Undergraduate spotlight: Katherine Frields

The UC Irvine undergraduate is combining her data science expertise with a love for Earth system science.

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Frields' path into science started when she was a child playing games with her brothers.

Picture Credit:
Katherine Frields / Columbia University

When Katherine Frields started as a freshman at UC Irvine three years ago, she was initially a data science major driven by an excitement for how statistics, math and computer science can work in tandem to address problems none of those fields can alone.

As her UCI story unfolded, Frields started seeing data science as an integral part of today's tech-dominated world. She joined the Data at UCI student group, and she launched and ran a four-part series dedicated to helping any student learn the fundamentals of data science and machine learning and how those fields can relate to their studies.

"I want data science to be accessible to all majors," said Frields. "Because you never know the ways your work might benefit from at least a basic knowledge of how data science works."

But despite her enthusiasm for her major, something felt missing.

"I grew up on a full diet of science," said Frields. "Me and my brothers, we'd just sit there and watch nature documentaries for hours and hours."

When they weren't watching documentaries, Frields and her siblings would play a game they liked to call 'food chain,' which saw each kid pretend to be a different part of an ecosystem – carnivores, herbivores, and even plants.

Frields' days of watching documentaries and playing 'food chain' instilled in her a love for the natural world, and that love came with her to UCI.

"After my second year, I realized I didn't want to just do data science," said Frields, who enjoys bird watching and visiting natural history museums when she's not busy at UCI. "I realized I really, really missed the natural sciences."

One day, while browsing UCI's course listings, Frields found herself drawn repeatedly to classes in the Department of Earth System Science (ESS).

Earth system science is an all-encompassing field, one that demands knowledge of multiple scientific disciplines, from geology and biology to atmospheric science and chemistry and physics.

“You have to have a very wide base of knowledge,” Frields said. “And that's what I enjoy most about it.”

Just as Frields delighted in playing all the different parts of an ecosystem with her brothers, she found the interconnected nature of Earth system science stimulating, and decided it was the missing chapter in her UCI story.

Frields started taking ESS classes, and before long she was applying her data science and machine learning knowledge as a student researcher in the research groups of ESS professors Angela Rigden and Michael Pritchard.

Pritchard’s group works to improve the accuracy of computer models that mimic Earth’s climate, and Frields helped Pritchard incorporate uncertainty into those models, improving and providing insight into model performance.

“We wanted to know what parts of our models are certain and which are uncertain,” said Frields, whose work with Rigden was similar, except that it focused on attempts to model how water evaporates and moves through the Earth system.

“Evapotranspiration is notoriously difficult to estimate because it can’t be directly measured by satellites, since it’s a flux of water, and models of it are pretty complicated, so there’s lots of parameters and calibration,” said Rigden. “I've done some previous work showing that evapotranspiration can be estimated pretty well by just looking at atmospheric humidity and temperature, and Katherine applied our model and compared it to data that is based on remote sensing observations. I was working on a proposal at the time based on this, so her work helped shape some of the early results for that proposal.”

Frields continued her research with Pritchard’s group, which uses AI to improve the accuracy of computer models that mimic Earth’s climate. In her research, Frields helped Pritchard and his postdoctoral fellow Jerry Lin incorporate uncertainty into models, which improved simulation sensitivity and performance. From there, Frields went on to be a part of the National Science Foundation’s Research Experiences for Undergraduates LEAP program (Learning the Earth with AI and Physics), where she continued using machine learning to gain insight into atmospheric processes.

Frields is entering her final year at UCI and will continue her research with Professor Pritchard as she applies for Earth system science Ph.D. programs so she can continue her research into AI applications in climate modeling.

It’s a story that started back when she and her brothers would play out the different parts of an ecosystem – only now the game also includes AI and climate system dynamics.

“I’m excited to continue exploring the many scientific disciplines that weave together to form our understanding of the past, present and future of our planet,” Frields said.

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