MATTHEW T. DUGGAN

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Education

University of South Carolina **Columbia, SC**
Bachelor of Science in Computer Sciences
Bachelor of Science in Biological Sciences *Prospective Graduation:* May 2022
Honors College **GPA:** 4.0

Research Experience

Precocial Bird Survival with Machine Learning **Oct 2020 - Present**
University of South Carolina Dr. Nathan Senner

- Received a $2,500 grant proposal for implicating Markov models and random forests on movement data from Black-Tailed godwits to predict their nesting success, behavioral plasticity, and predictability.
- Measuring the generalizability of machine learning on precise data (GPS: less than 30-meter error) to highly irregular data (Argos: greater than 100-meter error).

Identifying Significant Predictors of Water Quality **May 2021 - Aug 2021**
Pacific Northwest National Laboratory Dr. Nicholas Ward

- Constructed random forests to study the influencers of biogeochemical signals within the National Estuarine Research Reserve System (NERR).
- Managed version control in the project's GitHub repository of R programming scripts.
- Predicted ammonia, phosphate, nitrate, and chlorophyll A, with above satisfactory predictions (53-83% Nash-Sutcliffe efficiency) during severe weather events.

Effects of Chronic Radiation on Plant Germination **Nov 2020 - May 2021**
University of South Carolina Dr. Timothy Mousseau

- Observed differences in germination success for the chronically irradiated seeds of Chernobyl, Ukraine comparing various levels of exposure from different areas in the Chernobyl exclusion zone.
- Cowrote a $10,000 mini-REAP grant for the collection of germination samples.
- Assisted in experimental design, fabrication of incubation vessels, daily monitoring of germination progress, and final visualizations.

Automation of Camera Trap Image Processing **Nov 2018 - Mar 2021**
University of South Carolina Dr. Timothy Mousseau

- Published an autonomous object detection method utilizing TensorFlow libraries.
- Classified big ecological data by analyzing four million+ images from Fukushima, Japan; Chernobyl, Russia; Fort McCrady, SC; and Clarks Hill, SC.
- Developed a Convolutional Neural Network (CNN) with an average F1 score of 86% in McCrady and Clarks Hill, South Carolina camera trap projects for 21 indicator species.

Publications

Quantification of water quality predictors regarding nitrate loading between a fresh and saltwater estuary at high spatial and temporal resolution with random forests
First Author Submission Pending: Dec 2021
- Initial Draft Submission in the *Journal of Limnology and Oceanography Letters*.

An approach to rapid processing of camera trap images with minimal human input
First Author Aug 2021
- Published in the *Journal of Ecology and Evolution*. http://doi.org/10.22541/au.161648987.76811078/v1

Presentations

Inferring successful breeding of a precocial bird with tracking data
Virtual presentation at: International Biologging Society Oct 8, 2021
- Presenting the outcome of random forests on Argos tag information based on simulated data from known GPS movements.

Predicting Shorebird Nesting Behaviors with Movement Data
Virtual slide show presentation at: American Ornithological Society Aug 8, 2021
- Presenting the chosen random forest with a Bayesian fitness model predicting the survival and life fitness of black-tailed godwit chicks.

Utilization of Random Forests to predict Nutrient Concentration with Water Quality Predictors
Virtual slide show presentation at: Student Leadership Symposium July 29, 2021
- Presenter of creating and optimizing random forest architectures to

Hidden Markov Models and Random Forests with Movement Data
iPoster presented at: Discover USC Apr 28, 2021
- Presenter of the analysis, construction, and comparison of machine learning methods in predicting nesting, foraging, chick tending, migrating, and mortality behavior during the nesting season of black-tailed godwits.

Using Camera Traps for Environmental Management Purposes
Slide show presented at: National Military and Wildlife Association Mar 12, 2020
- Created and formatted slides regarding camera trap setup and demonstrating the applicability of machine learning techniques.

Detecting Deer (*Odocoileus virginianus*) in McCrady and Clarks Hill, SC
Poster presented at: Sustainable Showcase Sep 27, 2019
- Presenter of a preliminary convolutional neural network for the detection of white-tailed deer in two camera trap projects located at SCARING National Guard training centers.

Impact of Ionizing Radiation on Mammalian Abundance in Fukushima
Poster presented at: Discover USC Apr 23, 2019

- Organized the results and methods sections detailing the processing with human processors and analysis of the geospatial effects of chronic radiation on mammalian abundance.

Awards

Goldwater Scholarship **2021**
- $7,500 award for demonstrating a passion to pursue research based on campus interview, nomination, and national review of a research essay and prior involvement in machine learning applications in ecology.

Magellan Scholar Grant **2020**
- $2,500 grant to my project titled "Concluding Successful Nesting of *Limosa limosa* with Geolocation Data."

SC Space Grant Consortium Mini-REAP **2020**
- $10,000 award to my team's grant proposal titled, "Effects of Ionizing Radiation on Plant Germination." The goal of the mini- Research and Education Awards Program (mini-REAP) is to create NASA contacts with students and faculty at SC colleges.

Science Undergraduate Research Fellowship **2019**
- $2,780 grant from the University of South Carolina's Honors College to conduct machine learning research on camera trap data.

Skills

Computer Languages
Java | C++ | R | Git (Fluent)
Python | HTML | CSS | Dart (Proficient)

Technical Skills
Drone Pilot (Proficient)
Manual Transmission | ATVs (Proficient)
3D printing and design - Cura | Inventor | Meshmixer (Intermediate)
ArcGIS | Pix4D (Basic)

Certifications
Open Water Diver PADI 2021

Professional Organizations

National Fellowship Peer Mentor **Sept 2021 – Present**
Senior Peer Mentor
- Present to Honors University 101 classes and campus events about the National Fellowship Office and my experiences while applying and receiving national scholarships and fellowships.

Tau Beta Pi (TBP - Engineering Honor Society) **Jan 2021 – Present**

Active Member
- Participate in professional development events and discuss related projects regarding machine learning with fellow members.

Phi Beta Kappa (ΦBK – Sciences Honor Society) **Apr 2021 – Present**
Active Member
- Awarded membership based on my integrity, scholar achievement, and community involvement while being part of my undergraduate institution.

Herpetology Club **Dec 2020 – Present**
Vice President
- Founding member that assisted in leading excursions and herping events.

Sustainable Carolina **Jan 2019 – Present**
Peer Leader
- Head Green Office and Green Event Certification Programs and recognize or give environmental consulting to offices, events, and individuals that incorporate sustainable practices with the largest event expecting 17,000 attendees.

Beta Beta Beta (TriBeta - Biological Honor Society) **Jan 2019 – Present**
Historian (Sept 2019- Sept 2021)
- Mentor and inform members about gaining experience in the field of biology for mainly environmental career possibilities.

Residential Hall Association **Sep 2018 – May 2019**
Vice president
- Govern on issues of on-campus living, such as safety, diversity, sustainability, and wellness where representatives are elected by the resident hall body.

References

Dr. Timothy Mousseau
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