LEAP’s Summer 2023 REU Program: Concluding Reflections

August 7, 2023

LEAP’s Summer 2023 Research Experience for Undergraduates (REU) Program successfully concluded with this year’s cohort offering final research presentations at the Columbia University Innovation Hub on Thursday, July 27, 2023. The REU Program, conducted in partnership with the Summer at SEAS program, the DSI Scholars program, and the Significant Opportunities in Atmospheric Research and Science (SOARS) program at UCAR, provided undergraduate students from around the country the chance to pursue synergistic innovations in data science and climate science, while engaging in enrichment, networking, and social activities.

This summer, six students – Samarth “Sammy” Agrawal (Massachusetts), Thomas Chen (New Jersey), Mark Irby-Gill (New York), Rebecca Porter (Kansas), Amanda Sun (California), and Subashree Venkatasubramanian (Washington) – kicked off their REU immersion with a 3-week-long Momentum Bootcamp. Under the instruction of Candace Agonafir (LEAP postdoc), Yu Huang (LEAP doctoral student and 2023 Momentum Fellow), and Tian Zheng (LEAP’s Chief Convergence Officer and Education Director), and with support from Sungduk Yu (LEAP Research Scientist) and Julius Busecke (LEAP’s Manager of Data + Compute), the students gained skills and familiarity with the REU dataset, learned to apply machine learning to this dataset, and developed research...
proposals. Then, they spent 5 weeks conducting their research under the guidance of research mentors Pierre Gentine (LEAP’s Director), Stephan Mandt (Associate Professor of Computer Science at UC Irvine), and Mike Pritchard (Director of Climate Simulation Research at NVIDIA and LEAP’s Institutional Integration Director).

“It was an invaluable experience to gain exposure to machine learning concepts,” says Amanda, a rising senior studying Computer Science and Environmental Studies at Dartmouth College. Sammy, entering his junior year in Columbia University’s Department of Computer Science, also wanted to gain familiarity with the deep learning pipeline and a better understanding of climate dynamics: “I’ve never had a focused month to only think about research, and found it really rewarding. The REU definitely validated that research is something I love.” Mark was particularly thrilled about the ClimSim dataset with which the cohort was able to work: “The foresight [the ClimSim team] had to create a dataset that will allow easier access to climate data will only increase the learning capabilities in this field of study.”

In addition to the intense learning atmosphere they shared, the REU students also bonded as they roomed in neighboring suites in Columbia’s East Campus dormitory. “I had no idea that we would end up so close and that we would spend so much time together!” marvels Sammy. While special events like an ‘escape room’ outing and a trip to see “Hamilton” on Broadway were sprinkled throughout, the Summer 2023 cohort truly came together as they learned and studied together during the day and played cards or board games and explored local restaurants at night. “There was a great balance of shared interest but diverse perspectives and goals,” Sammy appreciated. Mark, a native New Yorker who will pursue a project in preparation for his honors capstone at Red Rocks Community College, also loved that “this summer in NYC has allowed me to spend more time with my family than I have in over a decade.”

The students expressed particular gratitude for their REU instructors and mentors. “Tian spent so long helping us, holding office hours, and giving really helpful suggestions that ended up becoming our research projects,” reflects Amanda. Sammy gives a “special shoutout to Yu Huang who put in many hours of overtime to help ensure our projects stayed on track,” and Thomas agrees that “the PIs have been incredibly helpful.” “I would not have been about to accomplish what I did this summer without the help of the weekly PI meetings and our meetings with our mentors,” adds Mark, who feels inspired to continue incorporating machine learning and AI into his future work.
For Huang, teaching in the REU Bootcamp represented her first time teaching students, and she felt gratified to hear that the students learned a lot. It was particularly delightful “to see the students developing stronger collaboration skills during the process of sharing knowledge with each other and solving coding problems together.”

Agonafir observed that the students “had the motivation to learn, and dove into the datasets and the models, putting in good effort toward their individual projects.” Gentine was also impressed by their ability to learn new concepts and develop research agendas, and enjoyed their fresh ideas as they discovered the field of climate data science. Mandt, the cohort’s Data Science Research mentor, “valued how much they cared about complex topics such as causal representation learning and generative modeling … they asked the right research questions.”

Well done, Sammy, Thomas, Mark, Rebecca, Amanda, and Suba! It was a pleasure to host you this summer, and LEAP hopes you will stay in touch.

The Summer 2023 Research Presentations may be viewed below:

- **Sammy Agrawal**: Capturing Convective Atmospheric Profiles Using Variational Encoder-Decoders
- **Thomas Chen**: Visualizing Interpretability for Precipitation Prediction Using Shapley Additive Explanations
- **Mark Irby-Gill**: Evaluating XGBoost as a Baseline Model for Spatially-Informed Precipitation Predictions
- **Rebecca Porter**: Exploring Data-Driven Equation Discovery to Model Moisture Flux
- **Amanda Sun**: Improving Subgrid Parameterization with Causal Discovery
- **Subashree Venkatasubramanian**: A Bayesian-Gamma Deep Learning Approach to Capture Heavy-Tailed Behavior in the ClimSim Dataset

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