Allison Liu

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Data scientist specializing in spatial analysis with six years of research experience. Passionate about applying statistical techniques and machine learning to uncover patterns in data and develop solutions to improve sustainability.

Education

University of Colorado Boulder – M.S. Applied Mathematics May 2022 – May 2023

- GPA: 3.86/4.00
- **Thesis: *Event detection in spatio-temporal data using singular value decompositions.***
  - Analyzed spatial and temporal trends in solar image data to understand solar flares.
  - Data Engineering – explored transformations of raw satellite data to identify patterns during time periods leading up to significant events.
  - Processed and cleaned seven years of remote sensing data collected by NASA's Atmospheric Imaging Assembly (AIA).
  - Anomaly detection – employed various machine learning algorithms to identify flaring events.
- Coursework: numerical methods, statistical learning, statistical analysis, applications of machine learning techniques.

University of Colorado Boulder – B.S. Applied Mathematics, Minor in Computer Science August 2018 – May 2022

- *Graduated Cum Laude with Honors*, GPA 3.72/4.00
- Mathematics coursework: numerical analysis, statistics, modeling, and linear algebra.
- Computer science coursework: machine learning, regressions, data analysis, algorithm design and optimization, deep neural networks, data structures, database systems.
- Awards/Honors: Engineering Honors Program, BOLD Scholar, Dean's List, Pres. Horace M. Hale Award, *College of Engineering 2022 Outstanding Graduate for Research.*

Experience

Bureau of Transportation Statistics - U.S Department of Transportation Washington, DC
Data Scientist April 2024 – February 2025

- Produced a nationally consistent dataset providing insights into transportation assets exposed to natural hazards. Project involved sourcing existing hazard data, spatial joining with transportation asset data, and conducting exposure analysis.
  - Created custom interactive web map visualization using JavaScript/React and MapLibre GL JS.
- Facilitated a collaboration of 50+ participants to develop a national bicycle, pedestrian, and accessibility infrastructure data standard. The collaboration is composed of representatives from state DOTs, local governments, academic researchers, and industry professionals.
- Designed a data processing pipeline for analysis of the National Transportation Noise Map released by BTS.
- Projects completed using Python GeoPandas, GDAL, ArcGIS, QGIS.
- Communicated with non-technical stakeholders and produced valuable deliverables given loosely-defined objectives.

Laboratory for Atmospheric and Space Physics (LASP) - University of Colorado Boulder Boulder, CO
Student Data Scientist February 2021 – December 2022

- Trained and optimized a generative adversarial network (GAN) to combine historic and current satellite data into a machine learning ready dataset for solar flare prediction.
  - Downloaded and cleaned solar magnetogram data from two datasets spanning 17 years.
  - Investigated and tuned various GAN machine learning architectures to optimize performance.
  - Data pre-processing and exploration, feature engineering, and statistical analysis of results.

Kapteyn-Murnane Group, JILA - University of Colorado Boulder Boulder, CO
Student Research Assistant June 2017 – August 2020

- Designed and built a commercial-quality M^2 laser diagnostic device using MATLAB and photonics components. Interfaced multiple pieces of scientific equipment and programmed a graphical user interface to collect and analyze data.
- Implemented a modified phase-retrieval algorithm to fully characterize a laser beam.
- Interfaced a novel laser system with an existing chemical engineering experiment.

Climbing Gym Routesetter at University of Colorado Boulder September 2020 – August 2022

- Collaborated with a team to create unique and complex rock climbs at the CU Climbing Gym.
- Organized competition logistics, worked with roped systems, frequently gave and received effective feedback.

Volunteering & Outreach

Boulder Solar Alliance Research Experience for Undergraduates (REU) May 2022 – June 2022

- Developed and led Python programming tutorials for undergraduate research students.

Machine Learning STEM Camp May 2021 – July 2021

- Developed and taught machine learning curriculum to high school students for a STEM summer program.

Partnerships for Informal Education in the Community (PISEC) February 2020 – May 2020

- Volunteered weekly as a STEM mentor for primary school students in low-income communities.

Skills

Technical Languages: Python (PyTorch, TensorFlow, sklearn, numpy, pandas), MATLAB, R, HTML/CSS/JavaScript. Limited - SQL, C++
Geospatial Tools: Python GeoPandas, GDAL, QGIS, ArcGIS
Tools/Technologies: Unix/Linus, Git, LaTeX, Bash Shell, Mathematica, Jupyter
Languages: English (Native), Chinese - Mandarin (Proficient)

Publications & Presentations

Data Augmentation of Magnetograms for Solar Flare Prediction using Generative Adversarial Networks. 2021
Poster Presented at the American Geophysical Union Conference - New Orleans, LA.

A. Liu, W. Carande.

10.1002/essoar.10510080.1

Detection of the Keto-Enol Tautomerization in Acetaldehyde, Acetone, Cyclohexanone, and Methyl Vinyl Ketone with a Novel VUV Light Source. 2021
Proc. Combust. Inst. 38.

D. Couch, Q. Nguyen, ***A. Liu***, D. Hickstein, H. Kapteyn, M. Murnane, and N. Labbe.

10.1010/j.proci.2020.06.139

Generation of extreme-ultraviolet beams with time-varying orbital angular momentum. 2019
Science 364, 6447.

L. Rego, K. Dorney, N. Brooks, Q. Nguyen, C. T. Liao, J. San Román, D. Couch, ***A. Liu***, E. Pisanty, M. Lewenstein, L. Plaja, H. C. Kapteyn, M. M. Murnane, and C. Hernández-García.

10.1126/science.aaw9486