microsoft PhD Fellowship Nominee

May 2022

University of Colorado Boulder CS Department

Apple AIML PhD Fellowship Nominee

October 2021

University of Colorado Boulder CS Department

Best DataBlitz Presentation

August 2021

ESI Systems Neuroscience Conference

Computer Science Department Professional Development Award

May 2021

University of Colorado Boulder

PRESENTATIONS

Embracing behavioral variability with data driven classification of firefly flash patterns

March 2024

Invited talk, Digital Entomology Symposium, ESA North Central Branch Meeting.
Fort Collins, CO, USA.

Embracing behavioral variability for data-driven classification of firefly flash patterns

October 2023

Invited talk, AI for Insect Monitoring Focus Group, GEOBON Monitoring Biodiversity for Action.
Montreal, Canada.

Exploring open- and closed-loop communication between fireflies and LEDs

March 2023

American Physical Society March Meeting.
Las Vegas, NV, USA.

A pipeline for automatic classification of firefly species from flash patterns

Sept 2022

Invited talk, University of Colorado Biofrontiers QED Supergroup.
Boulder, CO, USA.

Exploring Synchronization in Firefly-LED systems

April 2022

Aspen Center for Physics Dynamics of Living Systems Conference.
Aspen, CO, USA.

Synchronization Dynamics of Firefly-LED systems.

March 2022

American Physical Society March Meeting,
Minneapolis, MN, USA.

Visual communication of synchronous firefly swarms in natural and virtual realities

August 2021

DataBlitz talk, ESI Systems Neuroscience Conference.
Frankfurt, Germany.

LEADERSHIP AND OUTREACH

Graduate Student Mentorship

January 2023 - present

Hana Burroughs, undergraduate summer student studying firefly abundance in Colorado

Kumpeerakij Chanin, graduate student rotation in firefly synchronization modeling

Bowman Russell, undergraduate summer student studying Colorado Front Range firefly populations

Anurag Ranjan, undergraduate student studying firefly synchronization dynamics by simulating different flash counts

Colorado Firefly Project Science Liaison

May 2023 - July 2024

City of Boulder Open Space and Mountain Parks,

City of Fort Collins Natural Areas,

City of Loveland Natural Areas

Featured in [this article](#)

Computer Science Graduate Student Association Graduate Committee Liaison

August 2021 - May 2022

University of Colorado Boulder

Outside Science, Inside Parks

April 2022

National Park Service

Featured in [this article](#)

Congaree National Park Firefly Education

June 2021

National Park Service

TECHNICAL SKILLS

Programming Languages

Python, R, Matlab, C++, Javascript, C, Processing, bash, NetLogo

Frameworks

PyTorch, pandas, numpy, Keras, scipy, dplyr, React, Node, scikit-learn

Tools

Git, Docker, Azure, AzureML, Kubernetes, GCP, slurm

INDUSTRY EXPERIENCE

Software Engineer in Test NetApp Solidfire

December 2018 - May 2020

- Designed and implemented test automation framework for the performance and scaling of enterprise cloud storage solutions.
- Wrote and deployed dev-ops tooling to facilitate company-wide continuous integration and continuous deployment of features.
- Python, Jenkins

Software Quality Engineer Hitachi Vantara

August 2017 - September 2018

- Designed and tested edge integration features with enterprise cloud storage
- Development of test tracking website