

Roger Waleffe

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Research Interests

CS: Machine Learning and Artificial Intelligence; Computer Vision, especially with regards to self-driving; Big Data Systems; **Physics/Engineering:** Renewable Energy, Battery Technology, and Electric Motors; Plasma Science and Fusion Energy

Education

University of Wisconsin-Madison, Sep. 2019 – Present
Enrolled in Computer Science Ph.D. program

University of Wisconsin-Madison, Sep. 2015 – May 2019
B.S. – Applied Mathematics, Engineering, and Physics (AMEP), received May 2019
B.S. – Computer Science, received May 2019
Overall GPA: 4.00/4.00

Academic & Research Experience

Department of Neurology @ UW-Madison, Jun. 2019 – Present

Honorary Associate

Work with Dr. Aaron Struck and Dr. Elizabeth Felton's epilepsy research lab to continue development of automated seizure detection from electroencephalogram (EEG) recordings using machine learning models. Extends work (below) that began through undergraduate research with a graduate student in Prof. Suman Banerjee's WiNGS Lab.

WI Wireless and NetworkinG Systems Lab @ UW-Madison, Jun. 2018 – May 2019

Undergraduate Researcher

Worked with Prof. Suman Banerjee and his graduate student. Implemented a long short-term memory (LSTM) network for time series predication to improve the groups older results for scheduling water softener regeneration by 50 percent. Developed machine learning models for electroencephalogram (EEG) seizure detection using convolutional and recurrent convolutional neural networks (CNN, RCNN).

Wisconsin Plasma Physics Lab @ UW-Madison, Jan. 2016 – May 2018, Fall 2018

Undergraduate Researcher and Engineer

Worked with Prof. Cary Forest and graduate students to design next generation mirror plasma confinement devices. Progressed and developed magnetic and plasma equilibrium software to aid in geometry and stability analysis. Additional work constituted planning and building equipment for experiments on the Big Red Ball (BRB) including vacuum parts, probes, power supplies, and circuits.

Professional Experience

Amazon, Jun. 2018 – Aug. 2018

Software Development Engineer – Intern

Designed and built a server-less application on Amazon Web Services (AWS) to connect Amazon.com customer accounts to corresponding customer accounts at an Amazon subsidiary. Strongly considered scalability of application. Created dashboards, alarms, and documentation for the product. Product continues to operate in production and is stable (checked as of 02/28/2019). Worked with a team of seven other developers.

Honors, Awards, and Funding

Departmental Research Fellowship, 2019-2020

Fellowship awarded to the very top students admitted to the UW-Madison CS graduate program. The award covers salary, tuition remission, and health benefits.

UW-Madison CS NEST 2nd Place, 2019

Pitched a startup proposal for autonomous EEG monitoring and seizure detection. Judged against ~20 other teams. Team consisted of myself (presenter, lead), Jason Mohoney, Neil Klingensmith, and Dr. Aaron Struck.

Goldwater Scholarship, 2018

National award termed “the most prestigious undergraduate scholarship in STEM”. One of a maximum of four nominations from UW-Madison and one of 211 award winners.

Hilldale Research Fellowship, 2017

Provided funding for undergraduate research at UW-Madison on work entitled “Axisymmetric Spherical Mirror for a Fusion Neutron Source”.

Ingersoll Award, Fall 2015

Awarded to the top student in an introductory physics class at UW-Madison. Recipient for work in Physics 247: A Modern Introduction to Physics. Accelerated Honors Section.

William F. Vilas Scholarship, Fall 2015, 2016, 2017, 2018

Awarded to undergraduate students at UW-Madison for strong academic performance.

