Carlos Romero

Elmhurst, IL • 331-243-3866 • crome4975@365.elmhurst.edu • www.linkedin.com/in/cromerom

PERSONAL PROFILE

Hardworking and resourceful physics and mathematics double major with research experience in applying machine learning to high-energy physics and biophysics. Seeking admission into a PhD to gain the essential knowledge and skills to pursue scientific research on experimental high-energy physics.

EDUCATION

BS with Honors, Physics and Mathematics   Anticipated Graduation: December 2023
Elmhurst University, Elmhurst, IL
GPA: 3.94, Summa Cum Laude

RESEARCH EXPERIENCE

Neural networks and dimensionality reduction for Higgs boson dataset   Summer 2023
US CMS PURSUE Fermilab / University of Alabama
Supervisor: Professor Sergei Gleyzer

- Evaluated performance of different combinations of activation functions and optimization methods for binary classification.
- Compared neuron dropout implementations in the first, intermediate, and all layers as a regularization method for a deep neural network.
- Designed a deep neural network capable of accurately discriminating between Higgs boson events and signal events.
- Applied PCA (Principal Component Analysis), and both linear and non-linear autoencoders as dimensionality reduction and feature extraction methods to the Higgs dataset.
- Appraised the neural networks performance on the reduced dimensions from both PCA and autoencoders and the subsequent information loss.
- Presented findings in informal and formal settings.

Smoke plume source identification with machine learning   Fall 2022 - Ongoing
Independent Research - Elmhurst University
Supervisor: Professor Venkatesh Gopal

- Constructed a customizable smoke plume generation system.
- Assembled the optical system and the laser sheet.
- Recorded the smoke plume dissipation throughout the wind tunnel at different heights of the laser sheet.
- Explored the use of generative adversarial networks for the generation of smoke plume's synthetic data.
- Wrote a MATLAB script that extracts the light intensity average from the smoke plume recordings at five selected areas of the wind tunnel.
- Designed a neural network capable of classifying the plume's source location between three different heights.
- Explored variations of the population vector theory of arachnid prey location applied to plume detection.

Third-degree polynomial as an alternative to PCA   Summer 2022
Independent Research - Elmhurst University
Supervisor: Professor Stephen Farnham

- Investigated third-degree polynomial approximations and evaluated their efficiency compared to PCA (Principal Component Analysis).

Predicting ink color with quantum mechanical methods   Summer 2020
CASE program - Elmhurst University
Supervisor: Professor Álvaro Castillo
- Found an affordable method to study the color properties of fountain pen dye molecules and some of their derivatives using quantum mechanical calculations (DFT).
- Performed excitation energy calculation of the molecules with the Gaussian 09 suite of programs.
- Employed Hartree-Fock and DFT methods for geometry optimizations and critical point characterization.

TEACHING EXPERIENCE

Physics and Mathematics tutoring   Spring 2020 - Ongoing
Elmhurst University
- Provided tutoring for the university's students in advanced physics and mathematics courses at the university's Learning Center.
- Completed a one-year long tutor training program.
- Assisted in the organization and logistics of tutoring events at the university's Learning Center.

Mathematics teacher assistant for students with cognitive disabilities   Fall 2022 - Ongoing
Elmhurst University
- Served as a TA for three mathematics classes directed to students of the Elmhurst Learning and Success Academy.

SKILLS

- **Programming skills:** Python, Sklearn, Tensorflow, Keras, PyRoot, RDataFrame, Matlab, C++, Maple.
- **Computer skills:** Microsoft Office Suite, Github, Unix.
- **Tutoring:** Introductory Physics I & II, General Physics I & II, Analytical Mechanics, Intermediate Physics, Modern Physics, Calculus I, II, III, Linear Algebra, Discrete Math, Differential Equations.
- **Language skills:** Fluent in English and French. Spanish native speaker.

AWARDS AND HONORS

- Summa cum laude and with Honors (Expected December 2023)
- Awarded the Presidential Scholarship by EU (2020-2023)
- Dean's List 6 times (2020-2023)
- Awarded the Faculty / Staff Merit Scholarship by EU (2022-2023)
- Awarded the Kranz Merit Award by EU (2020-2023)
- Awarded the International Discovery Scholarship by EU (2020-2023)
- Awarded the International Student Grant by EU (2020-2023)
- Awarded the B & J Cureton Travel Scholarship by EU (2023)
- Awarded the B. Smith Honors Study Abroad Scholarship by EU (2023)
- Awarded the Swords Honors Memorial Scholarship by EU (2023)
- Awarded the Class of 1965 Scholarship by EU (2020-2021)

CONFERENCES

- NCUR (National Conference of Undergraduate Research) 2021: "On the Color of Fountain Pen Ink" Carlos Romero- Kaitlin Krivac.

REFERENCES

Venkatesh Gopal
Physics Department Chair
Elmhurst University
Schaible Science Center, 15
Elmhurst, IL, 60126
630-617-3658
vgopal@elmhurst.edu

Brian C. Wilhite
Dean of Science, Technology, and Mathematics
Elmhurst University
Schaible Science Center, 14
Elmhurst, IL, 60126
630-617-6484
wilhiteb@elmhurst.edu