Dean’s List, Fall 2015, Fall/Spring 2016, 2017, 2018, and Spring 2019 (all semesters)

Publications

Peterson, E. E., Endrizzi, D. A., Beidler, M., Bunkers, K. J., Clark, M., Egedal, J., Flanagan, K., McCollam, K. J., Milhone, J., Olson, J., Sovinec, C. R., **Waleffe, R.**, Wallace, J., Forest, C. B. (2019). A laboratory model for the Parker spiral and magnetized stellar winds. *Nature Physics*. <https://doi.org/10.1038/s41567-019-0592-7>
Media coverage: PBS, Quanta, Wired, Cosmos, Science News, UW-Madison

Brookhart, M. I., Stemo, A., **Waleffe, R.**, Forest, C. B. (2017). Driving magnetic turbulence using flux ropes in a moderate guide field linear system. *Journal of Plasma Physics*, 83(6), 905830604. <http://doi.org/10.1017/S0022377817000794>

In Submission:

Waleffe, R., Klingensmith, N., Banerjee, S. (2019). Time Series Prediction for Water Softener Resource Management. Submitted to *ACM Transactions on Internet of Things*.

Presentations

Poster: Waleffe, R., Peterson, E. E., Anderson, J., Clark, M., Wallace, J., Forest, C. B. (2018). Investigation of magnetic mirror configurations at the WiPPL facility and their applications. Presented by Anderson, J., at the *60th Annual Meeting of the APS Division of Plasma Physics*.

Poster: Waleffe, R., Peterson, E. E., Mirnov, V., Forest, C. B. (2017). Stability of a non-paraxial mirror and its applications as a neutron source. Presented at the *59th Annual Meeting of the APS Division of Plasma Physics*.

Talk: Waleffe, R., Peterson, E. E., Forest, C. B. (2017). Spherical Mirror as a Fusion Neutron Source. Presented at the *Meeting of the Physics Department Board of Visitors*.

Poster: Waleffe, R., Endrizzi, D. A., Peterson, E. E., Forest, C. B. (2016). High Current, High Density Arc Plasma Source for WiPAL. Presented at the *58th Annual Meeting of the APS Division of Plasma Physics*.

Entrepreneurial

Leader of Speegl (Unofficial company as of 08/18/19), Spring 2019 – Present
Leading a team including medical doctors and computer science graduate students exploring the possibility of a startup which uses machine learning to automate the detection of abnormalities from medical tests. Initial work includes detecting seizures from electroencephalograms (EEGs) and continues the pitch presented at CS-NEST 2019. Instructed and oversaw the development of an EEG visualization and annotation tool. Developed and built a machine learning framework for building/training/deploying models.

Other Experience

Sailing Instructor, Summer 2013, 2014, 2015

Taught sailing to various ages and skill levels including seven year olds, teenagers, and adults. Primarily taught racing and advanced sailors. Class sizes averaged between 5-10 students.

Personal Projects

Weather Prediction, Summer 2017

Built a recurrent convolutional neural network (RCNN) and trained it to predict future radar given sequences (movies) of recent historical radar.

Personal Website, Summer 2017

Created a personal website to show the results of projects and other graphical demonstrations.

Quad-copter, Summer 2016

Designed and built both a frame and an electric circuit and assembled them together. Wrote a flight controller to run on an Arduino, handling both remote controls and drone stabilization.

iOS Applications, 2015 – 2016

Developed an iOS game – Flip Gravity – where users control a ship through obstacles and varying gravity. Published on iOS app store with online game mode support through April 2018. Wrote a real time iOS messaging application. Worked on approximately five other applications.

Skills

Programming Languages

Java, Python, C

Programming Languages (Some experience)

C++, Objective-C, Swift, HTML, JavaScript, SQL, MATLAB, Mathematica

Software

Git, Tensorflow, Keras, JUnit, Mockito, Spring, PyQT

Amazon Web Services

Lambda, API Gateway, EC2, Cloud Formation, IAM, DynamoDB, S3, RDS, SNS, Cloud Watch, SageMaker

Engineering

Machining, Power Tools, Soldering, SolidWorks, Circuits, Vacuum Vessels